

Lipid profile in patients with coronary artery disease

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ABSTRACT

Objective: To determine the lipid profile and to identify and stratify risk factors in diabetic and non-diabetic patients with proven coronary artery disease at King Hussein Medical Center, Amman, Jordan.

Methods: One hundred and ninety-two patients who were admitted to Queen Alia Heart Institute, Amman, Jordan, proving to have coronary artery disease (CAD) by angiogram, with a mean age of 54 ± 22 years were studied. Seventy-seven patients were diabetics and 115 non-diabetics. Their lipid profiles (T-Cholesterol, high density lipoprotein level (HDL-C), low density lipoprotein level (LDL-C), triglyceride, glucose, glycosylated hemoglobin) and thyroid function test were compared to a control group of 162 individuals with no cardiac events or diabetes, mean age 48.9 ± 18 years. Prevalence of hyperlipidemia was calculated. Patients with high thyroid stimulating hormone were excluded.

Results: The mean (\pm standard deviation) plasma cholesterol for the group with CAD is 231.43 ± 57.99 mg/dl versus 202.8 ± 36.58 in the control group ($p<0.0003$). High density lipoprotein 35.98 ± 9.37 versus 44.43 ± 8.34 ($p=0.00011$). Low density lipoprotein 146.75 ± 50.93 versus 118.97 ± 45.9 ($p=0.003$). Triglyceride level 246.95 ± 142.1 versus $164 \text{ mg/l} \pm 93.78$ ($p=0.0002$). Thyroid stimulating hormone level was 1.55 ± 0.9 versus $1.51 \pm$

0.89 ng/l in control group ($p=0.35$ NS), HbA1c in diabetic group $7 \pm 2.3\%$. The prevalence of high plasma cholesterol, triglycerides (TG), LDL-C and low HDL-C was 60.9%, 68.3%, 63.5% and 48.4%. Inter-group comparison of patients with CAD (diabetics versus non-diabetics) revealed higher TG level in the diabetic group and statistically significant difference of the HDL and LDL levels between the 2 groups in favor of diabetic group explained by higher percentage of patients on anti-hyperlipidemic drugs than non-diabetics. More females with CAD were found in the diabetic group versus non-diabetic group (16.9% versus 6.1%. $z=2.4027$ $p=0.00820$).

Conclusion: Jordanian patients with CAD have higher cholesterol, LDL-C, Triglyceride and lower HDL-C levels than the control group which comes in accordance of other studies. Hyperlipidemia remains the strongest risk factor for CAD. Diabetic females are at higher risk for CAD versus non-diabetics with the same lipid profile. Aggressive treatment of hyperlipidemia is of paramount importance to reduce the morbidity and mortality of cardiac events in diabetic and non-diabetic patients.

Keywords: Diabetes, coronary artery disease, lipid profile.

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Atherosclerosis is a major health problem in patients with diabetes mellitus (DM) accounting for 80% of all mortality in diabetic patients. About 3-quarters of this mortality is due to coronary atherosclerosis.^{1,2} Data from Framingham Heart Study

in subjects aged 35-64 years at 30 years follow-up, showed that the age adjusted annual risk of vascular disease ranged from 2-fold increase in relative risk for coronary heart disease (in diabetic men) to more than 8-fold for intermittent claudication and cardiac

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failure (in diabetic women).³ Diabetic women lose the customary protection against coronary artery disease (CAD) enjoyed by non-diabetic premenopausal women; in the Framingham Heart Study the age adjusted incidence of myocardial infarction was higher in diabetic women than in non-diabetic men (13.8 versus 13.1 per 1000) at 26 years follow-up.³ The triad of diabetes, obesity and low levels of high-density lipoprotein (HDL-C) cholesterol carries a particularly high risk of CAD in the Framingham women cohort.⁴ The most common lipid abnormalities in patients with DM are an elevation in total plasma triglycerides (TG) mainly very low density lipoprotein (VLDL) and reduction in HDL-C. Low density lipoprotein (LDL) may be normal or moderately elevated.⁵⁻⁸ The risk of CAD is markedly increased in hypercholesterolemic patients who have other concurrent risk factors.^{9,10} However, if cholesterol levels are very low, CAD is uncommon even if other risk factors are present. To determine the lipid profile of patients with proven CAD by angiogram we conducted a prospective study to assess the lipid profile in these patients, to evaluate the prevalence of dyslipidemia in both diabetics and non-diabetics and to stratify the risk factors in this cohort.

Methods. One hundred and ninety-two patients who were admitted to Queen Alia Heart Institute, Amman, Jordan, between May through to November 1997 with unstable angina or post myocardial infarction after 2-4 weeks of stabilization for elective

angiogram. Inclusion criteria include all diabetic and non-diabetic patients with proved CAD by angiogram. Patients with high Thyroid Stimulating Hormone (TSH), morbid obesity (Body Mass Index; BMI >30 kg/m²), nephrotic syndrome or alcoholism (>21 unites/week) were excluded. Experienced consultant cardiologist performed complete history, physical examination and angiogram. Blood in a fasting state was extracted using a vacutainer in a plain tube for plasma cholesterol (TC), triglyceride (TG), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C) and TSH, and oxalate tube for HbA1c for diabetic patients. Lower density levels was considered high if a value above 100 mg/dl and HDL-C values below 40 mg /dl was considered low according to the latest Adult Treatment Panel (ATP) III.¹¹

Patients were divided into 2 groups; diabetic group (DM) n=77 and non-diabetic group n=115 (non-DM). A group of 162 healthy subjects with neither previous history of angina or myocardial infarct non-DM served as control group. Results were compared with the control group and inter-group comparison between DM and non-DM group was carried out.

Statistics were performed using mean ± standard deviation (SD), simple percentages, paired two-tailed t test and z statistic.

Results. The clinical characteristics, mean glucose, TSH, BMI, drug history and some risk factors are listed in **Table 1**. None of the patients were excluded on basis of high TSH, BMI or

Table 1 - Demographic features, drug history and risk factors for coronary heart disease.

Features %	Coronary artery disease		p1	ALL	Control	p2
	DM n=77	Non-DM n=115				
Mean (± SD) age/year	-	-	-	54 ± 22	48.9 ± 18	0.6
Male:Female (%)	13:64 (16.9)	7:108 (6.1)	0.0082	20:172	40:122	-
Body mass index (kg/m ²)	29.83 ± 2.01	25.47 ± 2.1	<0.00001	27.82 ± 2.49	26.48 ± 2.97	<0.0001
Smokers	33	38	0.2389	35.5	46	0.0233
Hypertension	40	31	0.238	35.5	21	0.00135
On aspirin	72.7	54	0.00554	61.5	13	<0.0001
Anti-hyperlipidemic	56	36	0.00376	46	2	<0.00001
Mean glucose mg/dl	206.1 ± 79.3	91.3 ± 18	<0.000013	137.8 ± 76.91	92.3 ± 17.6	<0.0001
TSH Miu/mL	1.58 ± 0.97	1.519 ± 0.95	0.632	1.546 ± 0.94	1.5 ± 0.92	0.35

n - number, DM - diabetes mellitus, TSH - thyrotropin, p1 - comparison between diabetes mellitus versus non-diabetes mellitus group
p2 - comparison of the coronary artery disease group versus control group, SD - standard deviation

Table 2 - Prevalence of dyslipidemia.

% n	Coronary artery disease		p1	All n=192	Control n=162	p2
	DM n=77	Non-DM n=115				
Hypercholesterolemia	67.5	72.2	0.2451	70.3	49.4	<0.003
Hypertriglyceridemia	71.4	55.7	0.0139	62	36.3	<0.0003
High LDL-C	80.5	89.6	0.0384	86	36.1	<0.001
Low HDL-C	75.3	73.9	0.4129	74.5	18.8	<0.0001

n - number, DM - diabetes mellitus, LDL-C - low density lipoprotein cholesterol, HDL-C - high density lipoprotein cholesterol
p1 - comparison between diabetes mellitus versus non-diabetes mellitus, p2 - comparison of the coronary artery disease group versus control group

Table 3 - The mean (\pm SD) lipid profile in patients with coronary heart disease and control groups.

Mean \pm SD	DM group n=77	non-DM group n=115	p1	Coronary artery disease n=192	Control n=162	p2
Mg/dl						
Cholesterol	228.5 \pm 60	233.4 \pm 56.8	0.28	231.4 \pm 57.9	202.8 \pm 36.6	0.0003
HDL-C	36.9 \pm 12.4	35.3 \pm 6.6	0.151	35.9 \pm 9.4	44.4 \pm 8.3	0.0011
LDL-C	142 \pm 52.7	149.9 \pm 49.7	0.189	146.7 \pm 50.9	118.9 \pm 45.9	0.003
Triglyceride	258 \pm 136.7	239.6 \pm 145.7	0.192	246.9 \pm 142.1	164 \pm 93.8	0.002

n - number, LDL-C - low density lipoprotein cholesterol, HDL-C - high density lipoprotein cholesterol, DM- diabetes mellitus
p1 - comparison between diabetes mellitus versus non-diabetes mellitus group
p2 - comparison of the coronary artery disease group versus control group, SD - standard deviation

excessive alcohol intake (5.1% in CAD group were taking <21 units/week versus 2.5% in control group).

The mean (\pm SD) diabetes duration in DM group was 9.43 ± 3.1 year. The mean HbA1c was $6.99 \pm 2.26\%$ (n=50). Prevalence of dyslipidemia (**Table 2**) Hypercholesterolemia was found in 70.3% of patients with CAD versus 49.4% in the control group ($p < 0.003$), diabetics were having less prevalent hypercholesterolemia than non-DM group ($p=0.24$ NS). Hypertriglyceridemia was found in 62% of CAD patients versus 36.3% of the control group ($p<0.0003$), more diabetic patients were having hypertriglyceridemia versus non diabetics (71.4% versus 55.7%, $p=0.013$). High LDL-C was found in 85.9% of CAD group versus 36.1% in the control group ($p<0.0001$), more non-diabetic patients were having high LDL-C than diabetics (89.6% versus 80.5%, $p=0.038$). Coronary artery disease group were having low HDL -C in 74.5% of patients versus only 18.8% in the control group ($p<0.0001$), however diabetic and non-diabetic patients were having low

HDL-C at almost the same rate (75.3% versus 73.9%, $p=0.4$) Lipid profile (**Table 3**). The mean TC in CAD group is 231.4 ± 57.9 versus 202.8 ± 36.6 in the control group ($p=0.0003$), HDL-C was lower in the CAD versus control group (35.9 \pm 9.4 versus 44.4 \pm 8.3, $p= 0.0011$).

Lower density lipoprotein level was significantly higher in the CAD group (146.7 ± 50.9) when compared to control group (118.9 ± 45.9), $p=0.003$. Again TG level was higher in CAD group versus controls (246.9 ± 142.1 versus 164 ± 93.8 , $p=0.002$). inter-group comparisons between DM versus non-DM group are shown in **Table 3**. Stratification of risk factors (RF) according to the most prevalent RF in the CAD group revealed that high LDL-C ranked on top of the pyramid at 85.9% using the new guidelines of ATPIII.¹¹ This was followed in decrescendo manner by Low HDL-C (74.3%), hypertriglyceridemia (62%), diabetes mellitus (40.1%), smoking and hypertension in last place (35.5% each)

Table 4 - Stratification and ranking of risk factors in coronary artery disease group.

Risk factors	%
High low density lipoproteins	85.9
Low high density lipoproteins	74.3
High T. Cholesterol	70.3
Hyper-Triglyceridemia	62
Diabetes Mellitus	40.1
Smoking	35.5
Hypertension	35.5
T - total	

Discussion. With the improvement of primary care in Jordan in the last decade and regression of deaths due to infectious disease to rear places. Deaths due to coronary artery diseases namely acute myocardial infarction (AMI) and its equivalent come to a leading place as it is in other parts of the world¹². Dyslipidemia becomes an important risk factor with westernizing of this country's food.¹² Adding to this the increase in prevalence and incidence of diabetes mellitus mainly Type 2 Diabetes due to consanguinity and poor control of diabetes due to noncompliance and non-acceptance of insulin therapy as in other area communities.^{13,14}

This study tackles the lipid profile of a cohort of patients who experienced AMI or unstable angina or its equivalent, and were admitted for elective angiogram. It did prove higher mean lipid levels in those with proven CAD, thing that was more pronounced in the diabetic subgroup (**Table 3**). The slightly lower but insignificant mean total cholesterol and LDL-C in the diabetic patients may be explained by the fact that there were more patients on anti-hyperlipidemia drugs in this group. Although other risk factors such as obesity, sedentarism and alcoholism were not considered in this study, nevertheless it showed with no doubt that hyperlipidemia namely hyper LDL-C and low HDL-C remain the strongest risk factor for CAD in Jordan (**Table 4**). Diabetic patients are at 3-fold increased risk of CAD than non-diabetic patients with same risk factors and lipid profile.

This study also revealed 2 other important issues. Firstly, despite the fact that the need for anticoagulation in CAD is well established¹⁵ and that all patients were referred for elective angiogram after being stabilized, nevertheless only 73% of them were on anticoagulation at admission to hospital.^{15,16} Secondly, the benefits of anti-hyperlipidemia drugs

mainly statin group and the early institution of statins are widely accepted and acknowledged,¹⁷⁻²² only 46% in the CAD group were on these drugs despite that more than 70% of patients have a recognized hyperlipidemia as a risk factor. Another important aspect is the high percentage of patients who are still smoking (35.5%) in the CAD group. Although the recent ex-smoker rate was not considered in this calculation as of non-agreement of definition of ex-smoker, nevertheless this figure is still high and alarming, as smoking is one of the important modifiable risk factor for CAD. The current study had shown a high prevalence of diabetic females with CAD (16.9% in the diabetic group versus 6.1% in the non-diabetic group, p=0.008), confirming that diabetic females lose their natural protection against CAD and at a younger age.³

In a study by Hammoudeh²³ who reported lipid profile for patients with acute coronary syndromes admitted to cardiac care unit. He found the mean TC, LDL and TG to be 202, 131 and 154 mg/dl which, are lower than the group studied by us. High density lipoprotein level was 38 mg/dl, which is slightly higher than our findings, emphasizing the fact that our cohort is not receiving the adequate treatment to modify an important risk factors namely dyslipidemia.

We recommend that all diabetic patients should have their CAD risk calculated and lipid profile checked and corrected to reduce the chance of CAD. Aggressive treatment of hyperlipidemia and the early institution of medical therapy are important parameters in reducing morbidity and mortality for all groups of patients.

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