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Study of the concentration of creatinine and some electrolytes in the blood serum of healthy males in the city of Sabratha

Rwida A. Emberesh[1*], Qutaiba Alrawi[2]

[1]Department of Zoology, Scientific College, Sabratha University, Libya
[2]Sorman Medical Technology, Sabratha University, Libya

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Abstract: Most researchers usually investigate the concentration of chemical components in the blood of people suffering from a disease, and studies are rarely conducted in healthy people. So the researchers conducted this preliminary statistical study of both creatinine and some electrolytes in the blood serum of a group of healthy males. Years 25 samples of healthy male blood were collected in Sabratha city. Their average age was 13.64, 41.92, The concentration of sodium, chloride, potassium., magnesium ions, and creatinine ions were measured in the blood serum of each volunteer in the hospital the city of Sabratha. The mean and deviation were standard for the concentrations of these chemical components, respectively: (5.15, 140.62 mmol /L, 3.98 (106.80)) mmol /L, 0.74 4.60) mmol /L, 0.18 2.06) milligram / dL), 0.17 0.84) milligrams / dL. When compared to internationally accepted reference values, the results showed the necessity of working to determine the concentration of creatinine, sodium, and potassium. And chloride through the serum of healthy males in Sabratha and then Libya. In the case of magnesium, it seemed clear that the internationally accepted reference value was sufficient for the purpose. The limits of the reference values were determined for the concentration of sodium, chloride , potassium ions , and the concentration of creatinine , and they were, respectively, (126.6, 149.8) mmol /L, (97.1,114.7) mmol /L, (2.9,6.0) mmol /L, (0.4,1.1) Milligrams / dL, and these limits were wider compared to the limits of reference values used in laboratories. The type of relationship between the study variables was also determined using the person correlation coefficient) , and this relationship) was confirmed graphically using what is known as in kilograms , the concentration of sodium and chloride ions was more interconnected and similar.

Keywords: Blood serum-creatinine-electrolytes-descriptive statistics, sodium, chloride, potassium ions, creatinine.

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INTRODUCTION

Blood is a red, viscous liquid that is a form of connective tissue. It fills the heart and flows inside the body through the blood vessels. The amount of blood in the body depends on age, body type, gender, and the way in which the amount of blood is measured in the body. Many chemical components are present in the blood, including: sodium, potassium, magnesium, chloride and creatinine.

Sodium, for example, has a role in maintaining fluid balance and maintaining normal osmotic relations [2], and it has an important role in cell permeability. The sodium pump is necessary for the active transport of glucose, amino acids, and others [3]. Potassium has a role in regulating osmotic pressure within cells, in maintaining acid - base balance, and in the assimilation of carbohydrates, as it is important in the formation of glycogen [4], and magnesium is considered a contributing factor. There are many enzymatic reactions that play an intermediate role in glucose metabolism , and it has an important role in muscle relaxation [5], and the chloride ion has several physiological functions, including: it helps regulate the osmotic pressure of body fluids, maintaining acid - base balance [4] , and as for creatinine It has an important diagnostic function; By knowing its concentration in the blood serum, the glomerular filtration rate can be calculated, which in turn indicates the efficiency of the kidneys [5].

Most researchers usually investigate the concentration of these chemical components in the blood of people suffering from a disease, and studies on them are rarely conducted in healthy people. Accordingly, the researchers conducted this preliminary study of these components in the blood serum of a group of healthy males for the purpose of investigating whether there is a need to calculate reference values for them in the blood serum of healthy people, or are the recognized international reference values sufficient. The researchers also applied some statistical analyzes to the concentrations of these components in blood serum provides important information for doctors and researchers.

Specifications of the Devices Used and Their Theory of Operation

The device used to measure magnesium concentration the creatine in the study samples is a type of visible-ray spectrometer Selectra ProM, is manufactured by ELITech Group, It is a company located in Puteaux in France, the light source is a quartz-iodine lamp with a voltage of 12 volts and a power of 20 watts, and the device is equipped with a unit for mixing the color developer solution with the sample, and its wavelength range is 340-800 nm, and the measurement is done automatically; After selecting the element to be analyzed, the device measures the absorbance of the standard solution and the absorbance of the sample solution, and then displays the result of the required analysis. As for the device used to measure the concentration of sodium and potassium.

The chloride in the study samples is an ARCHITECT c4000 device Manufactured by Abbott and located in Illinois, United States of America, it is a device consisting of two main units, one of which measures the concentration using the visible spectrum method, and the other unit measures the concentration using the direct potential method, which is the method that researchers followed to measure the concentration of sodium and potassium. Chloride, and the measurement is done automatically; After selecting the ion to be analyzed, the device measures the potential of the standard solution, measures the potential of the sample solution, and then displays the analysis result.

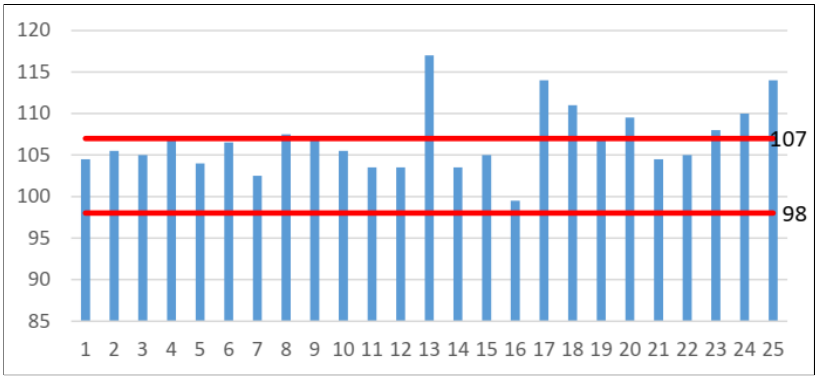
Sample Collection and Separation

25 samples of venous blood from healthy males were collected. The source of all samples was from the city of Sabratha, and they were all collected in the following way: A 2 ml sample of venous blood was drawn from each volunteer, and the sample was placed in a tube that did not contain an anticoagulant until about half of its volume was filled with a sample blood, then the samples was left for 20-30 minutes; That is, until it reached room temperature and a clot formed , after which the serum was separated from the sample by a centrifuge at 4000 rpm for 5 minutes. All samples were analyzed immediately after they were separated.

Analysis Materials and Measurement Conditions

All the chemicals with which the analyzes were conducted were sourced from a complete set of analysis supplies and sourced from one of the companies specialized in this, as will be discussed later.

In case of creatinine, the materials were from the company Spin react It is a company located in Girona In Spain, the materials used are: sodium chloride (Nacl) with a concentration of 17.5 mmol /L, which is the substance that develops the color, sodium hydroxide (NaOH) with a concentration of 0.29 mol/L as a buffer in order to make the medium alkaline, and a standard solution of creatinine with a concentration of 2 mg / dL in order to compare its absorption with the absorption of the sample, and the measurement is based on the reaction of creatinine with alkaline sodium chloride (Nacl) to form a red-colored compound, and the intensity of the resulting color is directly proportional to the concentration of creatinine in the sample that was measured at 505 nm. In case of magnesium, the materials were from a company Fluitest it is a branch of a company Analytic on it is a company located in Lichtenfels in Germany, the materials used are: xylidylblue At a concentration of 1 mmol /L, it is the color developer and buffer solution Tris buffer at a concentration of 250 mmol /L to keep the medium alkaline, and a standard solution of magnesium at a concentration of 2 mg / dL to compare its absorption with that of the sample, and the intensity of the color resulting from the reaction of magnesium with xylidylblue in alkaline media it is directly proportional to the magnesium concentration measured at 546 nm , and in the case of sodium and potassium the standard solutions for chloride were from Abbott, located in Illinois United States of America.



Figurer 1: Chloride concentration (m mol /L) in the blood serum of male samples and the limits of its reference value

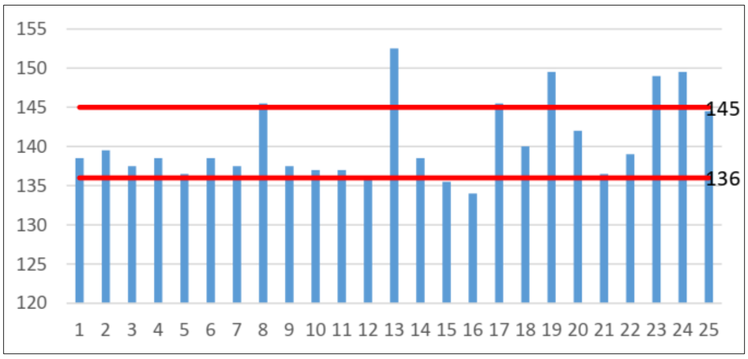


Figure 2: Sodium concentration (m mol /L) in the blood serum of male samples and the limits of its reference value

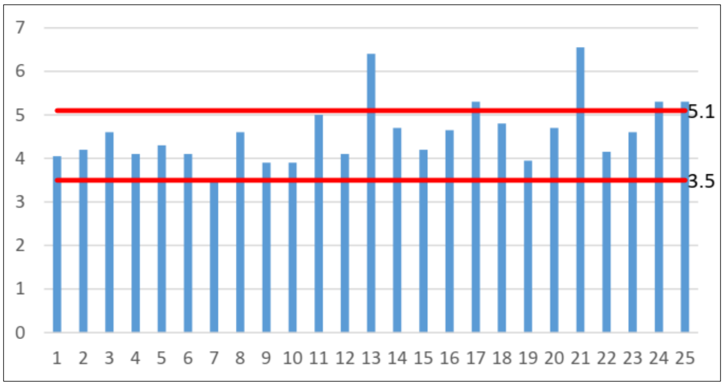


Figure 3: Potassium concentration (m mol /L) in the blood serum of male samples and the limits of its reference value

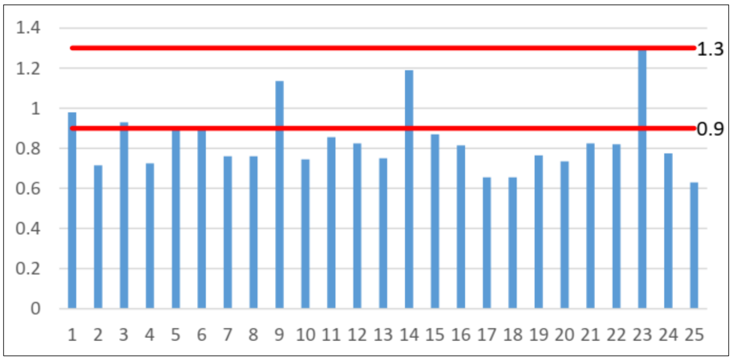


Figure 4: Creatinine concentration (mg / dL) in the serum of male samples and the limits of its reference value

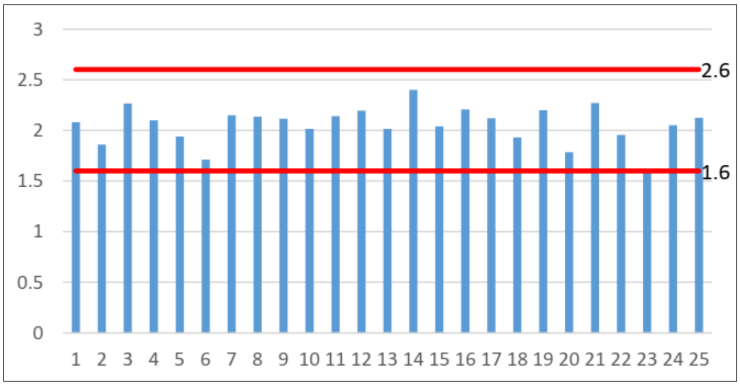


Figure 5: Magnesium concentration (milligrams / dL) in the blood serum of male samples and the limits of its reference value.

RESULTS AND DISCUSSION

Comparing results with reference values

(Through Figures (1, 2, 3, 4, 5, it is clear that only the magnesium readings were all, except one) (within the limits of the reference value [6], horizontal lines in each figure, as (for the rest of the four chemical components (creatinine, sodium, and potassium. And Kroid there were many cases in which the reading exceeded the limits of the reference value [6], for each of them, and when 20 random samples were selected from the readings of each chemical component ,except magnesium), it became clear that there were more than two readings for each component that exceeded the limits of the reference value, which indicates the necessity determined these components by relying on the results of analyzes of a larger number of samples from Libyan males in accordance with the recommendations of the clinical and Laboratory Standards institute's (CLSI) [7].

Statistical Analysis

A set of descriptive statistical indicators that include the arithmetic mean, standard deviation, coefficient of variation, skewness coefficient, and kurtosis coefficient were found for the age of the volunteers and for the concentration of sodium, chloride, potassium, and magnesium. And creatinine in the blood, shown in Table No (1).

Table 1: Descriptive statistics for study variables

	SMA	**standard deviation**	**Coefficient of variation %**	**Torsion coefficient**	**Kurtosis coefficient**
the age	41.92	13.64	% 33	0.40	-1.03
Sodium	140.62	5.15	% 4	1.02	-0.14
Chloride	106.80	3.98	% 4	0.92	0.91
Potassium	4.60	0.74	% 16	1.29	1.74
Magnesium	2.06	0.18	% 9	-0.78	0.89
Creatinine	0.84	0.17	% 20	1.42	1.93

SMA: Arithmetic average

The arithmetic mean, or the arithmetic mean, and sometimes the average in mathematics and statistics, is a value around which the values of a group are gathered and through which the rest of the values of the group can be judged, so this value is the arithmetic mean.

Through the results in Table No 1) we found that the ages of the participants in this study ranged between 13.64 and 41.92 years. As for the mean and standard deviation for the concentration of sodium ions, chloride, potassium, magnesium, and creatinine concentration, they were, respectively: (5.15)., (140.62) mmol /L (3.98), (106.80 (m mol/L, (0.74 4.60) (m mo/ /L) 0.18 2.06 (milligram / dL) 0.17, (0.84 (milligrams / dL)

In terms of dispersion, we note that the concentration of sodium and chloride ions is more homogeneous, while the concentration of creatinine is more dispersed compared to the rest of the chemical components.

Through the results of the skewness coefficient, we find that the concentration of magnesium ions is negatively skewed (the distribution is skewed slightly to the left compared to the rest of the variables. We find, for example, that the distribution of sodium and potassium ions Creatinine has a slight positive skewness, and this indicates that the probability that these data follow a normal distribution is small, while the degree of skewness in the distribution of chloride ion concentration is close to zero, and this indicates that it follows a normal distribution, and the moderation of the distributions of the chemical components will be confirmed with other tests later.

In terms of the degree of kurtosis, we note that the distribution of sodium ion concentration is relatively flat, while the distribution of chloride ion concentration is more tapered compared to the rest of the concentrations.

The nature of the distributions of the study data was studied using the Shapiro-Wilk test at a significance level of 0.05. This test is stronger than other statistical tests (8) and from the results in Table No (2), All concentrations do not follow a normal distribution because p –value < 0.05 except for the concentration of chloride ions. Serum magnesium ion concentration was excluded; because the readings were within the limits of internationally recognized reference values.

Table 2: Shapiro -Wilk test results for normal distribution test

Creatinine	**Potassium**	**Potassium**	**Sodium**	
p-value	0.003	0.068	0.007	0.004

Robust Statistics was used to estimate the limits of the reference values for the study variables because it gives a better estimate compared to parametric statistics when the hypothesis of a normal distribution test is not met, in addition not being significantly affected by extreme anomalous values [9, 10]. Use software to estimate it in addition, confidence intervals for the limits of the reference values were found using the bootstrap technique (Bootstrap Technique) is one of the backsampling. Methods that uses the simulation method based on the sample data itself [11].

Table 3: Limits of reference values and confidence intervals for each of sodium, chloride, potassium ions and creatinine concentration using Hippocampal appreciation.

chemical components	minimum	Confidence interval for the lower bound	the highest rate	Confidence interval for the upper bound	Reference values
Sodium (mmol /L)	126.6	(122.7,128.8)	149.8	(145.1,153.6)	145 - 136
Chloride (mmol /L)	97.1	(94.1,99.3)	114.7	(111.9,117.9)	107 - 98
Potassium (mmol /L)	2.9	(2.4,3.5)	6.0	(5.4,6.6)	5.1 – 3.5
Creatinine (milligrams / dL)	0.4	(0.3,0.6)	1.1	(1.0,1.3)	1.3 – 0.9

From the results in Table No (3): we find that the reference values for the chemical components (sodium, chloride, potassium) for this study are more broad than the internationally accepted reference values. As for the creatinine concentration, the upper limit of the reference value is less broad than the reference value used in laboratories.

Since the confidence intervals for the two reference values for this study did not exceed (0.2) the range of the reference value [12], this is an indication that the data is sufficient, and there is no need to collect additional data.

Pearson's correlation coefficient was used to determine the type of relationship between the study variables in terms of strength and direction.

Table 4: Pearson correlation coefficient and P-value for study variables

	the age		Sodium		Chloride		Potassium		Magnesium	
	R	P	r	P	r	P	r	P	R	P
Sodium	0.45	0.02								
Chloride	0.40	0.05	0.76	0.00						
Potassium	0.40	0.05	0.76	0.00	0.40	0.05				
Magnesium	-0.09	0.67	-0.26	0.24	-0.26	0.21	0.15	0.48		
Creatinine	-0.12	0.57	-0.10	0.63	-0.35	0.09	-0.18	0.38	0.09-	0.68

From Table 4, we notice that there is a difference in the correlation coefficient between each of the two variables in terms of strength and direction. For example, there is a direct correlation between age of both sodium, chloride and potassium. We also find that the relationship between the concentration of sodium and chloride ions is strong and direct, with a P- value of less than 0.05. This means that the correlation between each two variables is different from zero, while there is a very weak inverse correlation between age and magnesium. Creatinine and P-value bigger than 0.05, this means the correlation between each pair of variables is not significant.

Using a meta-analysis explained graphically using what is known as a dendogram Figure (7), the merging processes that take place in successive stages can be clarified, and the successive merging process depends on what is known as linking methods; The complete linkage method, or what is known as with the greatest distance, was used, meaning that at each stage the distance or similarity between any two groups is measured using the similarity between the two most distant elements. The pearson correlation coefficient was used as a measure of distance in this analysis.

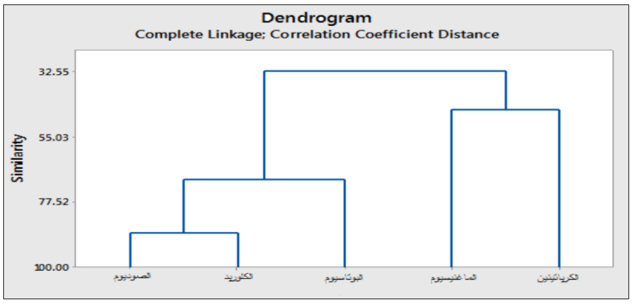


Figure 6: The shape of the dongram by the complete binding method for each of sodium, chloride, potassium, magnesium, and creatinine.

By studying Figure (7) which represents the shape of the dongram resulting from applying the complete correlation method for the chemical components, we find that the concentration of sodium and chloride ions clusters at the smallest distance or greatest symmetry, and this is confirmed by the correlation coefficient. When the distance increased, potassium merged with the group, sodium, chloride, but at the greatest or least similar distance.

We also notice that the two variables, magnesium and creatinine are more similar to each other. However, the two variables did not merge until the distance increased with the closest neighboring elements.

Finally, all groups of elements were merged into one group at the largest distance or lowest symmetry value in the last merging stage.

CONCLUSION

Through statistical analysis, we find that the concentration of creatinine is more dispersed and the concentration of chloride ions is more pointed compared to the distribution of the rest of the electrolytes. Through the results of the hippocampal statistics, it was found that the limits of the reference value for creatinine and the ions of sodium and potassium Chloride is more extensive than internationally traded reference values. In terms of the strength and direction of the relationship, the correlation between age and the concentration of both sodium and chloride is a moderate positive relationship, while between age and the rest of the elements and between the elements is close to zero between positive and negative values, that is direct and inverse.

Recommendations

- Conduct more extensive research that includes more samples.
- Conduct research to set reference values for sodium and chloride and potassium Creatinine in male serum from Libya.
- Educating those responsible for analysis in medical laboratories about the importance of saving the results obtained in order to create a data bank that can be used when needed.
- Research more into the nature of the relationship between the concentration of sodium and chloride ions in the blood.
- Studying the relationship between age and chemical components is under study with a larger sample size.

Thanks and Appreciation

In this research, we can only extend our greetings and appreciation to the volunteers who provided the samples and to the workers at Sabratha Teaching Hospital for providing assistance to make this research a success.

REFERENCES

1. Al-Takrouri, H. (1989). General Nutrition, first edition, Arab Publishing and Distribution House, Cairo, Egypt.
2. Abdul, M. Al-Shaer., Hisham, K., & Al-Khatib, I. (1990). *Basics of Physiology, first edition, Dar Al-Mustaqbal for Publishing and Distribution*, Amman, Jordan.
3. Irsan, I. M., Muhammad, S., Al-Sharbarda. (2001). Introduction to Clinical Biochemistry, first edition, *Wael House for Printing and Publishing*, Amman, Jordan.
4. Catherine Anthony and Gary Thibodeau. (1991), Structure and Functions of the Human Body, 7th Edition, *Tripoli University Publishing*, Tripoli, Libya.
5. Arneson, W. L., & Brickell, J. (2007). Clinical Chemistry: A Laboratory Perspective, 1st ed., F. A. Davis Company, Philadelphia, USA.
6. Carl, A. B., Edward, R., & David, E. B. (2006). Tietz text book of clinical chemistry and molecular diagnostics, 4th edition, Elsevier, USA.
7. Gong, Y. (2013). Pediatric Reference Intervals for Clinical Laboratory - Challenges and Opportunities. *Ann Clin Pathol, 1*(1), 1003.
8. Öztuna, D., Elhan, A. H., & Tüccar, E. (2006). Investigation of four different normality tests in terms of type 1 error rate and power under different distributions. *Turkish Journal of Medical Sciences*, *36*(3), 171-176.
9. Horn, P. S., Pesce, A. J., & Copeland, B. E. (1999). Reference interval computation using robust vs parametric and nonparametric analyses. *Clinical chemistry*, *45*(12), 2284-2285.
10. Horn, P. S., Pesce, A. J., & Copeland, B. E. (1998). A robust approach to reference interval estimation and evaluation. *Clinical chemistry*, *44*(3), 622-631.
11. James, G. (2013). An Introduction to Statistical Learning: with Applications in R, Springer Texts in Statistics, Springer Science + Business Media New York.
12. Friedrichs, K., Barnhart, K., Blanco, J (2011). ASVCP Quality Assurance and Laboratory Standards Committee (QALS) guidelines for the determination of reference intervals in veterinary species and other related topics. American Society for Veterinary Clinical Path https://www.asvcp.org/pubs/pdf/RI%20Guidelines%20For%20ASVCP%20website.pdf. Accessed November 10 2015.