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**Levels of Total Cholesterol and Triglycerides in Type 2 Diabetic Sudanese Patients**

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**Abstract:**

**Introduction:** Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both.<sup>(1)</sup>

**Objectives** This study aimed to estimate the levels of total cholesterol and triglycerides as control markers of type 2 diabetes mellitus in Sudanese patients.

**Methods:** Seventy Sudanese controlled NIDDM patients of age 42-80 years and of diabetes duration 1-27 years, 30 non diabetic subjects age and sex-matched taken as a control group. Fasting blood glucose, total cholesterol, and triglycerides (TG) were measured and the results obtained were statistically analysed.

**Results:** There were no statistically significant differences between diabetic group and control group observed in TG levels. The total cholesterol in the diabetic group showed significant increase than the control group (P=0.04), also this study showed, 64.3% of the diabetic group had FBG>140mg/dl , 24.3% had cholesterol level >240 mg/dl and 9% had Triglycerides level >200 mg/dl.

**Conclusion:** This study suggests the need for improving glycemic control in Sudanese diabetic patients, that might lead to improvement in lipid values and decrease the diabetes-associated complications.

**المخلص:**

هدفت هذه الدراسة لاستخدام التقييم الكيموحيوي لضبط مستوى السكر عند مرضي السكري غير المعتمدين علي الانسولين مقارنة مع اصحاء من نفس النوع والعمر. اشتملت هذه الدراسة علي 100 شخص منهم 70 مريضا بالسكري غير المعتمدين علي الانسولين تتراوح

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أعمارهم بين 42-80 عاما وتمتد فترة مرضهم بين 1-27 عاما و30 أصحاء من نفس النوع والعمر. تضمنت هذه الدراسة القياسات الكيموحيوية الأتية: سكر دم الصائم، الكوليستيرول، ثلاثي أسيل الجليسرول ومؤشر كتلة الجسم وحللت النتائج تحليلا إحصائيا. أظهرت الدراسة عدم وجود إختلاف ذو معني بين مجموعة مرضي السكري ومجموعة الأصحاء في مستويات ثلاثي أسيل الجليسرول بينما وجد تركيز كل من سكر دم الصائم و الكوليستيرول الكلي مرتفعا إرتفاعا ذا معني عند مجموعة مرضي السكري. مستوى الكوليستيرول أظهر إرتباطا موجبا مع ثلاثي أسيل الجليسرول. طبقا لتقسيم جمعية مرضي السكري العالمية الأمريكية أظهرت هذه الدراسة أن نسبة 35.7 يتميزون بدرجة ضبط جيدة (معدل قياس سكر دم الصائم لديهم أقل من 140مغ/ملتر) بينما 75.7% يتميزون بدرجة ضبط جيدة للكوليستيرول (مستوي الكوليستيرول لديهم أقل من 240مغ/ملتر) و 91% يتميزون بدرجة ضبط جيدة لثلاثي أسيل الجليسرول (مستوي ثلاثي أسيل الجليسرول لديهم أقل من 200مغ/ملتر). وعليه يعتبر ان بعض هؤلاء المرضى غير متمتعين بدرجة ضبط جيدة لمرض السكري.

**Key words:** Cholesterol, Triglyceride, Type 2 Diabetes Mellitus, Sudanese Patients.

**Introduction:**

Diabetes mellitus (DM) is a syndrome characterized by disordered metabolism and abnormally high blood glucose (hyperglycaemia) resulting from insufficient levels of insulin<sup>(2)</sup>. Abnormal lipid profile is an important risk factor in the development of macro vascular atherosclerotic complications in patients with type 2 diabetes mellitus<sup>(3)</sup>. Chronic elevation of blood glucose level leads to damage of blood vessels (angiopathy). The endothelial cells lining the blood vessels take in more glucose than normal, since they don't depend on insulin. They then form more surface glycoprotein's than normal, and cause the basement membrane to grow thicker and weaker. In diabetes, the resulting problems are grouped under "micro vascular disease" (due to damage to small blood vessels) and "macro vascular disease" (due to damage to the arteries)<sup>(4)</sup>. Using pig model for studying dyslipidaemia and atherosclerosis in diabetes. There are marked increases in total cholesterol, TG, glucose, in type 2 diabetic patients<sup>(5)</sup>. Type 2 diabetes is a major risk factor of the development of atherosclerosis in humans. Several studies showed that increased levels of total cholesterol and triglycerides in Patients with type 2 DM<sup>(6,7)</sup>. Patients with type 2 DM who are being treated on insulin had a better lipid profile (TC and TG) compared with those patients on oral hypoglycemic agents. Meanwhile, Lp (a) levels were raised in all diabetic patients and seem not to be affected either by insulin or by oral hypoglycemic treatment.<sup>(8)</sup>

**Methods:**

This is a case control study. This study was conducted in a clinical center for diabetic patients (Abu Agla) in wad Medani – Gezira state about 180 Km south east of Khartoum. The study was carried out during the period March to May 2008. Seventy samples from Sudanese subjects with type 2 diabetes mellitus were randomly allocated in this study, with age range 42 – 80 years. Male to female ratio was 28/42. And thirty samples from non diabetic Sudanese subjects were collected to serve as age and sex- matched control group. All study subjects gave consent to the study. A questionnaire was designed to include personal history, clinical picture and laboratory investigations. Exclusion criteria included patients with IDDM, heart disease, and those patients taking hypolipideamic drugs. Blood samples were collected after an overnight fasting (12 hours) from both diabetic and non diabetic groups. Five ml of venous blood were collected and divided into two tubes. Two ml of blood were drawn into fluoride sterile containers and

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plasma was separated by centrifugation at 4000 rpm for 10 minutes for estimation of fasting Blood glucose (FBG) .The rest 3 ml were collected in plane container separated, and the serum was used for estimation of Cholesterol and Triglycerides. All tests were done by enzymatic colorimetric method. Values were presented as mean ± standard deviation of all measured variables. Student t-test was applied to compare the measured parameters between patients and controls. A value of P<0.05 was considered statistically significant.

**Results:**

**characteristics of study group:**

Age ranges in NIDDM group and the age matched non diabetic group was 42-80 years. Age (means ± standard deviation) for the study groups are presented in Table (1).

BMI (means) in the NIDDM group and the age matched non diabetic group was 26.58 Kg/m<sup>2</sup> and 22.08 Kg/m<sup>2</sup> respectively. BMI (mean ± SD) for the study group are presented in table (1). Mean BMI value in NIDDM group was significantly higher than mean BMI value of age matched non diabetic group (P<0.001). Family history of diabetes mellitus (FH) was classified as negative or positive family history. The ratio of No/Yes FH in non diabetic group was 25/5 while in the diabetic group 26/44 (Table 1).

The ratio of male/female in diabetic group was 28/42 while in non diabetic group 13/17 is presented in Table (1). Family history of diabetes and sex in diabetic & non diabetic groups. In this study a high significant difference was observed in BMI between NIDDM & control subjects (P<0.001).

**Biochemical Parameters:**

FBG levels (mean ± SD) for both study groups are presented in Table (1). The NIDDM group had a higher level of FBG than the non diabetic group. The difference between the mean values was highly significant at (P<0.0001). Cholesterol levels (mean ± SD) for both study groups are presented in Table (1). The NIDDM group had significantly higher levels of cholesterol compared with non diabetic subjects (P<0.04). The levels (mean ± SD) of the TG for both study groups are also presented in Table (1) No significant differences were observed in the mean values of TG between the two study subjects.

**Table 1: Characteristics of the study groups**

Variable	Diabetic group (n=70)	Control group (n=30)	P value
Age (year)	59.86 ± 9.57	54.10 ± 9.67	0.007
Age at onset of DM (years)	52.64 ± 9.06	-	-
Duration of DM (years)	7.40 ± 6.47	-	-

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Family history of DM	62.8%	16.6%	-
BMI (kg/m <sup>2</sup> )	26.58 ± 4.49	22.08 ± 4.60	0.0001
FBG (mg/dl)	174.59 ± 61.94	88.87 ± 13.05	<0.0001
Total cholesterol (mg/dl)	179.45 ± 49.7	158.95 ± 33.75	0.04
TG (mg/dl)	114.71 ± 81.98	115.79 ± 53.05	0.94

**Assessment of Metabolic Control of NIDDM Patients:**

**Degree of metabolic control in NIDDM patients using FBG level:**

Table (2) shows the distribution of NIDDM Group according To their FBG level. Metabolic control was assessed using mean FBG level, according to the national diabetes study group classification (10) and graded as:-

- I) Excellent (great) control (FBG <115 mg/dl)
- II) Acceptable (good) control (FBG <140 mg/dl)
- III) Poor (bad) control (FBG >140 mg/dl)

18.6 % of diabetic patients were Excellent glycaemic controlled diabetics, 17.1 % of diabetics were good controlled diabetics, while 64.3% were poor controlled diabetics.

**Degree of metabolic control in NIDDM patients using cholesterol levels (TC):**

Table (2) shows the metabolic Assessment of NIDDM Patient Using Cholesterol levels.

Metabolic control was assessed using mean TC level, according to the national diabetes study group classification (10) and it was graded as follows:

- I) Excellent (great) control (cholesterol <200 mg/dl)
- II) Acceptable (good) control (cholesterol 200-239 mg/dl)
- III) Poor (bad) control (cholesterol >240mg/dl)

75.7% of study diabetic population was considered to be excellent, moderate controlled diabetics, while 24.3 % were poorly controlled.

**Degree of metabolic control in NIDDM patients using triglycerides levels (TG):**

Table (2) shows the metabolic Assessment of NIDDM Patient Using Triglycerides levels.

Metabolic control was assessed using mean TG level, according to the national diabetes study group classification (10) and it was graded as follows:

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I) Excellent (great) control (Triglycerides <150 mg/dl)

II) Acceptable (good) control (Triglycerides 150-200 mg/dl)

III) Poor (bad) control (Triglycerides >200mg/dl)

91% of study diabetic population was considered to be excellent, moderate controlled diabetics, while 10 % were poorly controlled.

**Table 2: Classification of the diabetic patients according to the national diabetes study group classification:**

**Assessment glycaemic diabetic relation to range of non control**

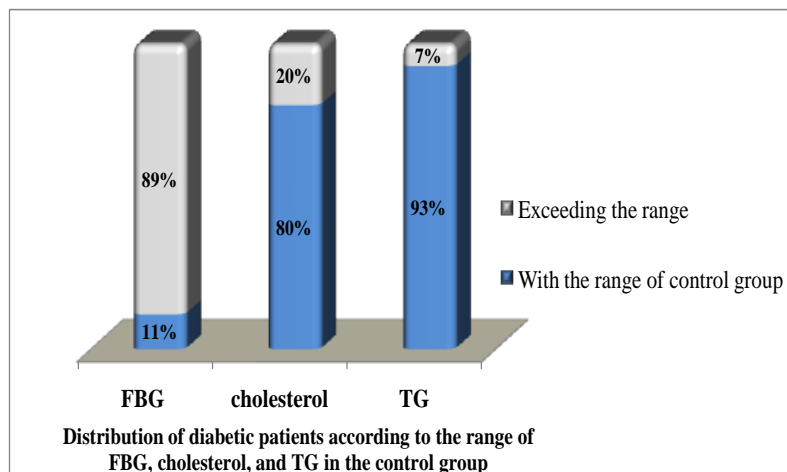
Figure (1) percentage of patients with glycaemic relation to the of the non control group. percentage of diabetic study were within ranges of the study group 11% for FBG, cholesterol TG (Figure

Group classification	FBG/ Total cholesterol/ TG	No. of patients	Percentage
<b>FBG (mg/dl)</b>			
Excellent	<115	13	18.6%
Acceptable	<140	12	17.1%
Poor	>140	45	64.3%
Group classification	FBG/ Total cholesterol/ TG	No. of patients	Percentage
<b>Total cholesterol</b>			
Excellent	<200	15	21
Acceptable	200-239	38	54.7
Poor	≥240	17	24.3
<b>TG</b>			
Excellent	< 150	57	81
Acceptable	150 - 200	7	10
Poor	>200	6	9

**of the control of the patients in the normal diabetic group.**

shows the NIDDM excellent control in normal range diabetic The the total group who the normal non diabetic as follows: 80% for and 92% for 1).

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**Figure 1: Distribution of diabetic patients according to the range of FBG, cholesterol, and TG in the control group**

**Discussion:**

The mean value FBG in NIDDM group was higher than that of non diabetic group and the difference is statistically significant at  $P < 0.001$ . The distribution of FBG among diabetic group was 18.6 % for  $< 115 \text{mg/dl}$  (excellent control), 17.1 % for  $< 140 \text{mg/dl}$  (acceptable control, and 64.3% for  $> 140 \text{mg/dl}$  (poor control). This result reveals that 35.7 of total diabetic group were in good glycaemic control<sup>(9)</sup> reported that 140 mg/dl of FBG is the upper limit of acceptable glycaemic control. The mean value of cholesterol in the NIDDM study group was  $179.45 \pm 49.79 \text{ mg/dl}$  which was higher than that of the corresponding non diabetic study group  $158.95 \pm 33.75$ . The difference was statistically significant at the level of  $P < 0.05$ . This finding is in line with the finding of Owen.<sup>(10)</sup>

The mean values of triacylglycerol were not statistically significantly different from the corresponding non diabetic study group. This is in line with findings of a previous study result were no significant difference noted in the levels of TG.<sup>(6)</sup> Cholesterol correlated significantly positive with TG ( $r = 0.294$ ,  $P < 0.05$ ).

In summary it was found that poor control of diabetes mellitus that is reflected mainly by increase in fasting blood glucose (FBG) and total cholesterol (TC) in diabetic subjects as compared to age matched non diabetic control.

We recommend that the measurement of lipid profiles in Sudanese diabetic patients can be used as a marker for glycaemic control.

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