LIPID PROFILE IN TYPE 1 DIABETIC PATIENTS ATTENDING DIABETIC CENTER IN SULAIMANIA CITY

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ABSTRACT

Background

Diabetes mellitus is a of metabolic disorder of carbohydrate metabolism in which glucose is under-utilized producing hyperglycemia and changes in lipid profile.

Objectives

To find out prevalence of dyslipidemia among type1 diabetic and relation of dyslipidemia with control of diabetes mellitus and its duration.

Pateins and Methods

The study was done in a diabetic center from July to November 2013, in which 159 Type1diabetic patients participate, during the interviews a questionnaire was filled including demographic characteristics in addition to laboratory investigation including fasting plasma glucose, glycosylated hemoglobin and lipid profile. SPSS was used to measure means; Chi-square and logistic regression were used when indicated to be significant at p-value ≤ 0.05.

Results

One hundred fifty nine patients were involved in this study. Eighty three female, their age between 13-35 years, Glycosylated hemoglobin was <7% in 13(8.2%) of them and ≥7% in 146 (91.8%). Dyslipidemia present in 89.9% of our patients. Significant relationship between glycosylated hemoglobin with only low density lipoprotein (p= 0.03) and total cholesterol (p= 0.04). Also significant relation found in high triglyceride in male (p= 0.01) with low high density lipoprotein in female (p=0.03) and between duration of DM and only low density lipoprotein (p= 0.01). Significant association was found between all lipid profile except total cholesterol and high body mass index.

Conclusion

High percentage of dyslipidemia found in current study associated with poor control of diabetes mellitus and high body mass index. Obesity, gender, duration of diabetes. Diastolic blood pressure and occupation can be used to predict some parameters of lipid profile

Keywords: *Diabetes Mellitus. Dyslipidemia, Glycosylated hemoglobin, Body mass index.*

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INTRODUCTION

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia and many metabolic changes including carbohydrate, lipid and protein metabolism. Some dyslipidemia are primary, while others are secondary to other disorders such as hypothyroidism, nephrotic syndrome, diabetes mellitus, alcoholism, obesity, pregnancy, steroid-therapy and estrogen therapy [1] .

Dyslipidemia often give rise to ectopic lipid deposits in the skin, tendons, blood vessels and eyes and are most harmful when they deposit in the blood vessels leading to atherosclerosis [2].

Changes occurring in diabetic dyslipidemia include quantitative and qualitative changes. Quantitative changes include increase in very low density lipoprotein (VLDL) and low density lipoprotein (LDL) levels and decrease in high density lipoprotein (HDL) levels due to increase in hepatic lipase activity. Qualitative changes include increase amount of triglycerides (TG) and low density lipoprotein (LDL), thus increasing risk of heart diseases [3].

Diet and exercise are among the most common environmental factors affecting lipid levels. However, genetic determinants of several monogenic lipid-related disorders have been clearly established [4].

Dyslipidemia is a potent predictor of cardiovascular morbidity and mortality in diabetic patients. The systemic metabolic disturbances of diabetes, including hyperglycemia and dyslipidemia, likely play a central role in the pathogenesis of diabetes-associated atherosclerosis through the generation of oxidative stress. The effects of oxidative stress in diabetes on both the vascular wall and lipoproteins in circulation may promote atherogenesis [5].

Male gender and poor glycaemia are associated with a potentially more atherogenic lipoprotein profile. Conventional antihyperglycemic treatment frequently normalizes the dyslipidemia in Type 1 Diabetes Mellitus (T1DM), but often does not completely correct that in Type 2 Diabetes Mellitus (T2 DM) [6].

Lifestyle modifications are the first intervention as smoking cessation, diet low in saturated and transfats, Optimal Waist Circumference. Optimal body mass index (BMI) and daily moderate physical activity. Treatment may be initiated at lower or higher lipid levels if family history or other investigations indicate elevated risk [7]

Aim of current study is to find out the prevalence of dyslipidemia among T1DM patients and to show the effects of diabetes control and its duration on lipid profile.

PATIENTS AND METHODS

A cross-sectional study was conducted on a sample of 159 participants enrolled in study registered in diabetic center in Sulaimania, from July to November of 2013. Measurements of blood pressure, height, weight and waist circumference was done for the participants. A blood sample was collected to estimate blood lipids and glucose. The inclusion criteria were patients with T1DM diagnosed at least one year ago and patients age was <36 years who had been using insulin since the diagnosis.

Exclusion criteria include patients receiving anti-lipid therapy and pregnant women.

Approval of the study was obtained from the ethical committee of Kurdistan board. The importance of the study was explained to patients, where verbal consent was obtained from each patient. A questionnaire designed for the purpose of the study was filled after interviewing with patients including socio-demographic profile and associated risk factors.

Socio-economic level according to the ministry of planning was defined as low, moderate, good, very good [8]. Measurements include weight and height to calculate body mass index (BMI) (kg/m2). Hypertension was defined as BP ≥140/80 mmHg according to American diabetes association standard medical care for 2013 [9].

Laboratory data that indicate dyslipidemia include Triglyceride (TG) levels ≥ 150 mg/dl, HDL < 40 mg/dl for men while for women <50mg/dl, LDL ≥ 100 mg/dl, TC level ≥ 200 mg/dl, high atherogenic index as Log TG/HDL of ≥0.11. Fasting plasma glucose: Good control<126 mg/dl , Bad control ≥126 mg/dl, Poor HbA1c levels of ≥ 7% and good control referred to <7% [10].

Data were coded, entered to Microsoft Excel sheet, cleaned and analyzed using Statistical Package for Social Science (SPSS) version 21.0. Data was described by calculation of frequencies, percentages, mean (± SD). Comparison between categorical variables was done using Chi- square test. A p-value ≤ 0.05 was considered significant. Variables found to be statistically significant with some of the lipid parameters were entered into logistic regression model.

RESULTS

One-hundred fifty nine cases of T1DM that came to center were taken as study group. The demographic characteristics of the patients as shown in Table (1) that includes: the age group of patients mostly of the age groups 20-29 years that represented 62 cases (39%), 83 (52.2%) were females. The residency of the patients mostly from inside Suliamania city 94 (59.1%). Most of patients had own house 124 (78%). Regarding the educational levels of the patients mostly secondary levels 84 (52.8%), regarding occupation of patient, majority were students 53 (33.3%), Regarding to income of the patients, most of them were moderate income 124(78%). Most of patients had normal BMI 93 (58.5%). Majority 154 (96.9%) had high systolic blood pressure and 22 (13.8%) had high diastolic blood pressure while 97 (61%) had family history of DM, Only 44 (27.7%) patients had family history of dyslipidemia, The duration of diabetic, 55 (34.6%) patients were between 5-10 years, Fasting plasma glucose levels above recommended value was found in 82.4%. Among them 91.8% had poor control with HbA1c ≥ 7%. The prevalence of dyslipidemia in T1DM was 89.94% and only 10.06% had normal lipid profile as shown in figure (1). Table (2) shows lipid parameters in T1DM. In 159, 49.7% had high TC with mean 201.2 mg/dl, LDL was high in 66% with mean 124.94 mg/dl, HDL was low in 56% with mean 44.07 mg/dl, TG was high in 40.9% with mean 170.23 mg/dl. VLDL high in 21.4% and the mean 34.04 mg/dl. Atherogenic index was high risk in 93.7%.

Table 1. Socio-demographic characteristics of the samples

Variables	No.	%	Variables	No.	%
Age(years) 13-19	43	27	**BMI 18.5-24.9**	93	58.5
20-29	62	39	**25 - 29.9**	33	20.8
30-35	54	34	**≥ 30**	15	9.4
Gender			**Waist circumference(cm)**		
Female	83	52.2	**Female <88, male <102**	151	95
Male	76	47.8			
Residency			**Systolic blood pressure**		
Inside Sulaimani city	94	59.1	**(mmHg) >140**	154	96.9
House Own house	124	78	**Diastolic blood pressure(mmHg) >80**	137	86.2
Educational levels			**Family history of DM**		
Secondary School	84	52.8	**Yes**	97	61
Occupations			**Family history of No**	115	72.3
Housewife	53	33.3	**dyslipidemia Yes**	44	27.7
Income/person/year($)			**Fasting plasma glucose**		
Moderate	124	78	**(mg/dl) ≥ 126**	131	82.4
Duration of DM/years			**HbA1c**		
5-10	55	34.6	**Poor control ≥ 7**	146	91.8

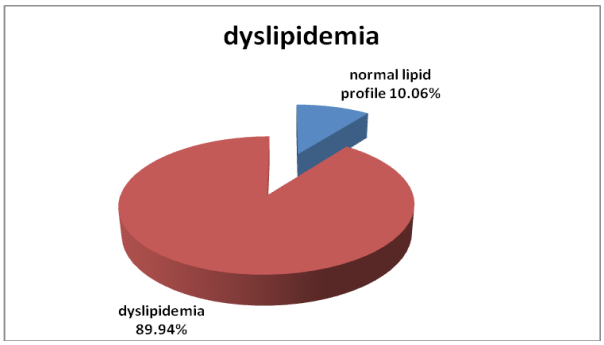

Figure 1. Prevalence of dyslipidemia in type1DM

Table 2. Prevalence of lipid parameter in type 1 DM.

Lipid parameters (mg/dl)		No.	%	Means±SD
Total cholesterol (TC)				
	< 200	80	50.3	201.19±53.73
	≥ 200	79	49.7	
LDL-cholesterol				
	< 100	54	34	124.94±47.12
	≥ 100	105	66	
HDL-cholesterol				
	For male < 40, female<50	89	56	44.07±14.86
	For male ≥ 40 ,female≥50	70	44	
Triglyceride (TG)				
	< 150	94	59.1	170.23±158
	≥ 150	65	40.9	
VLDL-cholesterol				
	< 40	125	78.6	34.04±31.74
	≥ 40	34	21.4	
Atherogenic Index Plasma (AIP)				
	Low risk < 0.11	10	6.3	0.53±0.35
	High risk ≥ 0.11	149	93.7	
Total		**159**	**100**	

Relation of HbA1c with only TC & LDL were statistically significant (P<0.05) .The lipid parameters and BMI of the patients were significant for all lipid parameters except for TC (P>0.05) as shown in Table (3). Male had statistically higher level of TG than female and lower HDL in female than male (P<0.05), Duration of DM shows statistically significant (P=0.01) for only LDL as shown in Table (4).

Logistic regression analysis shows that LDL had significant relation with duration of diabetes (5-10) years (OR= 3.713, P=0.008), poor control of DM (OR=5.224 , P=0.011) while TC shows significant association with housewife occupation (OR=2.857,p=0.015),high diastolic blood pressure (OR=7.87,P=0.003) and poor control of DM(OR=3.98,p=0.05) .

Table 3. Relation of lipid parameters with HbA1c and BMI in Type1 DM.

Lipid parameters(mg/dl)	HbA1c		p-value	BMI			P-value
	<7% N (%)	≥7% N (%)		<18.4 N (%)	18.5-24.9 N (%)	≥25 N (%)	
Total Cholesterol							
<200	10(76.9)	70(47.9)	0.04	11(61.)1	51(54.8)	18(37.5)	0.09
≥ 200	3(23.1)	76(52.1)		7(38.9)	42(45.2)	30(62.5)	
LDL-C							
<100	8(61.5)	46(31.5)	0.03	8(44.4)	38(40.9)	8(16.7)	0.01
≥100	5(38.5)	100(68.5		10(55.6)	55(59.1)	40(83.3)	
HDL-C							
male<40, female<50	9(69.2)	80(54.7)	0.31	5(27.8)	45(48.4)	39(81.3)	<0.001
male≥40, female≥50	4(30.7)	66(45.2)		13(72.2)	48(51.6)	9(18.7)	
Triglyceride (TG)							
<150	8(61.5)	86(58.9)	0.5	13(72.2)	65(69.9)	16(33.3)	<0.001
≥ 150	5(38.5)	60(41.1)		5(27.8)	28(30.1)	32(66.7)	
VLDL- C							
< 40	10(76.9)	115(78.8	0.5	15(83.3)	80(86)	30(62.5)	0.005
≥ 40	3(23.1)	31(21.2)		3(16.7)	13(14)	18(37.5)	
(AIP)							
Low risk <0.11	1(7.7)	9(6.2)	0.5	3(16.7)	7(7.5)	0(0)	0.03
High risk ≥0.11	12(92.3)	137(93.8		15(83.3)	86(92.2)	48(100)	
Total	13(100)	146(100)		18(100)	93(100)	48(100)	

Table 4.Relation of lipid parameters with gender and duration of Diabetes in Type1 DM.

Lipid parameters(mg/dl)	Gender		p-value	Duration of DM/y			P-value
	Female N (%)	Male N (%)		<5 N (%)	5-10 N (%)	≥10 N (%)	
Total Cholesterol							
<200	39(47)	41(53.9)	0.34	32(62.7)	25(47.2)	23(41.8)	0.08
≥ 200	44(53)	35(46.1)		19(37.3)	28(52.8)	32(58.2)	
LDL-C							
<100	27(32.5)	27(35.5)	0.6	23(45.1)	20(37.7)	11(20)	0.01
≥100	56(67.5)	49(64.5)		28(54.9)	33(62.3)	44(80)	
HDL-C							
male<40, female <50	53(63.9)	36(47.4)	0.03	24(47.1)	30(56.6)	35(63.6)	0.2
male≥40, female ≥50	30(36.1)	40(52.6)		27(52.9)	23(43.4)	20(36.4)	
Triglyceride (TG)							
<150 ≥	57(68.7)	37(48.7)	0.01	29(56.9)	30(56.6)	35(63.6)	0.6
150	26(31.3)	39(51.3)		22(43.1)	23(43.4)	20(36.4)	
VLDL-C							
< 40	69(83.1)	56(73.7)	0.1	38(74.5)	41(77.4)	46(83.6)	0.4
≥ 40	14(16.9)	20(26.3)		13(25.5)	12(22.6)	9(16.4)	
(AIP)							
Low risk <0.11	7(8.4)	3(3.9)	0.24	3(6)	4(7.5)	3(5.5)	0.8
High risk ≥0.11	76(91.6)	73(90.1)		48(94)	49(92.5)	52(94.5)	
Total	83(100)	76(100)		51(100)	53(100)	55(100)	

Table 5. Logistics regression analysis between low density lipoprotein (LDL) and total cholesterol (TC) as dependent variables with several independent variables.

Variables	B	p-value	OR	95% C.I. for OR	
				Lower	Upper
LDL					
BMI		.030			
Underweight			1		
Normal weight	-.548	.354	.578	.181	1.843
Over-weight & Obese	.731	.299	2.077	.523	8.248
Duration of DM (years)		.022			
< 5 years			1		
5 - 10 years	1.312	.008	3.713	1.409	9.785
> 10 years	.255	.572	1.291	.533	3.128
No drug history	1.627	.072	5.087	.864	29.958
High DBP (≥80)	1.010	.142	2.746	.712	10.588
HbA1c (poor control)	1.653	.011	5.224	1.450	18.829
Constant	-2.816	.015	.060		
Total Cholesterol (TC)					
Occupation		.063			
Student			1		
Governmental	.541	.380	1.717	.514	5.742
Non-governmental	.015	.973	1.016	.412	2.501
Housewife	1.050	.015	2.857	1.223	6.674
High DBP (≥80)	2.063	.003	7.870	2.057	30.104
HbA1c(poor control)	1.383	.053	3.987	.984	16.149
Constant	-1.903	.010	.149		

DISCUSSION

In our study, 82.4% of sample, the FPG values of the patients was ≥126 mg/dl well above the ADA criteria, similar result seen in study done by Rodrigues TC et al in 2010 in Brazil [11], Al-Naama LM et al in 2009 in Bahrain [12] and study by Wadwa R et al [13]. Higher percentage (91.8%) of poor control HbA1c ≥ 7 has been found in T1DM in current study consistent to Masram SW *et al* in 2012 in India [14], while inconsistent to study done by Idzior-Walus B in 2001 [15].

In our study dyslipidemia was 89.94%, same result was found in Nigeria [16] while lower prevalence (58%) reported from study in Pakistan [17]. This variation in prevalence may be due to differences in BMI and possibly genetic variation. High serum TC level among diabetic patients has been observed in the present study which is similar to finding in study by gylling H et al [18].

A low level of HDL was found in T1DM patients due to decreased rate of HDL turnover because of insulin deficiency [19]. We found a high serum TG concentration among T1DM patients, although the difference was significant for males. It has been observed that patients with T1 DM who receive no treatment or inadequately treatment have higher serum TG levels. It is observed that the relation of LDL and TC with glycated hemoglobin is statistically significant ($P<0.05$) while no significant relation between HDL, TG & VLDL with HbA1c were observed. Comparing our result to other studies, it was inconsistent to study done by Masraw SW *et al* 2012 in India[14] . In USA poor HbA1c found to be associated with high concentration of TC, LDL and TG, but not HDL[20-21] also study done by Maahs DM 2010 [21]. Same finding in study in Pakistan [17] , however no significant association reported in 2000 in Spain[22] . Female patients in present study with IDDM were more than male .which is consistent to study done in USA [23] .

and in Gaborone in 2006 [24] while inconsistent to study in UK in 2001[15] and in Pakistan[17] . Atherogenic index was higher in female in our study, this may be attributed to poorer diabetes control in female than in male and this may endanger them for cardiovascular diseases in adulthood as the protectiveness of cardiovascular disease in premenopausal women may be endangered in T1DM [25].

TG levels were found to be much raised among diabetic male, while LDL &TC were more in female than male as shown in other studies [17,25].

In study of Perez A *et al* in 2000 in Spain[22] reported the effect of diabetes on lipid abnormality more in female patients than male. In study of Idzior-Walus in UK[15] shows high TC in female patients, while TG and low HDL more in male patient, with no gender differences in LDL .

Dyslipidemia mostly occur in BMI≥25($p<0.05$), except for total cholesterol ($P=0.09$) ,Inconsistent to study in Gaborone [24], Hamad et al in Pakistan [26] where dyslipidemia occur in normal BMI and as obesity in current study is more prevalent in female patients as compared with their male counterpart which is consistent with the study done by AL-Janabi in Iraq [27] . In current study there was no significant relation of duration of DM and dyslipidemia except for LDL ($P=0.01$), Same finding find in study by Ladeia et al in Brazil[28].

In conclusions, our study shows high prevalence of dyslipidemia more common when the duration of DM between 5-10 years. Normal BMI and poor control DM (HbA1c≥7). Significant relation found between HbA1c and LDL and TC and between TG in male and lower HDL in female, also significant relation between all lipid profile except TC and high BMI. The optimal care of diabetic patients should include periodic screening for lipid profile in addition to initiate aggressive lifestyle changes such as weight reduction and physical exercise beside good glycemic control.

REFERENCES

1.Vasudevan DM ,Srekumari S, Vaidyanathan K .Text Book of Biochemistry for Medical Students. 6th ed. New Delhi: Jaypee brothers; 2011.P.113-90.

2.Jameson JL. HARRISON'S Endocrinology. 2nd ed. New York: McGraw Hill ; 2010. P.267-70.

3.Manu Arora, Shyamal Koley, Sunil Gupta , Sandhu JS. A Study on Lipid Profile and Body Fat in Patients with Diabetes Mellitus. Anthropologist. 2007; 9(4): 295-8.

4.Malhotra A, Wolford JK. The American Diabetes Association GENNID Study Group. Analysis of Quantitative Lipid Traits in the Genetics of NIDDM (GENNID) Study Diabetes 2005; 54:3007-14.

5.Ory DS, Schaffe JE. ApoA-1 in Diabetes: Damaged Goods. Diabetes 2010; 59:2358-9

6.Ren S, Lee H, Hu L, Lu L, Shen GX. Impact of Diabetes-Associated Lipoproteins on Generation of Fibrinolytic Regulators from Vascular Endothelial Cells. Journal of Clinical Endocrinology and Metabolism. 2002; 87(1):286-91.

7.Spratt KA. Managing Diabetic Dyslipidemia: Aggressive Approach. Journal of the American Osteopathic Association. 2009; 109:2-7.

8. Ministry of Planning and Development Cooperation; Central Organization for Statistics and Information Technology, Annual per capita income report in Iraq. 2012 June 21.

9. American Diabetes Association. Standards of Medical Care in Diabetes. Diabetes Care 2013; 36(1):11-66 .

10.Frohlich J, Dobiášová M . Fractional esterification rate of cholesterol and ratio of triglycerides to HDL cholesterol are powerful predictors of positive findings on coronary angiography. Clinical Chemistry. 2008; 49: (11) 1873-80.

11.Rodrigues TC, Pecis M, Canani LH, Schreiner L, KramerCK, Biavatti K, et al. Characterization of patients with type 1 diabetes mellitus in southern Brazil: chronic complications and associated factors . Revista da Associacao Medica Brasileira Journal. 2010; 56(1): 67-73

12. Al-Naama LM , Ajlan SK , Mahmood MS . Evaluation of Lipid and Lipoprotein Profile in Patients with Insulin Dependent Diabetes Mellitus. Journal of the Bahrain Medical Society. 2009; 21(3):298-301

13.Wadwa RP, Kinney GL, Maahs DM, Snell-Bergeon J, Hokanson JE, Garg SK, et al . Awareness and Treatment of Dyslipidemia in Young Adults with Type 1 Diabetes. Diabetes Care 2005; 28(5):1051-6.

14.Masram SW, Bimanpalli MV, Suresh G S. Study of Lipid Profile and Glycated Hemoglobin in Diabetes Mellitus. Indian Medical Gazette Journal. 2012; 146(7):257-65.

15.Idzior-Walus B, Mattock MB, Solnica B, Stevens L, Fuller JH; EURODIAB IDDM Complications Study Group. Factors associated with plasma lipids and lipoproteins in Type 1 diabetes mellitus: the EURODIAB IDDM Complications Study. Diabetic Medicine 2001; 18(10):786-96.

16.Ogbera AO, Fasanmade OA, Chinenye S, Akinlade A. Characterization of lipid parameters in diabetes mellitus – a Nigerian report. International Archives of Medicine. 2009; 2 (1):19.

17.Uttra KM, Devrajani BR, Ali Shah SZ, Devrajani T, Thanwar Das T, Raza S, et al. Lipid Profile of Patients with Diabetes mellitus in Pakistan . World Applied Sciences Journal 2011; 12 (9): 1382-4.

18.Gylling H, Tuominen JA, Koivisto VA, Miettinen TA. Cholesterol Metabolism in Type 1 Diabetes. Diabetes. 2004; 53: 2217-22.

19.Ferretti G, Bacchetti T, Busni D, Rabini RA, Curatola G. Protective effect of paraoxonase activity in high-density lipoproteins against erythrocyte membranes peroxidation: a comparison between healthy subjects and type 1 diabetic patients. Journal of Clinical Endocrinology and Metabolism. 2004 ; 89(6): 2957-62.

20.Petitti DB, Imperatore G, Palla SL, Daniels SR, Dolan LM, Kershnar AK, et al. Serum Lipids and Glucose Control. Archives of Pediatrics and Adolescent Medicine Journal. 2007; 161:159-65.

21.Maahs DM. Association of glycaemia with lipids in adults with type 1 diabetes: modification by dyslipidemia medication. Diabetologia. 2010 ; 53(12): 2518-25

22.Perez A, Wagner AM, Carreras G, Gimenez G, Sanchez-Quesada JL, Rigla M, et al. Prevalence and Phenotypic Distribution of Dyslipidemia in Type 1 Diabetes Mellitus. Archives of Internal Medicine Journal. 2000; 160: 2756-62.

23.Mayer-Davis EJ, Bo Ma, Lawson A, D'Agostino RB, Liese AD, Bell RA, et al . Cardiovascular Disease Risk Factors in Youth with Type 1 and Type 2 Diabetes: Implications of a Factor Analysis of Clustering. Metabolic Syndrome and Related Disorder Journal. 2009; 7(2):89-95.

24. Mengesha AY. Lipid profile among diabetes patients in Gaborone, Botswana. South African Medical Journal . 2006; 96:147-8.

25.Setoodeh A, Mostafavi F , Rabbani A , Hedayat T. Female Sex as a Risk Factor for Glycemic Control and Complications in Iranian Patients with Type 1 Diabetes Mellitus. Iranian Journal of Pediatric. 2011; 21(3):373-8.

26.Hamad A, Qureshi HJ . Dyslipidemia in recently diagnosed young subjects of type1 diabetes mellitus with normal favorable BMI: a risk factor of macro vascular disease. Biomedical. 2008; 24:130-3.

27.AL-Janabi A M. The influence of body mass index on glycosylated hemoglobin and lipid profile in diabetic patients. Kufa Medical Journal . 2010; 13(1):104-11.

28.Ladeia AM, Adan L, Couto-Silva AC, Hiltner A, Guimaraes AC. Lipid profile correlates with glycemic control in young patients with type1 diabetes mellitus. Preventive Cardiology. 2006 Spring ; 9(2): 82-8.