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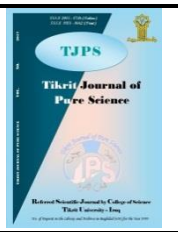

Apelin Levels and its Relationship with a Number of Electrolytes in Patients with Myocardial Infarction

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Abstract

The study aimed to determine the effect of the lack of Apelin peptide and its relation to the development and severity of coronary atherosclerosis and to prove its association with acute myocardial infarction and the positive effect when increasing its concentration in the body and protect it from various diseases. The study included 70 patients of different ages infected with myocardial infarction, both high blood pressure and diabetes, were significantly presented in the group of patients in this study and were compared with control group, which included 35 samples of healthy people. The study showed that there was a significant decrease (P≤0.05) in Apelin concentration in people who suffered from myocardial infarction compared with the control group, which was their Apelin concentrations within the normal rates, there was a significant decrease (P≤ 0.05) in the concentration of Apelin with males and females who suffered from myocardial infarction compared with males and females in control group, which was within normal concentrations that existed in the blood, parameters were measured the concentrations of Apelin and the results of study as follows: There was a significant decrease (P≤0.05) in the concentration of sodium, potassium, chloride and magnesium ions in patients with myocardial infarction compared with the control group. The concentrations of electrolytes in the sera of males and females were significantly decreases (P≤0.05) in regard to sodium, potassium and chloride ions in males and females patients compared to control group, while there were no significant differences (P≤0.05) in the concentration of magnesium between males and females of patients and control group. The correlation of sodium, potassium, magnesium and chloride ions with the concentration of the Apelin was positive. It rises continuously with elevation in the concentration of the Apelin and decrease in the concentration of Apelin. This has a positive effect on myocardial function and improve its function.

Introduction

Apelin is an internally generated peptide that is symbolized by the code APLN [1] and is linked to cells by the receptor protein G [2], and is found on the surfaces of some cell types [3]. The Apelin consists of 77 amino acid-pre-Propeptide and it is found in the peripheral cells which undergoes the dissociation of the proteolytic protein after it is transferred to the internal endoplasmic network to be mature peptide consists of 55 amino acid and it generates several active forms [1]. Apelin peptide is flexible and is produced extensively in a variety of tissues including kidneys and in various sites within the heart and the blood vessels system [4]. In 1993 O'Dowd and his group first discovered the gene that encodes the future "G-protein couoled" with 380 of amino acids, this receptor named as APL which is very similar to Angiotensin ll Type 1 (Angll-AT-1) in the human body. In 1998, Tatemoto and his group isolated a peptide consisting of 36 amino acids from the stomach of the cows, and it is associated with the

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receptor of the APJ and has been named this series of amino acids with Apelin. It was found in broad types of tissues including the central nervous system (CNS), heart, lungs , kidneys [6,7]. Previous studies have shown that the Apelin/APJ system also participates in the regulation of the heart and cardiovascular, gastrointestinal, and immune functions has a role in bone physiology, fluid homeostasis, the genetic development of the heart and blood vessels and has immune reactions in the lines of the muscle, which indicates the participation in the concentration of receptors with T-tubule [8]. Studies have shown that it has roles in kidney physiology as it can become a treatment for kidney disease [9]. It was also found to have a role in fat cells as its role in endocrine [10].

The present study aimed at identifying the relationship between the changes in the concentration of Apelin and myocardial infarction resulting from different heart diseases and studying the positive effect of increasing the concentration of Apelin in the protection of the body from diseases by identifying the relationship between the concentration of Apelin in the serum and changes in concentration ions (sodium, potassium chloride, magnesium) in patients with myocardial infarction.

Materials and Methods

A total of 70 blood samples were collected from patients with myocardial infarction. These samples were compared with the control group of 35 healthy individuals. A variety of analyzes were performed, including exams of the concentrations of sodium ions, potassium, chloride and magnesium ions. The ready-made kits were used which made by Agappe Company manufacturer in Switzerland in the measurement of Sodium and Potassium ions concentrations. Magnesium was measured using ready-made equipment from the Human Company manufactured in Germany, cloride was measured using ready-made equipment from the Spectrum Company manufactured in Egypt. It has been measured using the kit ready-equipped US Raybio Company.

Statistical Analysis:

The results were statistically analyzed using the statistical programme (minitab.ver.11) and the representation of the values found in the table (Mean ± SD). The (F-test) was used to compare the multithromatic parameters by using the multivariante Duncan test and determined the differences in the probability level of ($P \leq 0.05$) and graphs were drawn using Excel (2013) [11].

Results and Discussion

1 – The Apelin concentration

The results of the study showed a significant decrease ($P \leq 0.05$) in the concentration of Apelin for the group of patients as shown in Figure (1) where the concentration was (0.064 ± 0.018) ng / ml compared with control group (0.759 ±0.194) ng / ml, these results were in agreement with [12], while there was no significant difference between males and females for both groups of patients and control. The concentration of Apelin for the group of male patients was (0.059 ± 0.024) ng/ml and females (0.063 ± 0.025) ng/ml. compared to that of control group for males (0.775 ± 0.221) ng/ml (0.721 ± 0.232) ng/ml. The reason for the low concentrations of Apelin in patients due to the loss of internal lining cells and myocardial cells, as the Apelin produced and excreted in large amounts of internal lining of coronary blood vessels and myocardial cells. Therefore, the production of Apelin decreases in the case of myocardial infarction as a result of the loss of these cells so that the reduction of the Apelin may be related to the number of dead cells and the expansion of infarction [13].

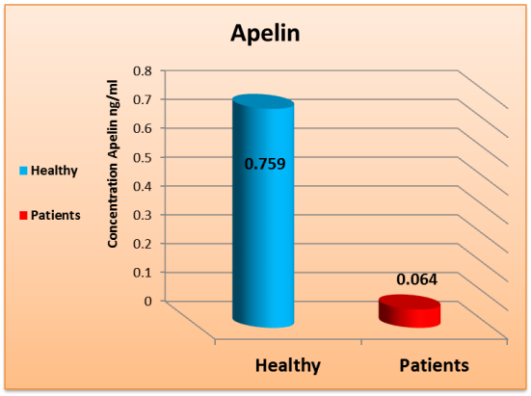

Figure (1) The levels of Apelin in patients and control groups

2 - Concentration of sodium ion and its relation to the concentration of Apelin

The results showed that there was a significant decrease ($P \leq 0.05$) in serum sodium ion concentration in patients group (100.669±16.819)mmol/L compared with control group (146.755 ± 10.713) mmol/L. The results were consistent with [14], as shown in Figure (2), while there was no significant difference between males and females for both groups of patients and control. The concentration of Apelin for the group of male patients was (99.778 ±16.695)mmol/L and females (101.611 ± 17.149) mmol / L. In the male control group, (147.27 ± 9.249) mmol/L and females (146.072 ± 12.743) mmol/L as shown in Figure (3). The reason for the decrease in sodium ions is due to hypoxia and ischemia, which increases the permeability of the muscular cell sheath (sarcolemma) of sodium [14], where people with myocardial infarction have a high retention rate of water causing a decrease in sodium blood pressure and decrease tension (hypotonicity). The lack of sodium in the blood can also be caused by the use of diuretics that work on a loop of Henle such as (furosemide and bumetanide). Inhibits the work of the symportic compounds of the chloride, potassium and sodium ions that facilitate the movement of ions from the Tubular cavity into cells tubular in the ascending part of the loop of Henle. This leads to sodium

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natriuresis, hypothyroidism, hypokalemia, hypoglycaemia and dehydration [15].

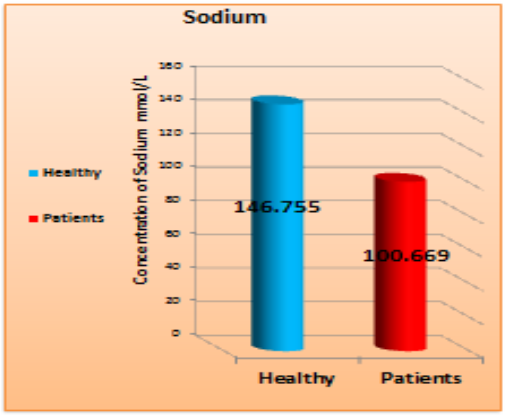

Figure (2) shows the concentration of sodium ion in the groups of patients and healthy (control)

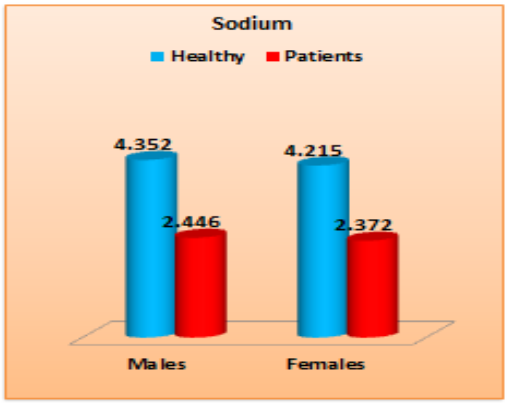

Figure (3) shows the concentration of sodium ion in males and females in the groups of patients and healthy (control)

As for the correlations between the concentration of sodium ion and the concentration of Apelin, it is a positive relationship, as shown in Figure (4). The lower the sodium concentration, the less the concentration of the Apelin according to the statistical correlation equation. The relationship is evident in patients with myocardial infarction. Previous studies have not indicated this relationship, but the effects of Apelin on sodium ions go in the opposite direction. The Sodium-Hydrogen exchanger (NHE) pumps the protons in exchange for sodium. Because of the increased concentration of intracellular sodium ions, the NHE rotation will be slow, leading to lower intracellular PH and removal of muscle fiber, Apelin increases Na within 5 minutes of perfusion and reaches stability within 20 minutes. This may explain the transient effect of Apelin on NHE within (1-2 minutes). Thus, Apelin can significantly increase NHE activity through APJ-R and thus stimulate sodium channels INa. Both mechanisms exert a positive effect on muscle contraction [16].

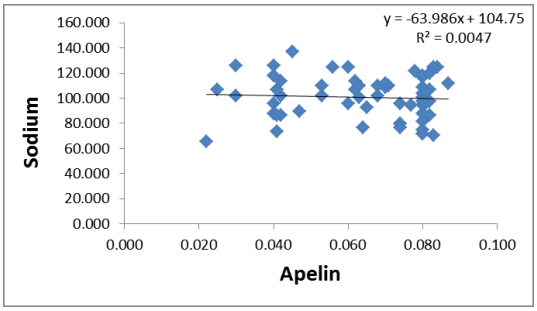

Figure (4) correlation between the concentration of sodium ion and the concentration of Apelin

3- Concentration of potassium ion and its relation to the concentration of Apelin

The results showed a significant decrease ($P \leq 0.05$) in potassium concentration in blood serum of the group of patients as shown in Figure (5). The concentration was (2.371 ± 0.726) mmol / L compared with control group (4.293 ± 0.594) mmol /L. The results were consistent with [17], while there were no significant differences between males and females of the two groups of patients and control. The concentration of Apelin for the group of male patients was (2.446 ±0.677) mmol/L and females (2.372 ± 0.675) mmol/L, while in the male control group, (4.352 ± 0.668) mmol/L and females (4.215 ± 0.497) mmol/L as shown in Figure (6). The reason for the low concentration of potassium ions may be due to the changes in the heart muscle in the case of cardiac insufficiency following myocardial infarction, which affects the balance of potassium [18]. The decrease in the level of potassium is common in patients with Acute Myocardial Infarction (AMI) who have high blood pressure and low potassium level was affected by the low level of magnesium [17]. Potassium deficiency cases were reported in 10% to 40% of patients taking thiazide [19].The mechanism involves increasing the exchange rate of sodium ions versus potassium ions and increasing the production of aldosterone as a response to the urinary tract which causes hypovolemia [20].

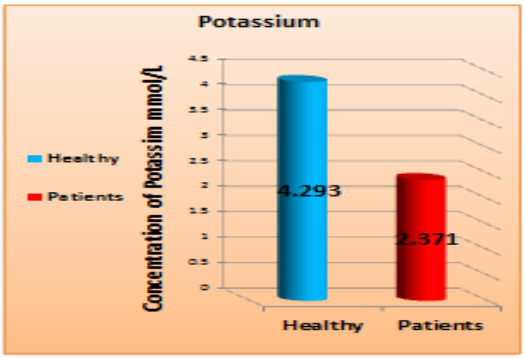

Figure (5) shows the concentration of potassium ion in the groups of patients and healthy (control)

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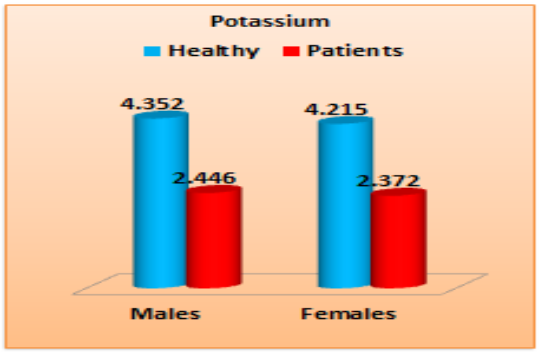

Figure (6) shows the concentration of potassium ion in males and females in the groups of patients and healthy (control)

Position correlation was found between the concentration of potassium and the concentration of Apelin, it is a positive relationship, as shown in Figure (7). The lower the concentration of potassium in the blood serum the lower the concentration of the Apelin and the opposite occurs if the concentration of the Apelin according to the correlation equation. Previous studies have not indicated this relationship, but this study that in cases of physiological diseases which affect the acid-base balance, can affect the balance of potassium ions as well, where the effectiveness of the sodium-potassium ATPase inhibitor is inhibited by the presence of an increase in the concentration of hydrogen ion, leading to the reduction of potassium ions in the blood [21]. The urinary drugs also contribute to the reduction of blood volume and therefore the reduction of ions [20], while the use of Apelin had a protective effect of the heart against the damage caused by re-perfusion after decreasing the volume of blood while reducing the size of the infarct and reduce damage in the membrane of the heart muscle. The treatment of the intravenous cell of the human vein with a dose of Apelin independently enhances vascular responses [22].

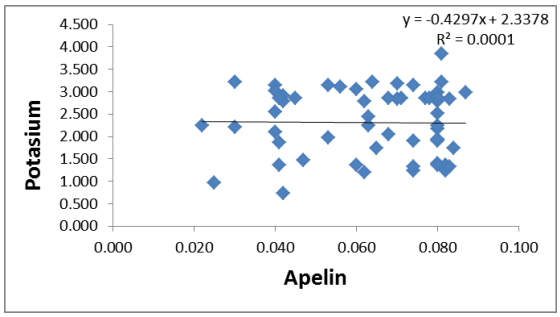

Figure (7) correlation between the concentration of Potassium ion and the concentration of Apelin

4-Concentration of chloride ion and its relation to the concentration of Apelin

The results showed a significant decrease (P≤0.05) in the serum chloride ion concentration of the group of patients as shown in Figure (8), with a concentration of (58.662 ± 13.770) mmol/L compared with control group (101.667 ± 2.662) mmol/ L. The results were consistent with the results of [23], The results showed that there were no significant differences between males and females in the two groups of patients and control. The concentration of Apelin for the group of male patients was (58.36±14.41) mmol/L and females (58.50 ± 13.04) mmol/L (101.33 ± 2.63) mmol/L and females (101.74 ± 2.67) mmol/L as shown in Figure (9). The low concentration of chloride ion may be due to diuretics such as the drug thiazide, which is an important cause for lack of blood chloride in particular in older women. The mechanism is to inhibit the co-transport of chloride and sodium ions that are located in the cortical section of the ascending arm of the loop of Henle and the distal twisted tubule in the kidney, leading to the failure of the re-uptake of these ions and its concentration is decreasing [15, 20].

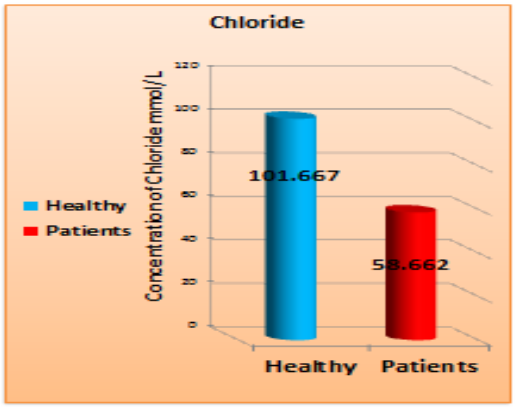

Figure (8) shows the chloride ion concentration in the patients and healthy groups (control)

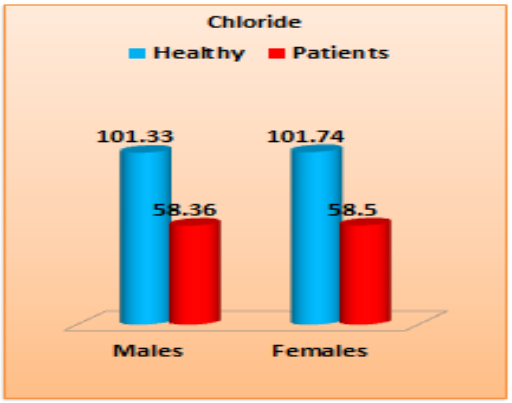

Figure (9) shows the concentration of chloride ion in males and females in the groups of patients and healthy (control)

The concentration of chloride ion and the concentration of Apelin is positively correlated, as shown in Figure (10). The lower the concentration of chloride in the blood serum, the lower the concentration of the Apelin and the opposite occurs in the case of the high concentration of Apelin according to the correlation equation. Ion chloride occurs in patients with infarction due to the use of drugs that reduce the volume of blood and affect the concentration of ions in the blood serum and the lack of oxygenation and ischemia affect the permeability of the membranes of the ions in muscle cells [14]. For this reason, the re-perfusion of the heart muscle can

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repeat the desired balance of these ions in body fluids is through the use of Apelin. Hypoxia regulates the expression of the Apelin gene and its secretion of cardiac muscle cells [11].

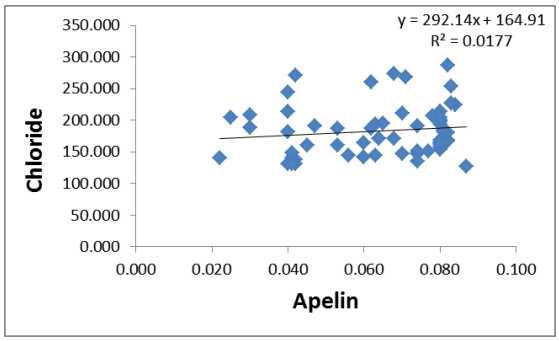

Figure (10) correlation between the concentration of chloride ion and the concentration of Apelin

5- Magnesium ion concentration and its relation to the concentration of the Apelin

The results showed a significant decrease ($P \leq 0.05$) in the serum magnesium concentration of the group of patients as shown in Figure (11), with a concentration of (1.714 ± 0.691) mg/dL compared to control group (2.032 ± 0.409) mg/dl, which were consistent with [24], The results showed that there were no significant differences between males and females in the two groups of patients and control. The concentration of Apelin for the group of male patients was (1.617 ± 0.672) mg/dL and females (1.813 ± 0.611) mg/dL. The males control group (2.081 ± 0.482) mg/dL and females (1.983 ± 0.277) mg/dL as shown in Figure (12). In this study, serum magnesium was associated with inflammation, arrhythmia, and functional of the endothelial layer [25]. The low level of serum magnesium was associated with accelerated arteriosclerosis [26]. The total magnesium of the body depends on the diet intake, and it was shown that the vast majority of older people do not take the required rate of magnesium, and the treatments for urine and interstitial renal disease caused the reduction of magnesium [27].

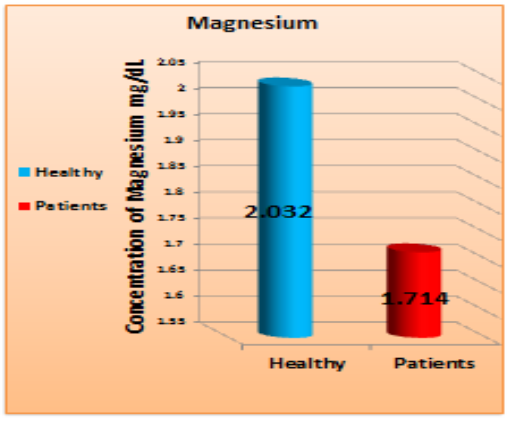

Figure (11) shows the concentration of magnesium ion in the groups of patients and healthy (control)

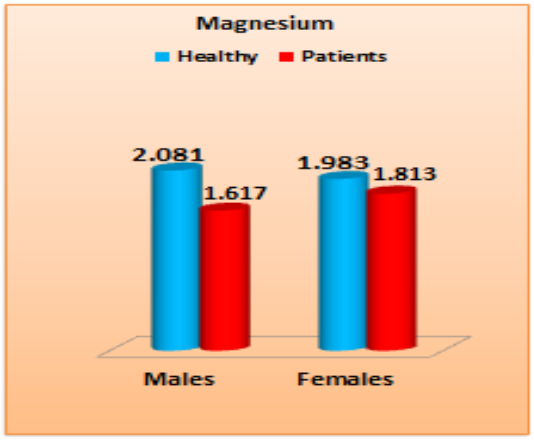

Figure (12) shows the concentration of magnesium ion in males and females in the groups of patients and healthy (control)

As for the correlation between magnesium concentration and the concentration of Apelin, it is a positive relationship, as shown in Figure (13). The lower the concentration of magnesium in the serum, the less the concentration of the Apelin and the opposite occurs in the case of the high concentration of Apelin according to the correlation equation of magnesium prepares for high arterial blood pressure, and intravenous magnesium use leads to decreased pressure, where Mg + 2 peripherally creates peripheral expansion in the blood vessels and thus hypotension [28]. This is in line with the physiological effects of Apelin, which is anti-angiotensin-II. Apelin, which works through the APJ receptor, may alter the harmful effects of AT-1 activation and help prevent progressive systolic dysplasia of the left ventricle, thereby preventing the onset of heart failure and thus reducing pressure [29].

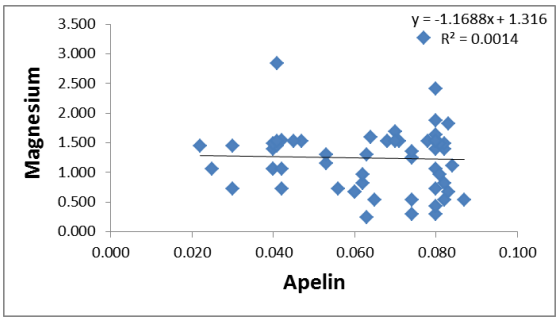

Figure (13) correlation between the concentration of the magnesium ion and the concentration of the Apelin

It may be concluded that the Apelin is directly proportional to the electrolytes (sodium, potassium, chloride, magnesium). It rises with the high concentration of the Apelin and decreases in its lowness, thus having a positive effect associated with the positive effect of Apelin in muscle contraction.

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دراسة مستويات الابلين وعلاقته مع عدد من الكهارل لدى المرضى المصابين باحتشاء العضلة القلبية

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[2] *كلية التربية ، جامعة سامراء ، سامراء ، العراق*

الملخص

تضمنت الدراسة التي اجريت في جامعة سامراء/ كلية العلوم التطبيقية وكلية التربية 70 مريضا مختلفي الاعمار مصابين باحتشاء العضلة القلبية والذين تم تشخيصهم من قبل المختصين في مستشفى سامراء العام، وتم مقارنتها مع مجموعة السيطرة التي تضمنت 35 عينة من الاشخاص الاصحاء وعند تحديد تركيز الابلين تبين ان هناك انخفاض معنوي ($P\leq0.05$) في تركيز الابلين لدى الاشخاص الذين يعانون من احتشاء العضلة القلبية مقارنة مع مجموعة السيطرة التي كان تركيز الابلين فيها ضمن المعدلات الطبيعية وكذلك وجد انخفاض معنوي ($P\leq0.05$)في تركيز الابلين عند الذكور والاناث لمجموعة المرضى مقارنة مع ذكور واناث مجموعة السيطرة التي كانت ضمن التركيز الطبيعي التي تتواجد بها في الدم ، وتم قياس مجموعة من المتغيرات الكيموحيوية وايجاد العلاقة الارتباطية احصائيا بين تراكيزها وتركيز الابلين وكانت نتائج الدراسة كالاتي: تراكيز الإلكترونيات وعلاقتها بمستويات الابلين : وجد انخفاض معنوي ($P\leq0.05$) في تركيز ايونات كل من الصوديوم والبوتاسيوم والكلوريد والمغنسيوم في مصل دم الاشخاص الذين يعانون من احتشاء العضلة القلبية مقارنة مع مجموعة السيطرة التي كانت ضمن التراكيز الطبيعية للمتغيرات الكيموحيوية. اما تركيز الإلكترونيات في مصل الدم للذكور والاناث وعلاقتها بتراكيز الابلين: وجد انخفاض معنوي ($P\leq0.05$) في تركيز ايونات كل من الصوديوم والبوتاسيوم والكلوريد عند الذكور والاناث لمجموعة المرضى مقارنة مع ذكور واناث مجموعة السيطرة التي كانت ضمن التركيز الطبيعية التي تتواجد بها الايونات في الدم، في حين لم نجد فروقات معنوية($P\leq0.05$) في تركيز ايونات المغنسيوم بين ذكور واناث كلا المجموعتين. وكانت علاقة ارتباط تركيز ايونات الصوديوم والبوتاسيوم والمغنسيوم والكلوريد مع تركيز الابلين علاقة طردية حيث ترتفع باستمرار مع الارتفاع بتركيز الابلين وتنخفض بانخفاض تركيز الابلين وبالتالي فإن ذلك له تأثير ايجابي على عمل العضلة القلبية ويحسن عملها.