



Study of the Physiological effects of heart Atherosclerosis on concentrations of some electrolytes, lipid component, sex hormones in Tikrit city and its Governorate

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Abstract

This study aimed to investigate the concentrations effect of some Electrolytes (Sodium, Potassium, and Magnesium) and some Lipids compounds (Cholesterol, Triglycerides, high density lipoprotein, low density lipoprotein, and very low density lipoprotein), and some sex hormones (estrogen and testosterone) on the atherosclerosis disease. The study included a comparison between 60 patients from both male and female with heart atherosclerosis disease, with 40 healthy from both gender. The age ranged between (30 - 83) years for both patients and healthy people. The results indicates a moral increase of ($P \leq 0.05$) in the concentration of (sodium ions, Cholesterol, Triglycerides, low density lipoprotein, and very low density lipoprotein) in patients compared with the healthy people. On the other hand, the concentration of (Potassium ions, Magnesium, high density lipoprotein, estrogen and testosterone hormones) shows a moral increase of ($P \leq 0.05$) for healthy people compared with patients. This conclude that the increase of sodium ions and harmful lipids, and the decrease in six hormones concentration, were all factors that contributed in the creation of the heart atherosclerosis.

Introduction

Heart diseases became the most common fatal disease that cause the death and spread rapidly in all over the world. They are not only restricted for old people, but the young people are also afflicted in abundance by this diseases [1]. A statistic was conducted by [2], they found that deaths number reached 58%, and about 30% of that were caused by heart diseases. Also, 46% of these deaths are for people aged less than 70 years, during their most productive period of life. This percentage increased by 17% in the years 2006-2015 comparing to death rate that caused by contagious diseases, especially in developing and low economic countries. And that cardiovascular diseases represent a huge economic burden for such countries [3], as the available resources to manage these diseases are limited, since these countries are too interested in giving priority to treat transmitting diseases rather than tackling those diseases, which are classified as non-transmitting. Such is the case in the developed countries, so that death by heart diseases represent 30% of the total death rate [4].

Atherosclerosis is considered one of the fatal diseases that causes a damage to the heart function [5], and it is defined as a stenosis and sclerosis of artery narrowed caused by depositing a harmful fats on the walls of the arteries, leading to the decrease of amounts of oxygen that reaches the heart tissues and other tissues of the body. Thus this disease is the reason behind coronary heart diseases that leads to angina pectus and myocardial infarction, which consequently ends by the stroke [6].

Several theories was suggested in order to explain the reasons behind the atherosclerosis infection. The most popular one was the theory related to the increase of cholesterol concentrations in blood serum, regardless of their being in food [7]. Hypotheses had preceded them like respond to injury hypotheses [8]. Another hypothesis that was suggested called the lipid hypothesis, which was reported after being discovered through giving cholesterol rich nourishment [9].

After high-speed centrifuge devices that produced in 1950, high-density and low-density cholesterol were

discovered and recognized, and found that the reason of atherosclerosis increases was the high concentration of low-density cholesterol LDL-C, and it was noticed that this component had a relation with incidents of atherosclerosis [10]. The main reason behind atherosclerosis incidents was confirmed to be the high concentrations of cholesterol in blood serum [11, 12]. After developing and discovering modern techniques applied in diagnosis heart diseases that took place in the second half of the 20th century, and can be able to diagnose these diseases. This technology had contributed in diminishing the risk of such diseases [13].

There is a widespread conception about the differences between the two genders related to the spread of coronary arteries diseases owing to the male sex hormones represented by testosterone and the female sex hormone estrogen. It was found that estrogen decreases the risk of atherosclerosis diseases infection due to Aromatase enzyme, which works on converting the male sex hormones Androgens into Estrogen hormone [14,15]. It was noticed that men, in getting older, who have low concentrations of aromatase enzyme are more expose to be infected by the atherosclerosis diseases in comparison to those who have normal concentrations of the enzyme [16]. In view of the importance of heart diseases subject, this study had been suggested, which aimed to.

Materials and Methods

Table (1) the chemical kits for determination some hormones and lipid profile

NO.	kit	company	technique
1	E2 ELA. Kit	Monobind-.S.A	ELISA
2	Testosterone ELA. Kit	Monobind – U . S.A	ELISA
3	Cholesterol. kit	BIOLAB – France	Spectrophotometer
4	TG. Kit	BIOLAB – France	Spectrophotometer
5	HDL-CH Kit	BIOLAB – France	Spectrophotometer
6	Magnesium. Kit	Spectrum–Egypt	Spectrophotometer
7	Sodium. kit	Spectrum–Egypt	Spectrophotometer
8	Potassium. Kit	Spectrum–Egypt	Spectrophotometer

An evaluation was done for the concentrations of low-density lipidic component LDL-C by applying the equation;

$$\text{LDL-CH (mg/dL)} = \text{TC} - \text{HDL-C} - \text{TG}/5 \quad [17].$$

Very low density lipoprotein (VLDL-C) were evaluated using the equation that mentioned by [18]:

$$\text{VLDL (mg/100 ml)} = \text{Triglyceride} / 5.$$

Statistical analysis

The data related to the samples were collected and analyzed statistically using SPSS program. Evaluation of arithmetic means, T-test and Duncan test were done for the comparison between the arithmetic means, and to find out significant indication [19].

Results and Discussion

Atherosclerosis effect on some concentration of electrolytes

Table (2) shows a comparison between atherosclerosis patients and healthy people in concentrations of some electrolytes. It can be seen that there is a significant excess ($P \leq 0.05$) in the concentrations of sodium ions

This study was carried out at Tikrit Educational Hospital labs, from October 2013 until February 2014. The study included (60) patients from both genders afflicted with heart atherosclerosis in comparison with (40) healthy people from both genders too. The ages of the patients and healthy people ranged between (30-83) years. Atherosclerosis was diagnosed according to the diagnosis of the specialist medical team of the above mentioned hospital. The study focused on recognizing the effect of heart atherosclerosis in concentrations of some lipidic components and hormones in Tikrit city and its suburbs.

A 100 blood sample were collected from diseased and healthy people, then 10 ml of blood was drawn from the humeral vein and put in a disposable test tube free of anti-coagulation substance EDTA. Blood was left in room temperature for 20 minutes then underwent to a process of blood serum separation by using a centrifuge device of 3500 RPM for 15 minutes. Then, serum separation was done by delicate sucker, and then was kept frozen at -20 °C until the time of making tests and measurements of the characteristics for this study.

Concentrations of hormones and lipidic components were evaluated according to the measurement-kit and technique, as shown in table (1) which shows measurement-kit and techniques that used to evaluate the standards that included in the current study:

(Na) for patients compared to healthy people. This attributed to the water loss by cells, and to a decrease of Aldosterone hormone secretion resulted from the stress [20, 21].

Table (2): Comparison of atherosclerosis effect between the patients and healthy people in some electrolytes

Characteristics	Mean± Stand. Div.	
	Patient (60)	Healthy (40)
Na mmol/L	*142.4 ± 11.3	132.75 ± 7.6
K mmol/L	4.19 ± 0.8	*4.51 ± 0.9
Mg mg/dl	1.95 ± 0.5	*2.25 ± 0.3

* Means there are significant differences ($P \leq 0.05$)

Also, the reason behind the increase of sodium concentration in blood serum for some patients can be as a result of excessive sodium salts in food [22], or it might be due to the excessive activity of the adrenal gland cortex and some sex hormones too. A rise of sodium concentration may happen, because of water loss outside the cells [21, 23]. Table 2 can also show a significant excess ($P \leq 0.05$) for healthy people

compared with diseased people in potassium ions concentration (K). These results are in agreement to what was found by [24, 25], who reported that patients afflicted with heart diseases have low levels of potassium. The reason behind that, is that Renin Angiotensin system releases more aldosterone hormone, which causes increase in discharge and discretion of potassium; consequently potassium concentration in blood serum decreases because of the increased permeability of potassium ions (K) with urine. In contrast, it increases the sodium ions retention, which causes a rise in blood pressure [26]. In addition, it shows a significant excess ($P \leq 0.05$) for healthy people compared with diseased people in magnesium ions concentrations (Mg). These results conformed to what had mentioned [27], who proved that magnesium ion decrease in blood serum is common among patients of heart diseases, and the mechanism of magnesium effect upon coronary blood vessels by extended it to prevent accumulating of blood plates or the tension of the coronary artery, and thus reduces the occurrence of atherosclerosis. There is a considerable relation between magnesium diminution and diabetes disease [28, 29].

The effect of atherosclerosis on lipidic components concentrations

Table(3) shows a comparison in the lipid components concentrations between atherosclerosis patients and healthy people. The results showed a significant excess ($p \leq 0.05$) in the cholesterol concentration for patients compared with healthy people. These results conformed to what had mentioned before, [30] who found out that heart diseases patients would be more vulnerable to fats accumulation in blood vessels and atherosclerosis occurrence [31], also referred to the existence of a positive relation between the excessive cholesterol and the patients with atherosclerosis diseases. There are many reasons that act on rising the cholesterol in the body: nourishment, genetics, metabolic process disorder, life pattern and infection of diabetes. The previous studies confirmed the relation between diabetes and atherosclerosis, and the diabetes works on developing the atherosclerosis diseases [32].

Table (3): the effect of atherosclerosis on lipid components in diseased and healthy people

Characteristics	Mean $\pm$ stand. Div.	
	Patients (60)	Healthy (40)
Cho mg/dl	248.8 $\pm$ 44.9*	159.4 $\pm$ 26.5
TG mg/dl	226.6 $\pm$ 96.9*	150.7 $\pm$ 84.8
HDL mg/dl	30.2 $\pm$ 11.6	*42.7 $\pm$ 12.8
LDL mg/dl	169.9 $\pm$ 44.4*	84.8 $\pm$ 23.9
VLDL mg/dl	43.3 $\pm$ 17.7**	29.8 $\pm$ 16.8

* Means there are a significant differences ($P \leq 0.05$) exist ,

**Means there are a significant differences ($P \leq 0.01$)

The patients from the same table have the significant excess in the concentrations of triglycerides ($P \leq 0.05$) compared with the healthy people. These results agreed to what had mentioned [33, 34], where the patients of heart diseases had showed a high concentrations of triglycerides. This increase

attributed to having big amounts of saturated fatty foods and sugars, where the increase of the taken fats ratio led to increase chylomicron production in intestines. whenever they decompose, they cause the release of lipidic acids, and so that the liver cells will receive great amounts of these lipidic acids, which cause an increase in triglycerides production [35].

Modern studies also declared the existence of a positive relation between the rise of triglycerides and the infection of atherosclerosis diseases [36]. It is also possible to refer that the increase of triglycerides was an independent dangerous factor for patients of coronary heart disease. The increase of triglycerides ratio causes several risk factors such as, insulin resistance, where insulin plays an important role to regulate lipids balance. And when insulin resistance occurs, then the natural response becomes weak, and this can leads to the disorder of lipids function in the membranes that sensitive to insulin within the lipidic membranes, liver and skeletal muscles [37]. Moreover, the concentration of high density lipoproteins HDL-C, showed a significant excess ($p \leq 0.05$), as can be seen clearly from the table for healthy people compared with diseased people. The decrease in the concentrations of HDL-C for patients considered one of the most important factors that augment the risk of heart disease [38, 39]. HDL-C concentrations increases can protect the heart and blood vessels from atherosclerosis by enhancing the vascular endothelium, and protect it from low-density lipoprotein oxidation LDL-C [40].

In addition, it shows a significant excess ($p \leq 0.05$) for healthy people compared with diseased people in concentrations low-density lipoprotein LDL-C. These results conformed to the results obtained earlier [41], where they indicates that LDL-C considered a main transmitter of cholesterol from liver to the terminal tissues, and it contains a high ratio of cholesterol. So that, the increase in LDL-C concentration can causes atherosclerosis infection, and the high levels of HDL-C is one of the most important factors that help in atherosclerosis occurrence in comparison with the rest of lipoprotein; this causes cholesterol accumulation on blood vessel paries, and then leads to the heart and blood vessels infection [42].

Finally, we recognize from the same table significant excess ($p \leq 0.01$) for patients compared with the healthy people in concentrations of very low-density lipoprotein VLDL-C. Our current study showed a great increase in their concentrations because of the existing of a complex metabolic relation between TG and the lipidic compound VLDL-C. It was found that the TG increases leads to the rise of VLDL-C concentration [43], and the main output of food assimilation is VLDL-C, which has an important role in affecting atherosclerosis.

The effect of atherosclerosis on concentrations of some sex hormones

Table (4) shows a comparison of atherosclerosis between diseased and healthy people in the

concentrations of some hormones. It is evident that there is a significant excess in general ($p \leq 0.01$) in the concentrations of estrogen hormone for healthy people compared with diseased people. These results conformed to what was found [44,45], which showed that estrogen hormone works on prevention and protection from heart disease and atherosclerosis, as estrogen works on storing fats under skin, and at the same time it reduces the level of low density lipoprotein LDL-C, which are considered of most important causes of atherosclerosis. Estrogen also works on increasing the concentrations of high density lipoprotein HDL-C, and thus it hinders the development of atherosclerosis; that's why we find that decreases the concentration of this hormone in diseased people enhances their infection with atherosclerosis [46,47].

Table (4) the effect of atherosclerosis among the patients and healthy in concentrations of some sex hormones

Characteristics	Mean± Stand. Div.	
	Patients (60)	Healthy (40)
E2 pg/ml	17.7±18.5	**43.0±30.0
Testo. ng/ml	2.70±1.50	*5.42±3.43

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** means: significant differences ($P \leq 0.01$)

*means: significant differences ($P \leq 0.05$)

From the same table, the results show a significant excess ($P \leq 0.05$) in Testosterone concentrations for healthy people in comparison with the patients people. This is in conformity to [48], where the study mentioned to a decrease of testosterone levels in patients who are afflicted with diseases of coronary artery, where this hormone has ability to limit the risk of heart diseases infection. Other studies had mentioned to that Testosterone greatly improves blood flow through the coronary arteries to the whole body, as it works on relaxing the coronary arteries by activating the canals of potassium and inhibiting canals of calcium [49]. In this study, it was found, that men who take supplementary that contain Testosterone have less chance to be infected by atherosclerosis, as testosterone supplementary work on reducing the lipids mass deposited on the parieses of blood vessels by inhabiting the adipogenic differentiation [50,51].

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دراسة تأثير مرض تصلب الشرايين القلبية في تراكيز بعض الالكتروليتات والمركبات الدهنية والهرمونات الجنسية في مدينة تكريت وضواحيها

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الملخص

هدفت هذه الدراسة لمعرفة تأثير تراكيز بعض الالكتروليتات (الصوديوم، البوتاسيوم، المغنيسيوم) وبعض المركبات الدهنية (الكولستيرول، الدهون الثلاثية، الدهون عالية الكثافة، الدهون واطئة الكثافة، الدهون واطئة الكثافة جدا) وكذلك بعض الهرمونات الجنسية (الهرمون الانثوي الاستروجين والهرمون الذكري التستوستيرون) في احداث مرض تصلب الشرايين). في مجتمع من المرضى تألف من. اشتملت الدراسة على (60) فرداً من كلا الجنسين يعانون من الاصابة بمرض تصلب الشرايين القلبية بالمقارنة مع (40) من الاصحاء ومن كلا الجنسين وتراوحت اعمار المرضى والاصحاء (30-83) سنة. وكانت النتائج ارتفاعاً معنوياً ($P \leq 0.05$) في تراكيز (ايونات الصوديوم، الكولستيرول، الدهون الثلاثية، الدهون واطئة الكثافة، الدهون واطئة الكثافة جدا) لدى المرضى بالمقارنة مع الاصحاء. وبالمقابل ازدادت تراكيز (ايونات البوتاسيوم، المغنيسيوم، الدهون عالية الكثافة وهرمونات الاستروجين وهرمون الشحمون الخصوي) معنوياً ($P \leq 0.05$) لدى الاصحاء بالمقارنة مع المرضى. يستنتج من هذه الدراسة ان زيادة اصوديوم والدهون الضارة وانخفاض تراكيز الهرمونات الجنسية جميعها عوامل ساهمت في احداث تصلب الشرايين القلبية.