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The lipid profile in children with type 1 diabetes mellitus

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***Abstract*---**Introduction: Diabetes mellitus (DM) is a common, chronic, metabolic syndrome characterized by hyperglycemia as a cardinal biochemical feature. The aim of study is to study the lipid profile changes in Type 1 DM in Erbil City in pediatrics aged 6 to 18 years. Method: All cases of type 1 diabetes mellitus aged 6 – 18 years who attended Diabetic Association Center in Erbil Governorate during the study period were enrolled in this study and were 52 (27 males and 25 female). A group of control matched for age and gender were selected from 3 schools chosen by simple random sampling (primary, secondary and preparatory schools). Results: The values of serum cholesterol, serum TGs, LDL-C and VLDL were found to be significantly higher in the patients with diabetes mellitus compared with controls. HDL-C result was equal between male and female patients; the mean fasting S. TGs was significantly high among patients with duration of diabetes of ≥ 5 years while total fasting S. cholesterol. Conclusion: It was concluded that the lipid abnormalities (total fasting serum cholesterol, serum TGs, LDL-C, VLDL-C) were significantly higher in diabetic patients than in control group, TGs was significantly higher in patients of more than 5 years' duration.

***Keywords*---**Lipid Profile, Children, Type 1 Diabetes Mellitus.

Introduction

Diabetes mellitus (DM) is a common, chronic, metabolic syndrome characterized by hyperglycemia as a cardinal biochemical feature. The major forms of diabetes are divided into those caused by deficiency of insulin secretion due to pancreatic

ß-cell damage (type 1 DM), and those that are a consequence of insulin resistance occurring at the level of skeletal muscle, liver, and adipose tissue, with various degrees of ß-cell impairment (type 2 DM) [1]. Also Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. Several distinct types of DM exist and are caused by a complex interaction of genetics and environmental factors [2, 3]. The global incidence of type 1 diabetes in children and adolescents is increasing with an estimated overall annual increase of around 3% [4, 5].The increase in incidence in type 1 diabetes has been shown in countries having both high and low prevalence with an indication of a steeper increase in some of the low prevalence countries. Several European studies have suggested that, in relative terms, increases are greatest in young children. Although type 1 diabetes usually accounts for only a minority of the total burden of diabetes in a population, which accounts for only 5–10% of those with diabetes [1], it is the predominant form of the disease in younger age groups in most developed countries [6, 7]. Lipid disorders or hyperlipidemia is common in diabetic patients [8]. Hyperlipidemia is a generalized disease of the arterial wall, which may progress or regress depending on a plethora of factors. The classic risk factors for hyperlipidemia or atherosclerosis in the general population are age, male gender, family history of premature cardiovascular disease (CVD), DM, hypertension, smoking, high LDL-C, low HDL-C, and obesity [8]. The aim of study is to study the lipid profile changes in Type 1 DM in Erbil City in pediatrics aged 6 to 18 years.

Method

The present study was performed in the Diabetic Association Center in Erbil City. This center is the main center for providing care to children with diabetes mellitus in Erbil Governorate (established at 2006) where they are referred to from different administrative areas of the governorate. A case control study was adopted to achieve the purposes of the study. The study was conducted in a period of three months from the beginning of December 2007 to the 29th of February 2008. All cases of type 1 diabetes mellitus aged 6 – 18 years who attended Diabetic Association Center in Erbil Governorate during the study period were enrolled in this study and were 52 (27 males and 25 female). Cases of hypothyroidism, nephrotic syndrome, familial hypercholesterolemia, and those receiving medications were excluded from the study. A group of control matched for age and gender were selected from 3 schools chosen by simple random sampling (primary, secondary and preparatory schools) in Erbil city. Before inclusion in the study, DM was ruled out in the control group by asking questions about the clinical signs of diabetes such as polyuria, polydipsia and recent weight loss, laboratory tests also confirmed the absence of DM in the control group. A questionnaire was designed by the researcher. Information was collected from parents of the participants via a face-to-face interview and included age, gender, residence, duration of diabetes, family history and regimen of insulin administration. Written consent was taken from parents of each child enrolled in this study. The weight was measured by precision dial scale (Seca Optima). Participants were weighed in light clothing as far as possible and without shoes. The scales were calibrated before use. Height was measured by using the (Centre of Diseases Control) CDC measuring board. Individuals were measured barefoot and standing erect, with feet together and head against the measuring rod,

looking straight ahead, with arms hanging loosely at the sides and palms facing thighs. BMI is used as a measure of overall obesity and was calculated: BMI = weight (kg)/height^2 (m^2). Venous blood samples were obtained after 12 hours of fasting state. In addition, patients were instructed to avoid insulin intake for more than 2 hours before the examinations. Blood sample were collected between 8:30-9:00 a.m., about 4 mL of blood was withdrawn by venipuncture, using plain tubes. After 25-30 mints, the serum was separated by centrifugation using a HITACHI centrifuge (model O5P-21) at 5000 rpm for 10 minutes. Then processed immediately for measuring serum cholesterol, serum TGs , HDL-C , then LDL-C was derived by Fredrickson-Friedwald formula [LDL-C=(TC-HDL)-TG/5], VLDL = S.TGs / 5 and fasting blood sugar by autoanalyser which made in French (open, automated, discrete, random access). Data were entered into Statistical Package for Social science (SPSS) program for Windows version 15. Quantitative variables were summarized by finding mean ± SD. Mann Whitney U test was used to test the difference in the mean between cases and control.

Results

The age group and gender of the patients and controls are distributed as shown in table 1.

Table1: Age and gender distribution of the patients and controls

Age and Gender	Patients No. and %	Controls No. and %
6-12years	12(23%)	12(23%)
13-18years	40(77%)	40(77%)
Male	27(52%)	27(52%)
Female	25(48%)	25(48%)

Overweight and obesity were found in 7(14%) of patients and 10(19%) of control and it statistically not significant as in table 2. Fasting blood sugar was found to be more than 140 mg/dl in 40 (77%) of patients compared to 0% of controls.

Table 2: BMI of Patients and controls

BMI	Patients No. and %	Controls No. and %	P-value
< 25	45 (87%)	42 (81%)	0.59
≥ 25	7 (14%)	10 (19%)	
Total	52	52	

About 54% of the patients, the duration of diabetes was >5 years while in 46% of them the duration was ≤5 years as shown in table 3.

Table 3: Duration of DM

Duration (years)	No.	Percentage
≤5	24	46%
>5	28	54%
Total	52	100.0

The values of serum cholesterol, serum TGs, LDL-C and VLDL were found to be significantly higher in the patients with diabetes mellitus compared with controls. The difference in HDL-C was not statistically significant as in (Table 4).

Table4: The distribution of mean ± standard deviations of various variables in patients with diabetes mellitus and controls

Variables	Patients with DM	Controls Mean± SD	P-value
Age	15 ± 3	15± 3	
Wt (Kg)	46± 16	49± 16	
Ht (cm)	145 ± 18	151 ± 14	
BMI (Wt*kg*/ht*m2*)	21 ± 4	21 ± 5	0.59§
Duration of DM (years)	6 ± 2		
S.cholesterol (mg/dl)	175 ± 55	136± 34	0.01 ***
S.TGs (mg/dl)	140 ± 135	74 ± 25	0.00 ***
HDL-C (mg/dl)	59 ± 19	53 ± 15	0.52 §
LDL-C (mg/dl)	93 ± 51	68 ± 30	0.02 **
VLDL-C (mg/dl)	23± 13	15± 5	0.01 ***

** p < 0.01(Significant) *** p < 0.001(Highly significant) § p > 0.05(Not significant)

Despite that the mean serum cholesterol, S. TGs, LDL-C and VLDL-C were higher in female, these results were of no significant relationship, while HDL-C result was equal between male and female patients as shown in table 5.

Table 5: Relation of Lipid Profile Results of patients with Gender

Lipid Profiles	Range	Male	Female	Total	P-Value
Total Serum Cholesterol	Normal 5-95th percentile	21(78%)	18 (72%)	39	0.66 §
	More than 95th percentile	6(22%)	7(28%)	13	
Total Serum Triglyceride	Normal 5-95th percentile	20(74%)	14(56%)	34	0.17 §
	More than 95th percentile	7(26%)	11(44%)	18	

HDL_C	Normal 5-95th percentile	25(93%)	23(92%)	48	0.93 §
	More than 95th percentile	2(7%)	2(8%)	4	
LDL_C	Normal 5-95th percentile	25(93%)	21(84%)	46	0.33 §
	More than 95th percentile	2(7%)	4(16%)	6	
VLDL_C	Normal 5-95th percentile	25(93%)	20(80%)	45	0.18 §
	More than 95th percentile	**2(7%)**	**5(20%)**	**7**	

§ p > 0.05 (not significant)

The mean fasting S. TGs was significantly high among patients with duration of diabetes of ≥ 5 years while total fasting S. cholesterol, LDL-C, HDL-C VLDL-C were of no significant relationship with duration of diabetes mellitus as in table 6.

Table 6: Relation of lipid profile Results and duration of diabetes mellitus

Lipid Profiles	Range	duration of DM		Total	P-Value
		5 years or less	More than5 years		
Total Serum Cholesterol	Normal 5-95th percentile	21(88%)	18(64%)	39	0.10 §
	More than 95th percentile	3 (12%)	10 (36%)	13	
Total Serum Triglyceride	Normal 5-95th percentile	20(83%)	14(50%)	34	0.02 **
	More than 95th percentile	4(17%)	14(50%)	18	
HDL_C	Normal 5-95th percentile	17(71%)	21(75 %)	38	0.97 §
	More than 95th percentile	7(29%)	7(25%)	14	
LDL_C	Normal 5-95th percentile	23(96%)	23(82%)	46	0.26 §
	More than 95th percentile	1(4%)	5(18%)	6	
VLDL_C	Normal 5-95th percentile	22(92%)	23(82%)	45	0.55 §
	More than 95th percentile	2(8%)	5(18%)	7	

§ P > 0.05 (not significant), ** P < 0.02(significant)

No significant relationship was noted of total fasting s. cholesterol, s. TGs, HDL-C, LDL-C and VLDL-C with BMI among diabetic patients as in table 7.

Table 7: Relation of Lipid Profile Results in Type I Diabetes Mellitus with BMI

Lipid Profile	Range	BMI		Total	P-Value
		Less than 25	25 and more		
Total Serum Cholesterol	Normal 5-95th percentile	32(71%)	7(100%)	39	0.22 §
	More than 95th percentile	13(29%)	0(0%)	13	
Total Serum Triglyceride	Normal 5-95th percentile	28(62%)	6(86%)	34	0.44 §
	More than 95th percentile	17(38%)	1(14%)	18	
HDL_C	Normal 5-95th percentile	31(69%)	7(100%)	38	0.18 §
	More than 95th percentile	14(32%)	0(0%)	14	
LDL_C	Normal 5-95th percentile	39(88%)	7(100%)	46	0.80 §
	More than 95th percentile	6(13%)	0(0%)	6	
VLDL_C	Normal 5-95th percentile	39(87%)	6(86%)	45	1.32 §
	More than 95th percentile	6(13%)	1(14%)	7	

§ p > 0.05(Not significant)

Discussion

Patients with Diabetes mellitus can have many lipid abnormalities, including elevated levels of total serum cholesterol, serum triglycerides, LDL-C, VLDL-C and low level of HDL-C especially if the blood sugar uncontrolled. These patients have a preponderance of abnormalities in the composition of LDL-C, which increase atherogenicity even if the absolute concentration of LDL-C is not significantly increased .The combination of elevated levels of LDL-C particles and high triglyceride levels represents a lethal cholesterol abnormality [(10)]. In the present study most of the patients 40 (77%) were 13-18 years of age, this could be explained that generally, the incidence of type 1 diabetes mellitus is age-dependent with a range of fewer than 1 per 1,000 at age 5 years to approximately 3 per 1,000 at age 16 years, Incidence increases with age and peaks in early to middle puberty [(11)], but IDDM can occur at any age [(12)]. Regarding the gender, in this research we found that 27 (52%) of patients were male and 25 (48%) were female, this slight difference could be explained that type 1 DM is more common in male in regions of high incidence and females appear to be at a greater risk in low-incidence regions [(12)], or male and female subjects are approximately equally affected [(11)]. In the present study, 45 (87%) of patients were less than 25 BMI and 7 (14%) patients were more than 25 BMI in comparison with the results of the control 42(81%) were less than 25, and 10 (19%**)** were more than 25, although this difference was not statistically significant (P-value =0.59). Weight loss could be due to insulin deficiency which cause breakdown of protein and fat [(12)]. The

mean fasting serum cholesterol, serum TG. s, LDL-C and VLDL-C ratio, were significantly higher among diabetic patients than in controls. This is concordance with other studies conducted elsewhere like Al-Naama et al in Basrah –Iraq [13], Khalil et al in Amman-Jordan [10] and Erciyas et al in Amsterdam-Netherlands [14]. But in contrast to Imani et al in Isfahan-Iran who showed surprisingly, lower serum cholesterol, LDL-C in diabetic patients, and this difference could be due to tight nutritional control in diabetic group -as the authors attributed in the study [15]. In this study, HDL-C was higher among patients than controls, although this difference was not significant statistically (P-value = 0.97).This result is in consistent with the finding of Al-Naama et al [13], and in contrast to other studies like, Khalil et al [10] , Imani et al and Erciyas et al studies [14, 15] .The results of our study and Al-Naama et al study are in agreement with the belief that the level of the HDL-C is normal or increased in type 1 DM [16]. Despite that the mean serum cholesterol, serum TGs, LDL-C, VLDL-C were higher in female while HDL-C was equal in male and female patients, all these results were statistically of no significant relationship. This is in concordance with the finding of Patiakas et al in Greece study, who stated that there was no important statistical difference between male and female in hypertriglyceridemia and mixed hyperlipidemia [17], and in contrast to the results reported by Perez et al in Barcelona-Spain who showed that female with type 1 diabetes displayed higher concentrations of LDL-C and a higher prevalence of hypercholesterolemia when glycemic control was poor, and the results were statistically significant [18]. This difference of results could be due to the difference in the sample size and age group between both studies. Despite that the mean fasting serum cholesterol, LDL-C, HDL-C and VLDL-C were higher in diabetic patients, but these differences were not statistically significant among patient with diabetes in relation to the duration of disease, whereas the result showed significant difference in the mean serum TGs (P-value = 0.02) which was higher among patients with duration more than 5 years. This could be explained by the most common pattern of dyslipidemia is hypertriglyceridemia [2] and no further studies have been found between the duration of diabetes and lipid disorders. The mean fasting serum cholesterol, serum TGs, LDL-C, HDL-C and VLDL-C were not influenced significantly by BMI among the patients .These results were in concordance with the reports of Bianga et al in Japanese study [19] and Herbert et al in Philippine study [20].

Conclusion

It was concluded that the lipid abnormalities (total fasting serum cholesterol, serum TGs, LDL-C, VLDL-C) were significantly higher in diabetic patients than in control group, while HDL-C, although was higher in diabetic patients, but it was not statistically significant. There was no relationship between the lipid abnormalities in diabetic patients and the gender, BMI, and duration of diabetes, while the S. TGs was significantly higher in patients of more than 5 years duration.

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