

## Research Article

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## Sudanese Lipid Profile in Diabetics and Non-Diabetics - Central Sudan-2013

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### ABSTRACT

**Objectives:** To find out the association of type 2 diabetes mellitus (T2DM) with increased risk of dyslipidemia and cardiovascular disease in Sudanese population, glucose, lipid profile as well as blood pressure were measured.

**Materials and Method:** A case-control study was made at Gezira State, Sudan, during the period of April 2012-March 2013. A total of two hundred matching inclusion criteria were enrolled in the study, participants divided into diabetic and non-diabetic groups to estimate the levels of FPG, Glycosylated hemoglobin HbA1c and lipid profile (TC, HDL-C, LDL-C, and TG). Samples were analyzed for different biochemical parameters, using A15, a random access auto-analyzer bio system. A questionnaire including personal information was filled as well as anthropometric and biochemical measures. Verbal consent obtain from each respondent then venous blood was collected after an overnight fast. Statistical analysis was carried-out using statistical package for social sciences (SPSS version 16, Chicago, IL, USA).

**Result:** Tukey- HSD test showed that BMI, SBP and DBP increased significantly by (0.001), (0.017) and (0.032) respectively. FPG and HbA1c were increased with highly significant ( $p > 0.0001$ ). TC, HDL-C and LDL-C showed non-significant increase in their mean concentrations (196.28), (54.28) and (105.75) respectively. TG mean concentration was (158.86) had increased significant (0.057).

**Conclusion:** Study showed significant increase in BMI. Lipid profile of study participants showed no differences in TC and LDL-C and HDL-C, but TG showed significant increased. Systolic (SBP) and diastolic (DBP) blood pressure showed significant increase in all study participants. Study population with T2DM was at high risk to develop metabolic syndrome.

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### Introduction

Diabetes mellitus is one of the common chronic diseases in the Sudan with a prevalence of 447,000 in 2000, and this prevalence is projected to increase in 2030 to reach 1,227,000 [1]. DM is defined as group of metabolic disorders of multiple etiologies characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both with disturbances of carbohydrate, fat and protein metabolism resulting in long term damage, dysfunction and failure of various organs. Symptoms of DM include: thirst, polyuria, blurring of vision, and weight loss. In its most severe forms, ketoacidosis or a non-ketotic hyperosmolar state may develop and lead to stupor and coma. In the absence of effective treatment, death terminates DM complications [2]. The statistical data in 2012 reveal 1.5 million deaths were directly caused by DM; more than 80% of them were in low- and middle-

income countries [3]. The global prevalence of DM was estimated to be 8.8% among adults aged 20-79 years, 7.0% for male, 8.1% for female and 7.5% for both sex [4,3]. By 2023, T2DM will become the leading cause of disease burden for males and the second leading cause for females [5]. HbA1c is "unusual" haemoglobin in patients with DM [6]. Maintaining of a good and low HbA1c, improve the chances of avoiding long-term complications of DM. The optimal rang for HbA1c in detecting the incident of Micro-albuminuria is  $\geq 6.6\%$  to 7%, and the maintenance of good glycemic control reduces the development and progression of nephropathy in type 1 and type 2 DM [7,8].

Metabolic syndrome is a group of metabolic disease include glucose intolerance, T2DM, atherogenic dyslipidemia, CVD, high blood pressure, HTN and central obesity). Dyslipidemia is a disorder in lipid metabolism which leads to changes in the serum levels of circulating lipids and lipoproteins [9]. This change

appears in elevated level of TG, LDL-C and decrease level of HDL-C [10]. Those abnormalities occurs in the same individual and causes a multiple set of risk factors that commonly appear together [11]. Moreover one of those abnormalities often precedes the other [12]. Metabolic syndrome criteria by presence of three or more of the following metabolic abnormalities: abdominal obesity Waist circumference WC >102 cm in men and WC >88 cm in women, hypertriglyceridemia, TG ≥150 mg/dL, low HDL-C levels, HDL-C <40 mg/dL in men and <50 mg/dL in women, raised blood pressure (SBP ≥130 mmHg, DBP ≥85 mmHg), and raised FPG ≥110 mg/dL. The normal cholesterol content of lipoprotein is 60-70% of LDL-C, 20-30% of HDL-C, and 10-15% of VLDL of the total serum cholesterol [10].

## Material and Methods

### Study Subject, Design and Area

A case-control study was undertaken. There were 200 adults in total, both males and females. There were 100 participants with T2DM and 100 participants who seemed to be healthy, engaged as aspect of a control group or (non-diabetic). The participants were recruited from rural and urban areas in and around Wad Madani district. The study persisted since April 2012 till March 2013.

### Inclusion and Exclusion Criteria

The subjects in this research ranged in age from 18 to 60 years old, had no existing infection, and had no diabetes - related complications. Entities who emerged to be healthful and consented were registered in the non-diabetic group. A subject was abolished if he or she failed to fulfill any of the criteria for inclusion.

### Ethical Approval

The Ethics Board of the Health ministry authorized the research ethical clearance.

### Study Procedure

Following approval, all patients and control subjects provided documentation on bio data and anthropometry (weight was verified in kilograms (kg) and heights in meters (m), and the body mass index (BMI) was calculated using the following formula: BMI = (weight in kilograms)/(height in meters)<sup>2</sup> (Ng M, 2014). The A15, a random access auto-analyzer bio system, was used to quantify plasma measurements for FBG, HbA1C and lipid profile.

### Statistical Analysis

#### Groups According to Study Variables

Variables	Characteristic	Diabetic	Non-diabetic	Sig
Gender	Male	26	31	-
	Female	74	69	
Age	20-29 yrs	1	2	0.03
	30-39 yrs	3	5	
	40-49 yrs	40	58	
	50-59 yrs	49	27	
	60-69 yrs	7	8	
WC(cm)	Male≤102	14	25	0.14
	Male>102	12	6	
	Female≤88	9	7	
	Female>88	65	62	
BMI (kg/m <sup>2</sup> )	under weight (BMI < 18.50)	0	1	0.04
	Normal (BMI 18.50 - 24.99)	15	33	
	Overweight (BMI 25 - 29.99)	40	38	
	Obese class I (BMI 30 - 34.99)	27	17	
	Obese class II (BMI 35-39.99)	14	8	
	Obese class III (BMI =>40.00)	4	3	

A statistical package for social sciences was being used to evaluate quantitative data (SPSS version 16, Chicago, IL, USA). The numerical data were all demonstrated as means± Standard Error of Mean. Chi-square test was used to calculate the percentage of distribution of study participants. For both study categories, Post Hoc Tests (Tukey- HSD) used for comparison of means between groups. P-values were considered significant at 0.05 or lower (p≤0.05).

### Results

The study participants were 100 cases (50%) for diabetic and non-diabetic. 143(71.5%) of the study participants were female, whereas 57 (28.5%) participated were male (table 1).

Increased WC was found in 77 (77.0%) diabetic and 68(68.0%) non- diabetic. Just 45 (24.9%) of study subjects had a standard BMI, while 78 (39.0%) were overweight and 73(36.5%) were obese. 128 (64.0 %) of participants embroiled in moderate physical activity (table 2). FPG levels were high in 98 (49.0 %) of study subjects, while HbA1C control was impoverished in 156 (78.0 %) (table 2).

Tukey- HSD test showed that the BMI mean was (28.95) and it increased significantly by (0.001) pointed to that the participants were obese. The mean concentrations of FPG (151.94) and HbA1c (6.83) in diabetic and non-diabetic groups with highly significant (p=>0.0001) for both. SBP mean was (116.45) with highly significant (0.017) and DBP mean was (79.34) with significant (0.032) indicating tendency to elevated blood pressure. TC showed non-significant increase in their mean concentrations (196.28). HDL-C mean showed high risk (54.28) with non-significant increased. LDL-C mean showed above optimal concentration level (105.75) with non-significant increased. TG mean concentration was (158.86) with significant increased (0.057) (table 3).

**Table 1:** General Characteristic of study groups

Variables		Frequency	Percent %
Group	Diabetic	100	50
	Non-diabetic	100	50
Gender	Male	57	28.5
	Female	143	71.5

**Table 2:** Distribution of Study Participants in Study

Physical activity	Low Moderate High	5 57 36	22 71 7	<0.0001
Blood pressure (mmHg)	Normal (SBP\ DBP= less than 120\80) Pre-hypertension (SBP\ DBP=120 -139\ 80-89) Stage1 HT (SBP\DBP=140-159\DBP 90 -99) Stage 2 HT (SBP\DBP= 60\100 and above)	29 68 2 1	53 42 4 1	SBP\ 0.004 DBP\<0.0001
FPG (mg/dL)	Normal < 110 High >110	18 82	84 16	<0.0001
HbA1C (%)	Excellent <6.5 Good 6.5-7.5 Moderate 7.5-8.9 Poor >=9	30 6 20 44	94 6 0	<0.0001
Total C (mg/dL)	Normal < 200 High >200	54 46	57 43	0.39
LDL-C (mg/dL)	Optimal < 100 Above Optimal > 100	45 55	46 54	0.50
HDL-C(mg/dL)	Low risk <=59 High risk>=59	70 30	64 36	0.23
TG (mg/dL)	Normal < 150 High > 150	49 51	58 42	0.13

**Table 3: Post Hoc Tests (Tukey- HSD)**

Variables	Minimum	Maximum	Mean	Std. Error	Sig (Tukey- HSD)
Age(year)	22	65	48.21	1.042	0.015
WC (cm)	52	127	98.42	1.565	0.936
BMI (kg/m <sup>2</sup> )	17.31	55.20	28.95	5.83	0.001
SBP (mmHg)	80	170	116.45	1.546	0.017
DBP (mmHg)	30	130	79.34	2.080	0.032
FPG (mg/dL)	46	442	151.94	10.223	<0.0001
HbA1C (%)	3.10	15.00	6.83	2.56	<0.0001
Total C (mg/dL)	75	312	196.28	6.130	0.915
LDL-C (mg/dL)	32	216	105.75	4.194	0.725
HDL-C(mg/dL)	15	100	54.28	2.226	0.515
TG (mg/dL)	38	533	158.86	11.207	0.057

## Discussion

Comparing diabetic and non-diabetic groups using Chi- Square to view the distribution of study participants in study groups according to study variables and Post Hoc Tests (Tukey- HSD) for comparison of means between groups, reveals that there was significant increase in their BMI, SBP, DBP, FPG, HbA1C and TG. These finding indicating that study participants were obese with significant increase in their blood pressure. Distribution of study participants in study groups according to study variables shows no differences between diabetic and non-diabetic participants. 46 participants showed high total serum cholesterol compared to 43 of non-diabetic participants. Also 55 participants were above optimal total serum LDL-C compared to 54 of non-diabetic participants. 30 participants were at high risk of low total serum HDL-C compared to 36 participants of non-diabetic HDL-C. 51 participants have high serum TG compared to 42 participants of non-diabetic. In contrast to our current results, a case-control study which was conducted in Sudan for determinations of lipid profile disorder indicated that nearly half of 250 diabetic patients had some disorder in their lipid profile [13].

Central obesity in obese has strong correlation to metabolic complications, this was clearly in the significant increase in the mean concentration of TG in addition to significant increase in

SPB and DBP indicating that more than one criteria of metabolic syndrome is exist in those groups, so participants were mostly at high risk for developing dyslipidemia and HTN and there is possibility to developing CVD, these findings were in line with that of who found that T2DM is socioeconomic disease affect mainly obese persons and is associated with increased risk of HTN and hyperlipidemia [14-16].

There was significant increase in physical inactivity. Only 36 participants have high physical activity in diabetic participant compared to 7 participants of non-diabetic participants, indicating low care about regular exercise. Physical inactivity play a role in the development of obesity and is independent mediator of metabolic derangements, in contrast to physical activity which protect against all causes of mortality, independent of body weight [17, 18]. Habitual physical activity was associated with reduced intra-hepatic fat content, and improved insulin resistance and lipid oxidation and this resulted risk of development of DM thus this is actual action of physical activity in weight loss and caloric expenditure [19-21]. Physical inactivity has been identified as the fourth leading risk factor for global mortality and it accounts for 6% of deaths globally [22].

## Conclusion

Study showed significant increase in BMI. Lipid profile of participants showed no differences in TC and LDL-C between diabetic. SBP showed significant increase in all study participants, particularly the overweight and obese participants. Study population with T2DM was at high risk to develop metabolic syndrome.

## Recommendations

Introducing prophylactic means to maintain well-being and control blood glucose through regular exercise and dietary restriction (minimizing taking sugary, fatty rich foods).

Regular checking up for HbA1c, lipid, renal profile and electrolytes to avoid aggressive complication of DM.

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## Abbreviations

**T2DM** =type2 diabetes mellitus; **WHO**= world health organization; **FPG**=Fasting Plasma Glucose; **HbA1c**= Glycosylated Hemoglobin; **SBP**= Systolic Blood Pressure; **DBP**= Diastolic Blood Pressure; **WC**= Waist Circumference; **BMI**= Body Mass Index; **p**=Probability; **mg**=Milligram; **M**=Meter; **mmHg**= millimeter of mercury

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