Free Fatty acids and Cardiovascular disease

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Abstract

One hundred thirty-five specimens of serum were used in this study, eighty of them having cardiovascular dysfunctions (Angina, Myocardial infarction and heart failure), compared with fifty-five normal healthy persons. Male and female were subjected to this study, with age ranging from (51-73). There was no other risk factor of cardiovascular disease like diabetes mellitus and hypercholesterolemia. BMI, WHR, FFA, cholesterol, triglycerides, HDL and LDL were determined for each specimen, the results showed that that BMI and WHR were significantly elevated in sera of male and female patients in G1, G2 and G3 (except male) than male and female normal individuals. Also the levels of FFA are significantly increased in sera of patient of G1. Cholesterol, triglycerides and LDL were significantly elevated in sera of patients with myocardial failure(MI) , heart failure(HF) and Angina individuals than normal subject for both sexes (except N.S elevated of the levels of LDL and triglycerides in sera of male patient with HF and angina respectively). While the levels of HDL are significantly decreased in sera of patients with MI (male and Female) , HF (male and Female) and angina (male and female).

From the results that obtained from this study we can conclude that the mean value of BMI ,WHR , cholesterol, triglycerides and LDL were markedly increased in sera of patients individuals with Cardiovascular disease (CVD). while the Free fatty acids-FFA only elevated in sera of male patients with angina.

Introduction

Cardiovascular disease (CVD) refers to diseases of the heart and diseases of the blood vessel system (arteries, capillaries, veins). "Cardio" refers to the heart and "vascular" refers to the blood vessel system(1). The heart is a strong, muscular pump slightly larger than your fist (2),It pumps blood continuously through the circulatory system (1) . The circulatory system includes two major organs, the heart and lungs, and blood vessels (arteries, capillaries, and veins). Heart and blood vessel problems do not happen quickly. Over time, the arteries that bring blood to the heart and brain can become blocked from a buildup of cells, fat, and cholesterol (plaque). Reduced blood flow to the heart from blockages in the arteries causes heart attacks. Lack of blood flow to the brain from a blood clot, or bleeding in the brain from a broken blood vessel, causes a stroke (1-3) .

Heart disease and stroke are the first and third leading causes of death for both men and women in the United States, accounting for nearly 40% of all deaths.

Although these largely preventable conditions are more common among people aged 65 years or older, the number of sudden deaths from heart disease among people aged 15–34 has increased(4).

There are many forms of heart and cardiovascular disease: Atherosclerosis, Coronary heart disease, Angina, Stroke, myocardial infarction (MI) ,High blood pressure (or hypertension) and Heart failure (3,4).

There are several risk factors for heart disease; some are controllable, others are not. Uncontrollable risk factors include: Male sex, older age and family history of heart disease (3) .

Many risk factors that can be controlled, by making changes in the lifestyle, smoking, High LDL, or "bad" cholesterol and low HDL, or "good" cholesterol and Free fatty acids-FFA [The terms Free fatty acids refers to fatty acids that are in the unesterified state. In plasma FFAs are combined with albumin, and in the cell they are attached to a fatty acid binding

protein or Z-protein]. Uncontrolled risk factor include hypertension (high blood pressure) , physical inactivity, obesity (more than 20% over one's ideal body weight), diabetes, High C-reactive protein , stress and anger (3-5) .

The aim of this study is to determine the correlation between serum lipids (Body Mass Inex-BMI, Waist to hip ratio–WHR, Free Fatty Acids-FF, cholesterol , tirglycerid and HDL-cholesterol) and variety of CVD, and estimate serum lipids in different types of CVD.

Material and Methods

The study design : A cross sectional study was Carried out over the period from the lst of May 2004 to the end of March 2005 .

The study population : One hundred thirty-five specimens of serum were used in this study, eighty of them having cardiovascular dysfunctions (Angina, Myocardial infarction and heart failure), compared with fifty-five normal healthy persons. Male and female were subjected to this study, with age ranging from (51-73). There was no other risk factor of cardiovascular disease like diabetes mellitus and hypercholesterolemia.

For each individuals weight, length, hip and waist was measured which are used to calculate :

1- BMI (which is the weight in kilograms divided by the square of height in meters),and this used to classify the class of obesity according to the following table (6) .

Classification	Obesity class	BMI kg/m2
Underweight		< 18.5
Normal		18.5to 24.9
Overweight		25 to 29.9
Obesity		
	I	30.0 to 34.9
	II	35.0 to 39.9
Extreme obesity	III	≥ 40

*Values are the same for both sexes[6]
**Classification of overweight and obesity in adults according to BMI

2- WHR (Waist to hip ratio) used as indicator for abdominal obesity , in which the person have abdominal obesity if the WHR > 0.85 for female and > o.95 for male (7) .

Blood samples were obtained. Serum was extracted and analyzed for serum lipids and lipoproteins. Statistical analysis of the results were applied using mean value, standard deviation ,T- test .

Determination of plasma levels of total cholesterol, HDL-C and triglyceride levels was performed by enzymatic and colorimetric methods (8-10 . LDL-C and very low density lipoprotein cholesterol (VLDL-C) levels were calculated from the Friedewald formula (11,12) .

$$V L D L = \frac{Triglycerides}{5}$$

LDL = cholesterol – (H D L + V L D L) .

The estimation of FFAs carried out by using copper soap formation method (13).

Results

This study includes a total of 80 patients having cardiovascular dysfunction with age ranging from (51 to 73) years .Those patients were diagnosed by doctor and clinical examination (x-ray , ECG ,etc), and distributed into three groups:-

Group 1 (G1): (23) Patients suffering from myocardial failure(MI).

Group 2 (G2): (31) Patients suffering from heart failure(HF).

Group 3 (G3): (26) Patients suffering from unstable Angina.

These three groups were compared with 55 normal healthy person with the same age . Fasting patients were selected and are free from other diseases like diabetic , liver and renal disease . [Table 1].

The data obtained form the normal and patients are summarized in Table 2, It is evident from this table that the mean of BMI and WHR are higher in Group 1, Group 2 and Group 3 than normal, while the mean of the levels of FFA were 530±88.7 µmol/L in Group 1, 521±97.8 µmol/L in Group 2 and 539.5±94.1 µmol/L in Group 3 as compared with 519.1 ± 107.5 µmol/L in normal group, also the mean of the levels of cholesterol were 259± 41.2 mg/dl in Group 1, 217.3 ± 22 mg/dl in Group 2 and 242 ± 27 in Group 3 compared with normal group 193±19 mg/dl. In the same table mean of the levels of triglycerides were 177± 21.8 mg/dl in Group 1 , 162 ± 27.4 mg/dl in Group2 and 153 ± 22 mg/dl in Group 3 compared with normal group 137± 11mg/dl , and mean value of LDL were 176 ± 28 mg/dl in Group 1, 155 ±

24 mg/dl in Group 2 and 135 ± 21.8 mg/dl in Group 3 compared with normal group 119±19 mg/dl , also the mean value of the levels of HDL were 33 ±9.7 mg/dl in Group1, 41 ± 12.3 mg/dl in Group 2 and 31.8 ± 11.5 mg/dl in Group 3 compared with normal group 58±4.9 mg/dl

Tables 3,4 and 5 study the variation between different parameters for both sexes in normal and three groups, these tables show that the BMI, WHR are significantly increased in male and female of the patients in (G1,G2 and G3) than normal male and female , while the levels of FFA (541±105 µmol/L) are significantly elevated in sera of male in G3 than normal male.There are no significant variation between male and female FFA levels than normal male and female in G1 and G2, and the levels of cholesterol and triglycerides are significantly higher in G1, G2 and G3 than the limit in normal group for both sexes, except triglyceride in sera of male in G3 . However the levels of LDL and HDL are significantly elevated in sera of male and femal for G1(only female),G2 and G3 as compared with the levels in normal male and female.

Table 1 : Population study characteristic

Subjects	Sex No.		
	Male	Female	total
Control	31	24	55
Group 1 : Myocardial infarction	13	10	23
Group 2: Heart failure	17	14	31
Group 3: Angina	16	10	26

Table 2 : Mean value (± S.D.) of lipid profile in three groups of cardiovascular disease (Myocardial infraction, heart failure, angina) and control group.

Parameters	Controle	Group 1	P <	Group 2	P <	Group 3	P <
BMI (Kg/m2)	30.76±2.5	34.97 ±4.6	0.001	33.41±3.6	0.001	34.54±4.6	0.001
WHR	0.82±0.10	0.97±0.11	0.001	0.88±0.09	0.001	0.94±0.15	0.001
FFA(µmol/L)	519.1 ± 107.5	530±88.7	N.S	521±97.8	N.S	539.5±94.1	0.2
Cholesterol (mg / l)	193±19	259± 41.2	N.S	217.3 ± 22	0.001	242 ± 27	0.001
Triglycerides(mg/dl)	137± 11	177± 21.8	0.001	162 ± 27.4	N.S	153 ± 22	0.001
LDL-C(mg/dl)	119±19	176 ± 28	0.001	155 ± 24	0.01	135 ± 21.8	N.S
HDL-C(mg/dl)	58±4.9	33 ±9.7	0.001	41 ± 12.3	0.001	31.8 ± 11.5	0.001

Table 3 : Mean value (± S.D.) of lipid profile in patients with myocardial infarction (MI) and normal subject

Parameters	Control		(MI)			
	Male	Female	Male	P <	Female	P <
BMI (Kg/m2)	31.3±3.77	30.7±4.9	33.97±3.1	0.02	35±4.1	0.02
WHR	0.85±0.096	0.91±0.09	0.91±0.1	0.02	0.99±0.1	0.02
FFA(µmol/L)	502±97.6	534±111	522±44	N.S	531.9±52	N.S
Cholesterol(mg/l)	197 ± 18	186 ± 13	261.8±11	0.001	259.45±15	0.001
Triglycerides(mg/dl)	139 ± 10	131 ± 18	165.6±100	0.2	180.6±88.7	0.5
LDL-C(mg/dl)	122 ± 21.7	116± 26.7	171.5±58	N.S	179.3±56.4	0.001
HDL-C(mg/dl)	61 ± 3.5	54 ± 4	40.5±20	0.001	31.5±13.1	0.001

Table 4 : Mean value (± S.D.) of lipid profile in patients with heart failure (HF)and normal subject

Parameters	Control		(HF)			
	Male	Female	Male	P <	Female±	P <
BMI (Kg/m2)	31.29±3.77	30.7±2.9	33.1±3.9	0.001	35.42±4.9	0.001
WHR	0.85±0.096	0.91±0.09	0.99±0.11	0.001	0.97±0.12	0.001
FFA(µmol/L)	502±97.6	534±111	516.8±75	N.S	525.7±84	N.S
Cholesterol (mg / l)	197 ± 18	186 ± 13	211 ± 29	0.001	222 ± 35	0.001
Triglycerides (mg / dl)	139 ± 10	131 ± 8	177 ± 10.2	0.001	156 ± 13	0.001
LDL-C(mg/dl)	122 ± 21.7	116± 26.7	158 ± 32.3	0.001	155 ± 46.7	0.001
HDL-C(mg/dl)	61 ± 3.5	54 ± 4	38.8 ± 9	0.001	45.3 ± 12	0.001

Table 5 : Mean value (± S.D.) of lipid profile in patients with Angina and normal subject

Parameters	Control		Angina			
	Male	Female	Male	P <	Female	P <
BMI (Kg/m2)	31.29±3.77	30.7±4.9	33.5±4.4	0.001	34±2.5	0.001
WHR	0.85±0.096	0.91±0.09	0.93±0.12	0.001	0.92±0.13	0.05
FFA(µmol/L)	502±97.6	534±111	541±105	0.2	537±95	N.S
Cholesterol (mg / l)	197 ± 18	186 ± 13	268 ± 26	0.001	245 ± 54	0.001
Triglycerides (mg / dl)	139 ± 10	131 ± 8	151 ± 33	N.S	157 ± 28	0.001
LDL-C(mg/dl)	122 ± 21.7	116± 26.7	138 ± 25	0.001	134 ± 21	0.05
HDL-C(mg/dl)	61 ± 3.5	54 ± 4	29 ± 20	0.001	34.6 ± 16	0.001

Discussion:

Total serum free fatty acids (FFA) levels provide an important measure of the physiological state . Most of the FFA in serum is bound to albumin; a small portion, however, is unbound (14) . There is evidence that a high level of free fatty acids in the blood plasma is an independent risk factor for ventricular arrhythmias and sudden death in people who have suffered a heart attack (15) . Also many studies have proved that the level of FFA was elevated in sera of obese persons, and that increase may be a risk factor for the development of diabetes and atherosclerosis. This risk may increased with increasing the levels of FFA even if this elevation in the upper normal limit (16) The present study clearly demonstrates that BMI and WHR were significantly elevated

in sera of male and female patients in G1, G2 and G3 (except male) than male and female normal individuals, and this findings are in agreement with finding of Mhurchu N (17), Who study the associations between BMI, WHR and cardiovascular disease in the Asia-Pacific region .

The levels of FFA are significantly increased in sera of patient of G1, and this finding are in agreement with the finding of Gray (18) , for other geographic areas and this can reported that a high level of circulating free fatty acids (non-esterified) is a potent risk factor for sudden death in men.

The level of cholesterol triglycerides and LDL are significantly increased in male and female individuals of G1(N.S in male for LDL), G2 and G3 (N.S in male for triglycerides) than normal male and female. All these results are in agreement with the finding of many other studies(19,20), While the levels of HDL are significantly decreased in sera of patients with MI (male and Female) , HF (male and Female) and angina (male and female), and these results are in agreement with finding of the reported literature (19) .

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