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Original article:

A study of serum lipid profile in undernourished patients of diabetes mellitus

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Abstracts:

Background & objective: The incidence of diabetes mellitus is increasing substantially worldwide. The latest estimates by the international diabetes federation project that 592 million (1 in 10 persons) worldwide will have diabetes mellitus by 2035. According to the official WHO data, India tops the list of countries with the highest number of diabetics. The aim of the study is to find the serum lipid profile in undernourished patients. To compare the lipid profile of undernourished patients with those who have either normal weight or are obese.

Material and method: This study was carried out on 150 patients of diabetes mellitus with varying nutritional status and 60 control, below 50 years with varying nutritional status, who were not suffering from any medical illness. Selection of the cases was done as per inclusion and exclusion criteria, different tests are performed as per the need of the study.

Results: Different tests are performed, comparison was done and the conclusion is withdrawn.

Conclusion: Undernourished diabetics show lower levels of serum lipids than normal weight and obese diabetics while serum HDL-cholesterol levels are higher in undernourished diabetics, it is apparent that undernourished diabetic subjects are endowed with a lipid profile apparently less prone for atherosclerosis.

Key Words: undernourished, lipid profile, diabetes mellitus.

Introduction:

The incidence of diabetes mellitus is increasing substantially worldwide. Over the past three decades, the global burden of diabetes mellitus has swelled from 30 million in 1985 to 382 million in 2014, with current trends indicating that these rates will only continue to rise. The latest estimates by the international diabetes federation project that 592 million (1 in 10 persons) worldwide will have diabetes mellitus by 2035. According to the official WHO data, India tops the list of countries with the highest number of diabetics, 72 million cases recorded in 2017 1. One consequence of the growing rates of diabetes mellitus is a considerable economic burden both for the patient and the healthcare system. Diabetes mellitus are primarily attributed to both macrovascular and microvascular complications such as coronary artery disease, myocardial infarction, hypertension, peripheral vascular disease, retinopathy, end-stage renal disease and neuropathy. A close link exists between diabetes mellitus and cardiovascular disease. Cardiovascular disease is the most prevalent cause of mortality and morbidity in diabetic populations 2. Observations on clinical profile of diabetic subjects show varying degree of nutritional status. That

diabetes develops more frequently in over-weight than in underweight persons has long been apparent to the clinician. Studies show that diabetes mellitus is almost as prevalent in undernourished populations as it is in well-nourished ones 3,4. Undernutrition itself may be the risk factor that replace obesity in predisposing such populations to diabetes. This view is supported by the fact that majority of patients with non-insulin dependent diabetes in underdeveloped countries like India 5. Most of the studies on lipids in obese or overweight diabetics have shown significant elevations in various lipid fractions which accounts for their higher vascular complications, very few studies are available on serum lipids in undernourished diabetics in India. The aim of the study is to find the serum lipid profile in undernourished patients. To compare the lipid profile of undernourished patients with those who have either normal weight or are obese.

Material and Method:

This study was carried out on 150 patients of diabetes mellitus with varying nutritional status attending medical outpatient department or admitted in Mamata Medical College. The study also included sixty persons, below 50 years with varying nutritional status, who were not suffering from any medical illness and served as control. Patients were grouped according to their nutritional status Group I (Undernourished) 50 patients, Group II (Normal weight) 50 patients, Group III (Obese) 50 patients. Control subjects were also grouped according to their nutritional status Group I (Undernourished) 20 subjects, Group II (Normal weight) 20 subjects, Group III (Obese) 20 subjects. Criteria for selection of cases known diabetics on dietary control or anti-diabetic drugs with blood sugar in the acceptable range of control state i.e. fasting blood sugar 70-110 mg%, two-hour postprandial blood sugar < 140 mg% 6. Age of the patients was less than 50 years, to exclude the effect of ageing on serum lipids. Diabetic patients with chronic renal disease, liver disease, and hypothyroidism were not included in this study. Patients on antihypertensive drugs, diuretics, oral contraceptives and patients taking other drugs known to alter lipid metabolism were excluded from the study. The criteria for selecting diabetic patients and control subjects into each group was done according to anthropometric measurements. Weight 7 and height 8. Body mass index (BMI) = weight in kilograms / height meter2 9. Triceps skinfold thickness with skinfold caliper 10,11. Complete haemogram, urine examination, blood biochemistry, blood sugar levels, liver function tests, X-ray chest, ECG and total lipid profile was done for all the groups of patients and control subjects after the acceptable range of blood sugar for control of diabetic state was achieved as mentioned above, in selection criteria. Statistical analysis was performed by SPSS version 20.0. For all tests, $p<0.05$ was considered significant.

Result:

150 patients of diabetes mellitus were taken up for the present study. 60 healthy subjects who served as control were included in this study. Group I (undernourished) diabetic patients was 40.29 ± 7.29 years with a range of 20 to 49 years. There were 30 males (60%) and 20 females (40%) out of 50 cases. The mean duration of diabetes in group I cases was 4.83 ± 3.9 years with a range of 1 month to 20 years. Group II (normal weight) diabetic patients was 41.84 ± 6.52 years with a range of 26 to 49 years. This group comprised of 50 diabetic patients 25 were males (50%) and 25 females (50%). The mean duration of diabetes was 5.62 ± 3.12 years with range from 1 to 11 years. Group III (obese) diabetic patients was 44.76 ± 4.23 years with a range of 30 to 49 years. Out of a total of 50 diabetic

patients, there were 29 males (58%) and 21 females (42%). The mean duration of diabetes was 5.5 ± 3.01 years ranging from 1 to 13 years.

Age and sex distribution of control groups, Group I (undernourished) control subjects was 39.85 ± 4.02 years. The range was 32 to 48 years out of total 20 subjects there were 12 (60%) males and 8 (40%) females. Group II (normal weight) control subjects was 40.5 ± 5.4 years. The range was from 30 to 48 years. There were 20 subjects out of which 12 (60%) were males and 8 (40%) were females. Group III (obese) control subjects was 40.6 ± 4.8 years with a range of 30 to 48 years. There were 12 males (60%) and 8 females (40%) out of a total of 20 subjects.

Anthropometric measurements of diabetic patients, Group I mean weight was 41.84 ± 5.64 kgs with a range of 30 to 55 kgs, Group II 59.78 ± 8.15 kgs with a range of 45 to 79 kgs and Group III 77.83 ± 6.88 kgs with a range of 64 to 92 kgs. The mean height in group I, group II and group III was 160.66 ± 6.97 (range 148 to 178 cms), 164.88 ± 7.46 cms (range 150 to 180 cms) and 165.96 ± 7.4 cms (range 150 to 180 cms) respectively. The mean body mass index (BMI) was 16.28 ± 1.64 m.units (range 13.7 to 17.7 m.units), 21.85 ± 1.30 m.units and 28.25 ± 0.61 m.units (range27.4 to 30.01 m.units) in group I, group II and group III cases respectively. The mean triceps skinfold thickness (TSFT) was 6.75 ± 1.17 mm (range 5 to 9.6 mm), 16.56 ± 3.85 mm (range 10.5 to 25 mm) and 25.38± 3.19 mm (range 20.5 to 31.5 mm) in group I, II and III respectively.

Anthropometric measurements of control group, Group I average weight was 41.3 ± 4.18 kgs (range 34 to 46 kgs), 57.65 ± 6.34 kgs (range 48 to 72 kgs) in group II and 78.05 ± 6.90 kgs (range 65 to100 kgs) in group III. The mean height was 101.25 ± 5.70 cms (range 148 to 170 cms), 164.9 ± 6.17 cms (range 153 to 178 cms) and 164.25 ± 6.9 cms (153 to 180 cms) in group I, group II and group III respectively. The mean body mass index (BMI) was 15.8 ± 0.77 m.units (range 14.02 to 17.30 m.units), 21.11 ± 1.01 m.units (range 19.14 to 23.30 m.units) and 28.86 ± 1.05 m.units (range 27.99 to 31.24 m.units) in group I,II and III respectively. The mean triceps skinfold thickness (TSFT) was 6.2 ± 0.97 mm (range 4.5 to 8.5 mm), 15.8 ± 3.64 mm (range 11.5 to 24.5 mm) and 26.11 ± 2.83 mm (range 21.5 to 31.5 mm) in group I, II and III respectively.

Table 1: Comparison of lipid profile in under-nourished control versus normal weight control and obese Control

	Group I	**Group II**		**Group III**	
	Mean ± SD	**Mean ± SD**	**P**	**Mean ± SD**	**P**
TL	420.7 ± 29.9	506.85 ± 74.39	<.001	647.35 ± 65.68	<.001
TC	154.7 ± 29.9	179.6 ± 44.91	>.05	215.9 ± 33.30	<.001
TG	93.9 ± 20.3	118.3 ± 29.5	<.01	189.25 ± 40.35	<.001

HDL-C	52.6 ± 9.6	52.9 ± 7.6	>.05	47.25 ± 6.67	>.05
LDL-C	81.2 ± 28.3	105.73 ± 45.8	>.05	135.32 ± 35.99	<.001
P-lipid	123.7 ± 14.7	157.25 ± 33.1	<.001	213.15 ± 39.9	<.001

Group I: Undernourished control, Group II: Normal weight control, Group III: Obese control.

Total Lipid (TL), Total cholesterol (TC), Triglyceride (TG), High-density lipoprotein-cholesterol (HDL-C), Low-density lipoprotein cholesterol (LDL-C), Phospholipid (P-lipid).

Table 2: Comparison of lipid profile in normal weight control versus obese control.

	Normal weight control	**Obese control**	
	Group II	Group III	
	Mean ± SD	Mean ± SD	P
TL	506.85 ± 74.39	647.35 ± 65.68	<.001
TC	179.6 ± 44.91	215.9 ± 33.30	<.01
TG	118.3 ± 29.5	189.25 ± 40.35	<.001
HDL-C	52.9 ± 7.6	47.25 ± 6.67	<.02
LDL-C	105.73 ± 45.8	135.32 ± 35.99	<.05
P-lipid	157.25 ± 33.1	213.15 ± 39.9	<.001

Table 3: Comparison of lipid profile in under nourished diabetic versus under nourished control subjects with varying nutritional status.

	Under-nourished diabetic	**Under-nourished control**	
	Group I	Group I	
	Mean ± SD	Mean ± SD	P
TL	552.12 ± 67.43	420.7 ± 29.9	<.001
TC	198.6 ± 49.44	154.7 ± 29.9	<.001
TG	157.36 ± 42.83	93.9 ± 20.3	<.001
HDL-C	60.3 ± 11.86	52.6 ± 9.6	<.02
LDL-C	106.6 ± 48.6	81.2 ± 28.3	<.05
P-lipid	165.98 ± 17.80	123.7 ± 14.7	<.001

Table 4: Comparison of lipid profile in normal weight diabetic versus normal weight control subjects with varying nutritional status.

	Normal weight diabetic	**Normal weight control**	
	Group II	Group II	
	Mean ± SD	Mean ± SD	P
TL	658.18 ± 76.25	506.85 ± 74.39	<.001
TC	228 ± 48.68	179.6 ± 44.91	<.001
TG	197.88 ± 43.39	118.3 ± 29.5	<.001
HDL-C	49.18 ± 12.08	52.9 ± 7.6	>.05
LDL-C	139.16 ± 53.8	105.73 ± 45.8	<.02
P-lipid	207.58 ± 56	157.25 ± 33.1	<.001

Table 5: Comparison of lipid profile in obese diabetic versus obese control subjects with varying nutritional status.

	Obese diabetic	**Obese control**	
	Group III	Group III	
	Mean ± SD	Mean ± SD	P
TL	797.68 ± 40.79	647.35 ± 65.68	<.001
TC	263.02 ± 18.01	215.9 ± 33.30	<.001
TG	257 ± 24.70	189.25 ± 40.35	<.001
HDL-C	46.48 ± 9.2	47.25 ± 6.67	>.05
LDL-C	164.96 ± 16.8	135.32 ± 35.99	<.001
P-lipid	252.82 ± 23.54	213.15 ± 39.9	<.001

Table 6: Comparison of lipid profile in diabetics versus subjects with varying nutritional status.

	Group I	**Group II**		**Group III**	
	Mean ± SD	**Mean ± SD**	**P**	**Mean ± SD**	**P**
TL	552.12± 67.43	658.18± 76.25	<.001	797.68± 40.79	<.001
TC	198.6 ± 49.44	228 ± 48.68	<.01	263.02± 18.01	<.001
TG	157.36±	197.88±	<.001	257 ±	<.001

	42.83	43.39		24.70	
HDL-C	60.3 ± 11.86	49.18 ± 12.08	<.001	46.48 ± 9.2	<.001
LDL-C	106.6 ± 48.6	139.16± 53.8	<.01	164.96± 16.8	<.001
P-lipid	165.98± 17.80	207.58± 56	<.001	252.82± 23.54	<.001

Group I: Under nourished diabetic, Group II: Normal weight diabetic, Group III: Obese diabetic.

Table 7: Comparison of lipid profile in normal weight diabetics versus obese diabetics.

	Normal Weight diabetic	**Obese diabetic**	
	Group II	Group III	
	Mean ± SD	Mean ± SD	P
TL	658.18 ± 76.25	797.68 ± 40.79	<.001
TC	228 ± 48.68	263.02 ± 18.01	<.001
TG	197.88 ± 43.39	257 ± 24.70	<.001
HDL-C	49.18 ± 12.08	46.48 ± 9.2	>.05
LDL-C	139.16 ± 53.8	164.96 ± 16.8	<.01
P-lipid	207.58 ± 56	252.82 ± 23.54	<.001

Discussion:

As per table 1 and 2 the observations of serum lipids in control subjects with varying nutritional status was in undernourished control subjects when compared with normal weight control subjects revealed statistically significant lower levels of serum total lipid, triglycerides and phospholipids. But HDL-cholesterol, LDL-cholesterol and total cholesterol did not show statistically significant difference between the two groups 12. Undernourished control subjects in comparison to obese control subjects showed statistically significant decrease in all the components of serum lipids except HDL-cholesterol which did not show statistically significant difference between the two groups 13. Normal weight control subjects in comparison to obese control subjects revealed statistically significant lower levels of all the components of serum lipids except HDL-cholesterol which was statistically higher in normal weight control subjects. Table 3, 4, 5 undernourished diabetics when compared with undernourished control, showed statistically significant increase in all the components of serum lipids. Normal weight diabetics when compared with normal weight control subject's revealed statistically significant increase in all the components of serum lipids except HDL-cholesterol which did not show statistically significant difference between the two groups. Obese diabetics in comparison to obese control subjects also showed statistically significant increase in all the components of serum lipid except HDL-cholesterol which did not show statistically significant difference

between the two groups 14. It is evident that diabetic patients irrespective of their nutritional status show elevated levels of serum lipids. However, as regards serum HDL-cholesterol only undernourished diabetics show significant elevations in comparison to their corresponding control. Since diabetes mellitus leads to premature atherosclerosis, elevated levels of serum lipids may account for the higher vascular complications in diabetic patients. Further, the levels of high density lipoprotein (HDL) cholesterol were elevated significantly only in undernourished diabetics as compared to undernourished control subjects in the present study. Clinical and epidemiological studies show a consistent negative correlation between absolute serum HDL-cholesterol and coronary risk. It has been postulated that the protective effect of high density lipoprotein cholesterol may relate to the role of HDL in the removal of cholesterol from peripheral tissues.

Present study is associated with higher levels of HDL cholesterol in undernourished diabetics as compared to their control, which may diminish the risk of atherosclerosis in them.

The observations of lipid profile in diabetics with varying nutritional status table 6 and 7 undernourished diabetics when compared with normal weight diabetics, the former showed statistically lower levels of all the components of serum lipids except HDL-cholesterol which was statistically higher in undernourished diabetics 15. Undernourished diabetics when compared with obese diabetics also showed the same results as observed above .i.e. statistically lower levels of all the components of serum lipids except HDL-cholesterol which was statistically higher in undernourished diabetics 14. Normal weight diabetics when compared with obese diabetics also showed statistically lower levels of all the components of serum lipids except HDL-cholesterol which did not show statistically significant difference between two groups 14.

Results of this study indicate that diabetic subject's inspite of being undernourished show elevated levels of all lipid fractions when compared with undernourished control subjects. Although the values of all these parameters were significantly lower in undernourished diabetics as compared to well-nourished diabetics, but these lipid fractions showed a significant increase vis-à-vis undernourished control subjects. Further, the levels of HDL-cholesterol were higher in undernourished diabetics as compared to obese and normal weight diabetics.

Judging from the current knowledge on the roles of various fractions of serum lipids in the development of atherosclerosis, it appears that undernourished diabetic subjects may be less vulnerable to this complication than well-nourished ones. An important feature of the present study is that, highest levels of serum lipids were seen in obese diabetic subjects while serum high density lipoprotein (HDL) cholesterol was lower. Thus obese diabetics appears to be at highest risk for development of atherosclerosis. This provides another argument for maintaining caloric restriction in diabetics to maintain ideal body weight.

Conclusion:

Undernourished diabetics show lower levels of serum lipids than normal weight and obese diabetics while serum HDL-cholesterol levels are higher in undernourished diabetics. Since elevated levels of serum lipids are regarded as a risk factor for atherosclerosis and HDL-cholesterol as a protective factor for atherosclerosis, it is apparent that undernourished diabetic subjects are endowed with a lipid profile apparently less prone for atherosclerosis.

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