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A Study on the Role of Hypokalemia in Infections with Covid-19 Virus in Babylon province

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Abstract

Introduction: Droplets from a person who has COVID can spread to others mostly through their cough or sneeze. The management of the contagion and eventual control of it, therefore, appears to depend on its early and correct diagnosis. Additionally, the fact that COVID infections can manifest clinically in a variety of ways, from not appearing in any significant to severe states, emphasizes the need for quick, easy, accurate, and early detection techniques. This article discusses the effects of potassium ions on human organ function and potential contributions to the development of COVID-19 disease. The study included 50 samples, 30 people had Corona diseases with hypokalemia and 20 without hypokalemia persons, but didn't get any medical treatment. All of the cases were checked, and the results of the patients and the control group were statistically compared. All tests and samples were done at Marjan Teaching Hospital in Babil province from June 2021 to November 2021. People between the ages of 17 and 60 years took part in the study. Potassium estimation methods for all samples from blood Samples examine by using emission photometry (colorimetric) or by blood electrolytes (ST-200CC) blood analysis. Results: By June 15, 2021, 50 patients with COVID-19 (15 women and 35 men; age [17–60] years) were admitted to hospital in Marjan Teaching Hospital in Babil province from June 2021 to November 2021, consisting of 30 patients had severe hypokalemia with covid -19, 20 without hypokalemia-, the results were significantly associated with the severity of hypokalemia ($P<0.001$),60% of severe and critically ill patients had hypokalemia which was most common among patients covid -19. Hypokalemia was mostly caused by K+ loss. They responded well to K+ supplementation. Conclusion, Due to the inhibition of the ACE2 enzyme, which controls blood pressure by controlling potassium's activity in several metabolic processes, the coronavirus lowers potassium levels, which in turn impacts respiratory symptoms and pulmonary function. The majority of COVID-19 patients have hypokalemia. Due to ongoing renal K+ loss brought on by the breakdown of ACE2, treating hypokalemia is difficult. A favorable prognosis is indicated by the cessation of K+ loss, and it may be dependable., As a result, it is important to keep track of potassium levels when the body is infected with the virus, which is what the research's findings targeted.

Keywords
COVID-19, ACE2, rennin-angiotensin system (RAS), potassium, ICTV

COVID-19 also called (SARS-CoV-2), is caused by a type of coronavirus related to the corona viridian family lead to its spread throughout the world infecting billions of people worldwide [1]. The virus that causes COVID infection is known as SARS-CoV-2, according to the classification in (ICTV) [2]. Numerous studies on the genesis, prognosis, identification, and therapy of COVID-19 have been recorded, and it is clear that COVID affects all organs, for example, the spleen, liver, lung, and liver [[3, 4]. Less than 3.5 mEq/L (3.5 mmol/L) of serum potassium is considered hypokalemia. Serum levels between 2.5 and 3.0 mEq/L are considered moderate hypokalemia, whereas those below 2.5 mEq/L are considered severe hypokalemia [5]. A potentially fatal imbalance known as hypokalemia may be brought on artificially. Inadequate potassium intake, excessive potassium excretion, or a move of potassium from the

extracellular to the intracellular space can all lead to hypokalemia. The most prevalent mechanism is an increase in excretion [6]. Low potassium syndrome, hypopotassemia syndrome, and hypokalemic syndrome are further names for hypokalemia. Mild hypokalemia has no symptoms. Low potassium levels can occasionally cause arrhythmia, or irregular heartbeats, as well as significant muscular weakness. But these symptoms typically reverse after treatment [7]. A protracted sickness that produces vomiting or diarrhea, using drugs, especially diuretics known to induce potassium loss, and having a heart problem all raise the risk of hypokalemia and its consequences. The Covid-19virus binds to a receptor called ACE2 and speeds up its breakdown, which lessens ACE2's ability to block RAS. This results in increased salt and water absorption raised blood pressure, and increased potassium excretion [8]. The attack method for the (RAS), which is crucial in maintaining electrolyte equilibrium and blood pressure management by balancing potassium and sodium, is ACE2 [9]. The covid-2 virus attaches to ACE2 receptors found on the cellular membrane surface of patients to invade human cells by virus. The abnormal renin-angiotensin system activity, which rises as a result of decreased angiotensin-converting protein counteractivity, may be the cause of the low potassium levels found in COVID-19 individuals. Potassium's role in viral replication affects both the assembly of viruses bound to spaces. virus suppression by potassium depletion [10].

Methodology

The study include 50 samples, 30 people had Corona diseases with hypokalemia and 20 without hypokalemia persons, but didn't get any medical treatment. All of the cases were checked, and the results of the patients and the control group were statistically compared. All of the tests and samples were done at Marjan Teaching Hospital in Babil province from June 2021 to November 2021. People between the ages of 17 and 60 years took part in the study. (5) ml of blood was used to make serum samples. Relative Centrifugal Force (RCF) = 5000 was used to centrifuge the samples for 10 minutes, and the time was set to 10. Those tubes were filled with them. It was -80 °C right away. All of the patients who were diagnosed with hypokalemia had blood drawn from their veins. To avoid the swelling of platelets caused by EDTA, blood samples were only looked at for about 30 minutes. Examinations were performed for the patients, such as checking potassium levels and comparing the results taken with control samples. techniques for estimating potassium Tanaka et al. used emission flame photometry to successfully determine potassium levels from blood samples taken at any time [11]. The techniques as described by [12, 13], are the ones that are most often employed.

Statistical Analysis: Variant twenty of SPSS was utilized to finish the measurable examination. (Means ± SD) were utilized to address the factors. The correlation between patient gathering and control bunch was finished by using SPSS; with a p-value of < 0.001 was considered critical.

Results and Discussion

In this study, which was carried out at Marjan Teaching Hospital in the province of Babylon for the year 2021, we discovered that out of 50 people who were exposed to the virus with corona, 30(60%) out of 50 patients had a decrease in potassium, and these results were noticed when they were infected with the virus, and the results were significant($p < 0.001$), whereas another study with 290 patients with COVID-19 appeared increase of potassium excretion in almost 96.5% [7]. While a different study with 170 patients indicated that using potassium at a daily dose of 40 mEq improved the effectiveness of potassium supplementation. In this study, patients were categorized based on their serum potassium levels [14]. These latest results confirm the need of checking up on potassium levels when suffering from COVID-19 infection. The current investigation showed that 60 percent of the 50 individuals with COVID-19 had hypokalemia. Surprisingly, data from Marjan Teaching Hospital indicate that patients have a significant frequency of hypokalemia [15]. The current study also makes covid-19 patients more at risk for adverse outcomes, which is cause for concern.

However, this cross-sectional study lacks information on critical patient outcomes. Compared to other studies, this one found a somewhat reduced frequency of hypokalemia (60%) [16, 17] might be, in part, a result of increasing awareness of the condition among patients suggested by the prescription of continuous oral potassium supplements in as high as 50% of the patients. As previously indicated, the main determinant of serum potassium levels is potassium homeostasis. The results for hypokalemia were displayed in table (1) by p-value and mean, ST. deviation, According to a study, potassium excretion rises throughout the viral infection phase, causing its proportion in the body to decline along with several other ions including sodium and magnesium [18]. In the current study, individuals with hypokalemia consume considerably less potassium than healthy participants. The findings of investigations in Chinese patients [2] concurred with those of the current study in that both other patients' potassium consumption was lower than that of other patients [15]. While the current study found that individuals with lower blood potassium levels had reduced potassium excretion, this suggests that potassium was in a constant state and that potassium intake and outflow must be equal to maintain potassium balance. Therefore, rather than increased potassium excretion being the cause of potassium depletion or hypokalemia, the notion of total body potassium depletion leading to decreased potassium excretion is compatible with this result [19].

Table (1)Showed Descriptive Statistics in this study(n=50).

	Mean	Std. Deviation	Hypokalemia	*P value*
	36.80	11.226		
mmol/L	2.8280	.41492		
Serum potassium (mEq/L)			3.2±0.3	<0.001

Table (2) Showed frequency and cumulative percent in patients according to gender (n=30).

Total Frequency	Percent	Cumulative Percent	
	2	6.3	6.3
Female	12	37.5	43.8
Male	18	56.3	100.0
Total	32	100.0	

Table(3)The frequency and cumulative percent of patients in this study according to age (n=30).

Frequency	Percent	Cumulative Percent	
17	1	3.1	3.3
19	1	3.1	6.7
23	2	6.3	13.3
24	1	3.1	16.7
25	1	3.1	20.0
26	1	3.1	23.3
29	1	3.1	26.7
30	1	3.1	30.0
31	1	3.1	33.3
32	1	3.1	36.7
34	3	9.4	46.7
35	2	6.3	53.3
36	1	3.1	56.7
38	1	3.1	60.0
40	2	6.3	66.7
45	2	6.3	73.3
46	2	6.3	80.0
49	1	3.1	83.3
50	1	3.1	86.7
51	1	3.1	90.0
52	1	3.1	93.3
55	1	3.1	96.7
60	1	3.1	100.0
Total	30	93.8	
	2	6.3	
30	100.0		

In table (2) The results showed the predominant in males compared with females. The frequency in females is 12 out of 30 while in males 18 out of 30 patients Cumulative Percent in males is high compared with a female. The results showed the effects of gender on this disease. This study offers

circumstantial evidence against the idea that intracellular shift is the primary cause of hypokalemia in individuals with COVID-19. when there is very high hypokalemia for an unknown reason. Strong evidence that insufficient dietary potassium was the primary cause of hypokalemia in individuals with COVID-19 is provided by the considerable correlation between poor dietary potassium consumption and hypokalemia. this study only included patients who resided in Hilla, whose dietary habits might not accurately reflect those of patients who reside in other parts of Iraq. Because there were very few patients who participated in this investigation, any significant relationships that were found there might be the consequence of statistical power. Some non-significant associations observed in this study might result from limited statistical power since the number of participating patients was relatively small.

Conclusion

Potassium is essential for maintaining a normal heartbeat and proper muscular contractions (N.BL.K+ = 3.0–5.0 mEq/L). Additionally, potassium controls the water and acid-base balance in blood and tissues. The primary role of electrolytes, such as potassium, is to maintain osmotic pressure and water distribution. These ions also contribute to maintaining pH, oxidation reactions, and protein complexes for proteins. By allowing plasma potassium to enter cells or by excreting it through the kidneys, the body restores potassium homeostasis. The coronavirus reduces potassium levels, which then affect lung function and other biochemical processes because it inhibits an enzyme called ACE2, which balances potassium's participation in a variety of biochemical processes and regulates blood pressure.

References

1. Amal Talib Al Sa'ady, Z.A.A., Ali Fadhil Obaid, Hayder Abdul-Amir Makki Alhindy, Amir S. Al-Mumin *Prevalence of adverse effects from COVID-19 vaccine among Iraqi adults: A retrospective cross-sectional study*. Journal of Emergency Medicine, Trauma Acute Care, 2022. **3**(6): p. 1-9.
2. Rothan, H.A. and S.N. Byrareddy, *The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak*. J Autoimmun, 2020. **109**: p. 102433.
3. Jain, U., *Effect of COVID-19 on the Organs*. Cureus, 2020. **12**(8): p. e9540.
4. Hayder Abdul-Amir Maki Al-Hindy, J.M., HO Hashim, *BCG Vaccine in preventing COVID-19 epidemic had to be reviewed: correlation does not imply causation*. Australian Journal of Basic and Applied Sciences, 2021. **14**(11): p. 58-63.
5. Cui, J., F. Li, and Z.L. Shi, *Origin and evolution of pathogenic coronaviruses*. Nat Rev Microbiol, 2019. **17**(3): p. 181-192.
6. Noori, M., et al., *How SARS-CoV-2 might affect potassium balance via impairing epithelial sodium channels?* Mol Biol Rep, 2021. **48**(9): p. 6655-6661.
7. Alfano, G., et al., *Hypokalemia in Patients with COVID-19*. Clin Exp Nephrol, 2021. **25**(4): p. 401-409.
8. Obukhov, A.G., et al., *SARS-CoV-2 Infections and ACE2: Clinical Outcomes Linked With Increased Morbidity and Mortality in Individuals With Diabetes*. Diabetes, 2020. **69**(9): p. 1875-1886.
9. Noori, M., et al., *A Review on the Possible Pathophysiology of Potassium Abnormalities in COVID-19*. Iran J Kidney Dis, 2021. **15**(6): p. 397-407.
10. Ribeiro SC, F.A., Barretti P, Pecoits-Filho R, de Moraes TP, *Low Serum Potassium Levels Increase the Infectious-Caused Mortality in Peritoneal Dialysis Patients: A Propensity-Matched Score Study*. PLoS ONE 2015. **10**(6): p. e0127453.
11. Tanaka, T., et al., *A simple method to estimate populational 24-h urinary sodium and potassium excretion using a casual urine specimen*. Journal of Human Hypertension, 2002. **16**(2): p. 97-103.
12. Brown, I.J., et al., *Estimating 24-hour urinary sodium excretion from casual urinary sodium concentrations in Western populations: the INTERSALT study*. Am J Epidemiol, 2013. **177**(11): p. 1180-92.
13. Kawasaki, T., et al., *A simple method for estimating 24 h urinary sodium and potassium excretion from second-morning voiding urine*

specimen in adults. Clin Exp Pharmacol Physiol, 1993. **20**(1): p. 7-14.
14. Chen, Y., et al., *Disordered signaling governing ferroportin transcription favors breast cancer growth*. Cell Signal, 2015. **27**(1): p. 168-76.
15. Tentori, F., et al., *SP498INTERNATIONAL VARIABILITY IN THE PREVALENCE OF HYPOKALEMIA AMONG PATIENTS ON PERITONEAL DIALYSIS (PD): RESULTS FROM THE PDOPPS*. Nephrology Dialysis Transplantation, 2017. **32**(suppl_3): p. iii296-iii296.
16. Tennankore, K., et al., *The Association of Functional Status with Mortality and Dialysis Modality Change: Results from the Peritoneal Dialysis Outcomes and Practice Patterns Study (PDOPPS)*. Perit Dial Int, 2019. **39**(2): p. 103-111.
17. Karim Abdul-Husseein, H., et al., *Liver Function Abnormalities in COVID-19 Patients and their Association with Age and Sex: a Cross-Sectional Study*. Archives of Razi Institute, 2023. **78**(1): p. 453-458.
18. Carney, S.L., N.L. Wong, and J.H. Dirks, *Effect of magnesium deficiency and excess on renal tubular potassium transport in the rat*. Clin Sci (Lond), 1981. **60**(5): p. 549-54.
19. Palmer, B.F. and D.J. Clegg, *Physiology and Pathophysiology of Potassium Homeostasis: Core Curriculum 2019*. American Journal of Kidney Diseases, 2019. **74**(5): p. 682-695