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Studying the effect of smoking on level concentrations of some ions in the blood serum of smokers

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Abstract
In this study, the effect of smoking on the concentrations of some important element ions in blood samples of a group of smokers was studied. These elements are (chloride ion, potassium ion, calcium ion, and sodium ion). Fifty blood samples were taken from smokers and 50 blood samples from non-smokers. The Erma EL 120 Electrolyte Analyzer device was used, which works by the ISE method "ion selective electrode" with a sample volume of less than 90 µl. It measures Na, K, Cl, Ca and Li ions. Automatic calibration after 4 hours or before the analysis (two-point), calibration with each analysis (one-point). Age was taken into consideration in addition to the smoking period, and the concentrations of the target element ions in the study were compared in the blood samples of smokers with the concentrations of ions in the blood of the control group, which included blood samples of non-smokers. The results of this study showed that there was a decrease in the concentration of calcium ion in the blood samples of smokers, as well as a decrease in the concentration of chloride ions, while the concentration of potassium ion and sodium ion were not affected in comparison with the blood samples of non-smokers. This was shown by the statistical studies conducted in this study, which were identical to previous studies in this field.

Keywords: Smoking, ions, concentration, non-smokers, blood serum

1. Introduction
Tobacco smoking is a major risk factor for a number of chronic diseases, including cancer, lung disease, and cardiovascular disease. Tobacco and its products contain many carcinogenic organic substances in addition to toxic elements [1]. Tobacco smoking has serious consequences for most of the human body's systems. Researchers have focused more attention on the harmful effects of smoking due to the high mortality rate from diseases such as cancer, cardiovascular disease, and respiratory disease, with less attention to research on its effect on other body systems [2]. As is known, the human body contains inorganic components represented by some elements found in different parts of it, including the elements found in blood plasma as a major component of it. On the other hand, smoking has another danger that lies in its effect on the concentrations of ions of some essential and important elements in the blood serum. In this study, we will shed light on some changes in the concentrations of ions of four important elements in the blood serum, which are (chloride ions, potassium ions, calcium ions, and sodium ions), and note the extent of the change in the concentration of these elements, and then point out some of the health effects resulting from that change. Chlorine is spread in the blood and in the fluids outside the cells and a small part of it is inside the red blood cells and some cells. One of the most important functions that the chlorine element can participate in is maintaining the pH of the blood constant and works to regulate osmotic pressure and water balance as well as activating the work of some enzymes such as amylase enzyme. It also increases the ability of red blood cells to carry a large amount of carbon dioxide from the cells and tissues of the body to the lungs to exit with the exhaled air outside the body. A person may suffer from symptoms of chlorine deficiency when exposed to some factors that cause a decrease in its percentage in the body such as severe diarrhea, continuous vomiting, or profuse sweating during violent or strenuous exercise in hot weather. Symptoms of its deficiency appear in the form of muscle spasms, frequent irritation, ulcers in the kidneys, decreased secretion of hydrochloric acid in the stomach, and the body's inability to retain water [3]. Potassium is found in the form of free positively charged ions, 98% of which are spread in fluids inside cells.

The body works to retain potassium more than sodium, so we find that its quantity in the body exceeds the quantity of sodium despite its low intake in the diet. One of the most important functions of potassium is its important role in the process of muscle contraction and maintaining heart activity [4]. It regulates osmotic pressure in cells as well as maintaining basicity and acidity in them. It has a very important role in transmitting pulses or nerve signals through muscles and nerves in addition to other tasks. A deficiency of potassium in the body leads to problems and diseases, including muscle weakness and consequently dysfunction in the nervous system and respiratory system, as well as diabetes and urinary tract diseases.It is one of the essential mineral elements for the body and constitutes 2% of the body weight of an adult, which is equivalent to (1.5-1), as 99% of it is found in the bones and teeth combined with phosphorus and some other elements, as its presence is estimated at 1:2 for phosphorus, and the remaining 1% is found in blood plasma and other body fluids and soft tissues [5]. The main function of calcium is to form teeth and bones by combining with phosphorus through calcification in the form of salt crystals. It also plays an important role in the process of blood clotting when wounds occur in the body [6]. Calcium transmits nerve signals in the area of connection of nerve cells, and there are many other functions inside the cell, including facilitating the entry and exit of fluids and some ions in it. A deficiency of calcium in the body causes many diseases, symptoms and health problems, including porosity or bone penetration disease and rickets in children. Among the other diseases caused by calcium deficiency is tetany or spasm, which leads to convulsions that do not Voluntary in some limb muscles.The adult human body contains about 120 grams of sodium, 60% of which is in the plasma and fluids outside the cells, and the rest is in the skeleton and fluids inside the cells. It performs many of the body's main functions, the most important of which is regulating the acid-base balance and regulating the permeability of cell membranes during the absorption of essential nutrients [7]. Potassium participates in transmitting nerve signals and transmitting them in the muscles. Among the most important health problems and symptoms caused by sodium deficiency in the body are muscle pain and cramps, abdominal pain, loss of appetite, and mental disorders. In the case of severe deficiency, it leads to failure in blood circulation [8].

2. Study Objectives

The important health damages caused by the phenomenon of smoking as a result of its effect on the concentrations of some important elements in the blood. Raising awareness among members of society, especially adolescents and young people, of the risks resulting from addiction to this negative phenomenon. Developing some appropriate recommendations and treatments that in turn contribute to treating this problem. The most important chemical compounds in cigarette smoke: The tobacco plant is used to prepare products that deliver nicotine to the body, and nicotine is the main and effective component in tobacco products [9]. The Native Americans are considered the first to use tobacco for smoking in pipes similar to a pipe for medical and religious purposes represented in ritual celebrations, but it was present before that, as it is a plant that belongs to a family of nightshades called Nicotiana, and the leaves of this plant are used for smoking, chewing, and sniffing if it is powdered. Tobacco smoke contains more than 7,000 chemicals; at least 250 of which are harmful to health, and tobacco laboratory scientists can track the effects of chemicals found in tobacco in the body of the smoker and the people around him, by conducting studies on all uses of tobacco types. Nicotine is the primary and active chemical that occurs naturally in the tobacco plant. It is a toxic alkaloid that causes compulsive addiction. Its negative effect is the disruption of the functions of the body's organs, as it accelerates the heartbeat and breathing, raises blood pressure, and reduces the appetite for food due to the resulting disruption in the hunger center; as one cigarette contains one milligram of nicotine [10].

Tar is a sticky substance that turns black when burned, and is considered one of the particles that settle in the lungs, which later causes lung cancer after smoking addiction. Tar is a compound of hydrocarbons, i.e. organic materials of hydrogen, carbon, and benzopyrene, i.e. hydrogenated coal [11]. Carbon monoxide is the gas responsible for disrupting the transport of oxygen in the blood, and it also causes heart disease as a result of its combination with nicotine, which results in the deposition of fats and cholesterol in the blood, which leads to blood clots [12]. Other substances in tobacco: Many toxic substances are added to tobacco, such as sulfuric acid, arsenic, which is a highly toxic substance, butane gas, which is usually used in cigar lighters, methanol, lead, carbon dioxide gas, which is produced by combustion, toluene, which is a solvent used in factories, acetone, ammonia, cadmium, which is a heavy metal, DDT, which is a major insecticide, naphthalene, hydrogen cyanide, and formalin [13].

3. Study Samples

The sample is a specific part in terms of quantity and type and represents a number of individuals with similar and similar characteristics. A group of samples were taken from the blood serum of smokers, 50 samples, so that their ages were different and shown in Table 1, taking into account that the smoking period was approximately constant from 6 to 10 years. In addition, 50 samples were taken from the blood serum of non-smokers to make them a control group.

4. Method of work

After collecting samples from the blood of smokers and samples from non-smokers, the samples are processed by separating the blood serum using a centrifuge at room temperature at a speed of (3500) rpm for a period ranging from 13 to 15 minutes. After removing the samples from the separation device, the samples are stored at a temperature of -20 degrees Celsius. After that, the concentrations of electrolytes containing four elements, namely chlorine, potassium, calcium and sodium, are estimated using a device ERMA EL 120 Electrolyte Analyzer device was used, which works by the ISE method "ion selective electrode" with a sample volume of less than 90 µl. It measures Na, K, Cl, Ca and Li ions. Automatic calibration after 4 hours or before the analysis (two-point), calibration with each analysis (one-point).

5. Basic Data

5.1 Age data for people

The age of the people from whom blood samples were taken was taken into consideration because, as is known, the concentrations of the ions of the elements studied in this study

change with age. Therefore, the samples were divided according to age groups as shown in Table 1. In this study, (15) smokers out of (50) smokers, at a rate of (30%), are between (24-30) years old, and (10) smokers out of (50) smokers, at a rate of (20%), are between (31-38) years old, while (12) smokers out of (50) smokers, at a rate of (24%), are between (39-45) years old, while (6) smokers out of (50) smokers, at a rate of (12%), are between (46-50) years old. There are also (4) smokers out of (50) smokers, at a rate of (8%), whose ages range between (51-60) years, and (3) smokers out of a total of (50) smokers, at a rate of (6%), whose ages reached (60) years and above, and Table (1) shows that.

Table 1: Age distribution of smokers

Age	Number	Percentage
24-30 years	15	30%
Years 31-38	10	20%
Year 39-45	12	24%
Years 46-50	6	12%
Year 51-60	4	8%
Years 60 up	3	6%
Total	50	100%

5.2 Smoking Period

All samples were taken from people who had a smoking period ranging from 6 to 10 years approximately, either intermittently or continuously, so that the study would be limited to a time period appropriate for the research and to avoid the effect of increasing the number of years or, in the case of smoking years, being few compared to other samples. This gives a more accurate reality to the study and is better than taking different periods of smoking time.

6. Analysis and discussion of the results

6.1 Results of blood chlorine test

The results that appeared through estimating the concentrations of chlorine ions in blood serum samples in the smoking group and comparing them with the control group indicate that there is a clear decrease in the concentration of chlorine ions. This is noted in Table 2.

Table 2: Change concentration of chlorine in the blood

Percentage		Change concentration of chlorine in the blood		Numbers
Control group	Smokers group		Control group	Smokers group
10%	72%	Decrease	5	36
2%	0%	Increase	1	0
88%	28%	Normal level	44	14

From the data in the table above, there is a clear decrease in the concentration of chloride ions. There is a significant moral difference in its concentration in the blood of smokers compared to its concentration in the blood of non-smokers. There is clear difference in its concentration when compared to its concentration in the control group we notice this from figure1. This decrease in chlorine concentration may be due to the fact that chlorine ions are considered a diagnostic sign of heart failure, as chlorine is one of the most important ions that play a distinct role in fluid balance and has a close relationship with the cardiac, nervous and renal systems. There are studies that confirm the existence of a relationship between heart failure diseases and chlorine ion concentrations in the blood. It is scientifically known that smoking is a major cause of heart disease, as many diuretics used to treat the heart cause the loss of large amounts of chlorine, and thus a decrease in chlorine concentrations in the blood serum occurs [14].

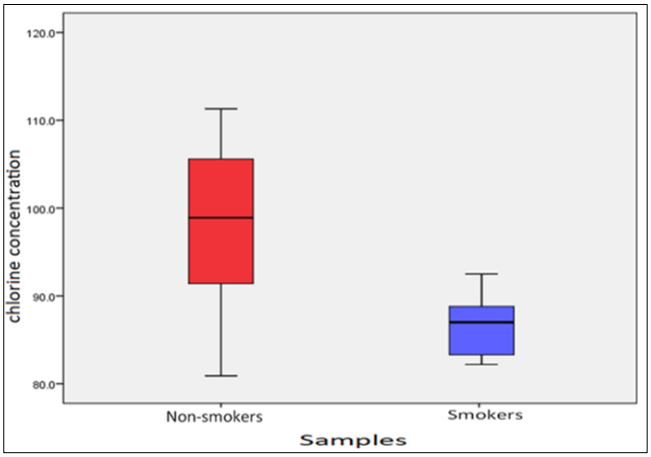

Fig 1: Change in chlorine concentration

6.2 Results of the blood potassium level test

The results that appeared through estimating the concentrations of potassium ions in blood serum samples in the smoking group and comparing them with the control group indicate that there is no clear change in the concentration of potassium ions, as the concentration was normal, and we note this through Table 3.

Table 3: Change concentration of potassium in the blood

Percentage (Control Group)	Percentage (Smokers Group)	Change in Potassium Concentration	Numbers (Control Group)	Numbers (Smokers Group)
0%	0%	Decrease	0	0
0%	0%	Increase	0	0
100%	100%	Normal level	50	50

The table above indicates that there is no effect of smoking on the concentrations of potassium ions in the blood samples of smokers compared to their concentrations in the blood samples of non-smokers. This can be clearly explained in Figure 2.

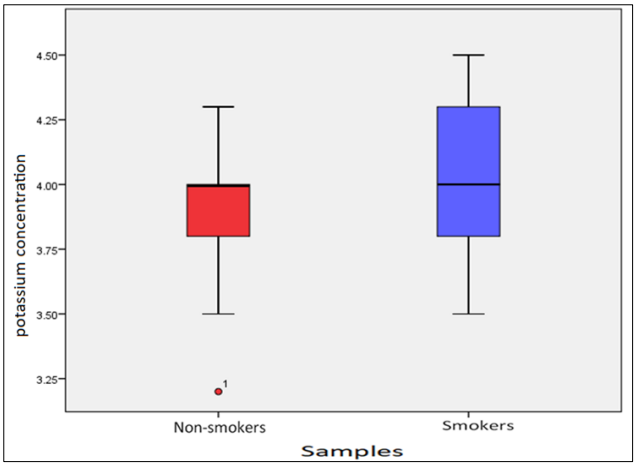

Fig 2: Change in potassium concentration

6.3 Results of the blood calcium test

The results that appeared through estimating the concentrations of calcium ions in blood serum samples in the smoking group and comparing them with the control group indicate that there is a clear decrease in the concentration of calcium ions. This is noted in Table 4.

Table 4: Change concentration of calcium in the blood

Percentage (Control Group)	Percentage (Smokers Group)	Change in Calcium Concentration	Numbers (Control Group)	Numbers (Smokers Group)
10%	90%	Decrease	5	45
0%	0%	Increase	0	0
90%	10%	Normal level	45	5

From the data in the table above, it is clear that there is a very large and clear decrease in the level of calcium concentration in the blood samples of the smokers group, while the control group had the rest of the calcium concentrations within the normal range, unlike the rest of the elements targeted by the study. This is attributed to the fact that the factors affecting and causing a decrease in the level of calcium in the blood are more common and widespread compared to the rest of the elements targeted by the study, in addition to the effect of smoking, which clearly contributed to reducing the level of calcium in the blood as a result of the decrease in the glomerular filtration rate (GFR) in the kidneys to less than 30 milliliters per minute, which in turn leads to weakening the effectiveness of the enzyme (1α-Hydroxylase) and thus causes a decrease in the absorption of calcium in the intestine, which is the direct cause of a slight decrease in the level of calcium in the blood [15]. Figure 3 shows the effect of smoking on the level of calcium.

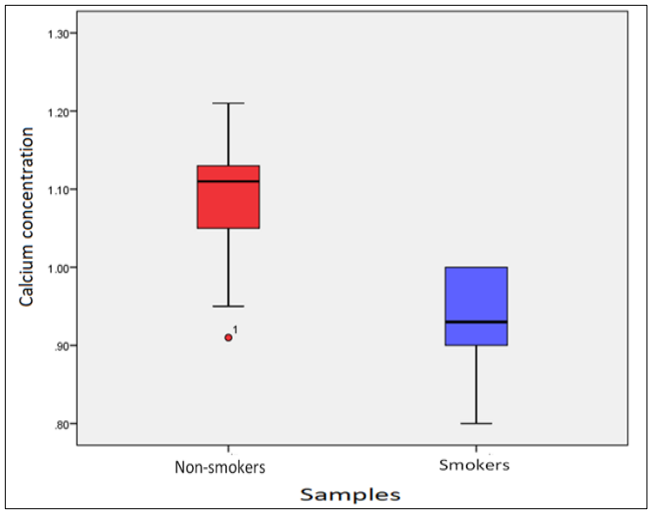

Fig 3: Change in Calcium concentration

6.4 Results of the blood sodium test

The results that appeared through estimating the concentrations of sodium ions in blood serum samples in the smoking group and comparing them with the control group indicate there is no clear change in the concentration of sodium ions, as the concentration was normal, and we note this through Table 5.

The table above indicates that there is no effect of smoking on the concentrations of sodium ions in the blood samples of smokers compared to their concentrations in the blood samples of non-smokers. This can be clearly explained in Figure 4.

Table 5: Change concentration of sodium in the blood

Percentage (Control Group)	Percentage (Smokers Group)	Change in Sodium Concentration	Numbers (Control Group)	Numbers (Smokers Group)
20%	20%	Decrease	10	10
10%	0%	Increase	5	0
70%	80%	Normal level	35	40

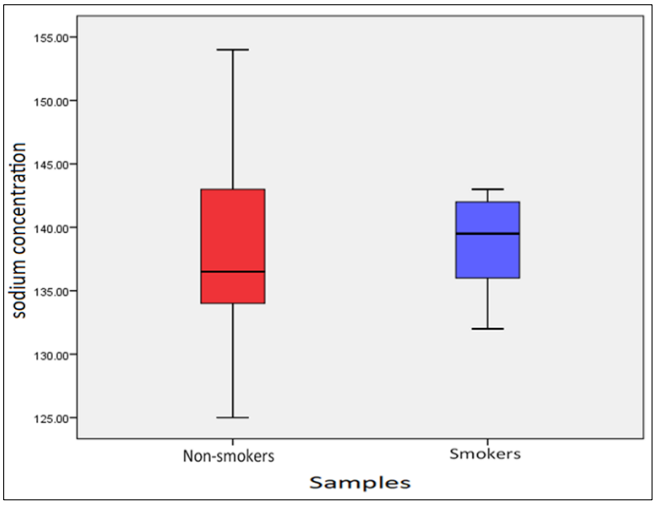

Fig 4: Change in sodium concentration

Table 6: Statistics for each model

Element	N	Mean	Std. Deviation	Std. Error Mean
Cl	50	89.5000	15.48692	2.82751
Ca	50	6.140	1.6517	0.3016
K	50	3.2933	0.84320	0.15395
Na	50	121.8000	14.05261	2.56564

7. Statistical methods used in the study

- Using the SPSS program and using box plots.
- Relative standard deviation and Arithmetic mean: The standard deviation and arithmetic mean were calculated for each element used in the study as shown in Table 6.
- ANOVA test: ANOVA test for the elements used in this study. Table 7 shows the effect on the elements at $p<0.05$, where we notice the clear effect on each of elements chlorine and calcium, while there is no effect on the element potassium and sodium.

Table 7: ANOVA test for the elements

Element	Source	Sum of squares	DF	Mean Square	F	Sig.
Cl	Between Groups	1373.633	1	1373.633	6.890	0.014
	Within Groups	5581.867	48	199.352		
	Total	6955.500	49			
Ca	Between Groups	0.300	1	0.300	0.107	0.044
	Within Groups	78.812	48	2.815		
	Total	79.112	49			
K	Between Groups	5.633	1	5.633	10.526	0.198
	Within Groups	14.985	48	0.535		
	Total	20.619	49			
Na	Between Groups	1763.333	1	1763.333	12.457	0.091
	Within Groups	3963.467	48	141.552		
	Total	5726.800	49			

8. Conclusions

From this study there are a set of points concluded

- Addiction to smoking for more than 5 years leads to a very large and clear decrease in the concentration of calcium and chlorine in the blood, and thus leads to major health symptoms and problems.
- Decrease in the concentrations of calcium and chlorine in the blood serum occurs for smokers, even if the smoking period is short, and thus it is the cause of many serious diseases.
- As for the rest of the elements targeted by the study (potassium and sodium), the study confirmed there is no effect of smoking for a short period of time on the concentrations of these elements in the blood serum.
- Excessive smoking over a short period of time leads to a doubling of the negative effects on the concentrations of all element ions.

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