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A Study on Electrolyte Abnormalities in Patients with Chronic Kidney Disease

Mrs. Jothilakshmi.R [1]*, Ms.Oviya.T. P[2], Ms. Aswini.R[3]

[1*]Demonstrator, College of Allied Health Science, DR MGR Educational and Research Institute, ACS Medical College, Chennai, Tamil Nadu.

Orcid ID: 0009-0005-9593-0183

Email ID: jothilakshmi68935@gmail.com

[2]Lecturer, College of Allied Health Science, DR MGR Educational and Research Institute, ACS Medical College, Chennai, Tamil Nadu.

Orcid ID: 0009-0000-2504-0971

Email ID: oviyasundaram20@gmail.com

[3]Demonstrator, College of Allied Health Science, DR MGR Educational and Research Institute, ACS Medical College, Chennai, Tamil Nadu.

Orcid ID: 0009-0002-6989-6688

Email ID: aswiniraammlt@gmail.com

***Corresponding Author:**

Mrs. Jothilakshmi.R

Demonstrator, College of Allied Health Science, DR MGR Educational and Research Institute, ACS Medical College, Chennai, Tamil Nadu.

Orcid ID: 0009-0005-9593-0183

Email ID: jothilakshmi68935@gmail.com

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ABSTRACT

BACKGROUND: Electrolytes are naturally occurring elements and compounds that play a crucial role in regulating key physiological functions. Electrolyte replacement becomes essential in cases of prolonged vomiting, diarrhea, or after intense physical activity. Commercial electrolyte solutions are readily available, especially for treating sick children. An electrolyte panel, also known as a serum electrolyte test, is a blood test used to measure the levels of the body's major electrolytes. These substances are found in the blood, body fluids, and urine.

AIM: The aim of this study is to evaluate serum electrolyte abnormalities in chronic kidney disease (CKD) patients to assess the severity of the condition.

MATERIALS AND METHODS: Collect the serum blood samples for the above 20 years included in this study. And a comparison of men and women in age categories. The blood samples were drawn from the CKD patients. The samples are analyzed by the Elyte 5i semi-auto analyzer machine for electrolytes (sodium, potassium, and chloride).

RESULT: Out of 100 blood samples collected, abnormalities of electrolytes (sodium, potassium, chloride) were found in 50 patients, and 50 were in the control group. The abnormalities of electrolytes lead to many disorders: hypernatremia, hyponatremia, hyperkalemia, hypokalemia, hyperchloremia, and hypochloremia. There is no significant association between gender and electrolytes, sodium ($p=0.42$), potassium ($p=0.53$), or chloride ($p=0.216$).

CONCLUSION: The present study concluded that increased or decreased electrolytes lead to severe complications. The blood samples were collected for above 20 years of age including. There is no significant association between gender and electrolytes for sodium, potassium, and chloride

Keyword: *Electrolytes, Sodium, Potassium, Chloride, CKD Patients.*

1. INTRODUCTION

Electrolytes are substances that contain ions and are capable of conducting electricity through the movement of these ions not electrons when dissolved in a polar solvent like water. This category includes most soluble salts, acids, and bases. Upon dissolution, the substance separates into positively charged ions (cations) and negatively charged ions (anions), which then distribute evenly throughout the solvent. These solutions remain electrically neutral overall. In an applied electric field, cations move toward the negatively charged electrode (rich in electrons), while anions move toward the positively charged electrode (electron-deficient). This opposite movement of ions generates an electric current. Certain gases, such as hydrogen chloride (HCl), can also act as electrolytes under specific conditions like high temperature or low pressure. Solid-state electrolytes and polyelectrolytes (such as DNA, polypeptides, or synthetic polymers like polystyrene sulfonate) also exist, which have charged functional groups enabling ion conduction. A substance that dissociates into ions in solution or molten form gains the ability to conduct electricity. In medical contexts, the term "electrolyte" typically refers to substances dissolved in bodily fluids. Key electrolytes include sodium, potassium, chloride, calcium, magnesium, and phosphate. Electrolyte replacement is often necessary in cases of prolonged vomiting, diarrhea, or excessive sweating from intense physical activity. Commercial electrolyte solutions, especially oral rehydration solutions, are widely used, particularly for children. Electrolyte monitoring plays a crucial role in managing conditions like anorexia and bulimia. An electrolyte panel, or serum electrolyte test, is a routine blood test used to measure the levels of major electrolytes in the blood, body fluids, and urine. It is also commonly included in a comprehensive metabolic panel to detect imbalances in fluid, acid-base, and electrolyte levels.

The kidneys are central to regulating body fluids and electrolytes and maintaining acid-base balance. Chronic Kidney Disease (CKD) significantly affects this regulation. In 2016, CKD impacted approximately 753 million people globally 417 million females and 336 million males.

2. MATERIALS AND METHODS

This protocol was approved by the ethics committee. The present study was carried out in ACS Medical College and Hospital, Velapanchavadi, Chennai. 100 patients around ACS Medical College and Hospital were chosen for the study. The study included patients aged above only 20 years; among those, 50 were control patients and 50 were CKD patients investigated in the present study.

Blood samples are collected by the vein puncture method (MEDIAN CUBITAL VEIN). The blood samples are analyzed by the ELYTE 5i semi-auto analyzer machine. The serum is analyzed by a semi-auto analyzer for electrolytes sodium, potassium, and chloride.

STATISTICAL ANALYSIS

Statistical analysis was performed using IBM SPSS version 20.

Data were presented as mean ± standard deviation.

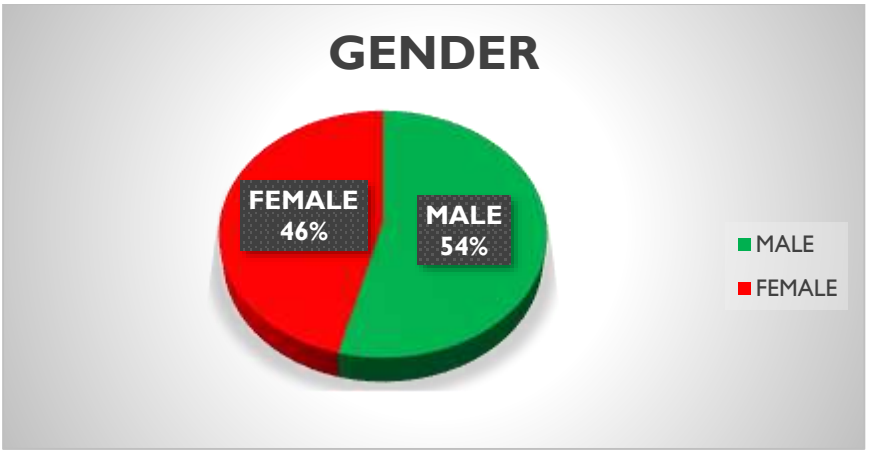
Sodium (p=0.42), potassium (p=0.53), and chloride (p=0.216) are no significant.

3. RESULT

Out of 100 blood samples that were collected, abnormalities of electrolytes (sodium, potassium, and chloride) were found in 50 control group patients and 50 CKD patients. The abnormalities of electrolytes lead to many disorders hypernatremia, hyponatremia, hyperkalemia, hypokalemia, hyperchloremia, and hypochloremia. There is no significant association between gender and electrolytes, sodium (p=0.42), potassium (p=0.53), chloride (p=0.216).

Table 1: Gender graph:

GENDER	COUNT	PERCENTAGE
MALE	54	54%
FEMALE	46	46%



In this study, a total of 100 participants were included, comprising 50% from the study group and 50% from the control group, all diagnosed with chronic kidney disease.

Table 2: Age graph:

AGE	COUNT	PERCENTAGE
<40	26	26%
41-60	33	33%
61-80	36	36%
>80	05	05%

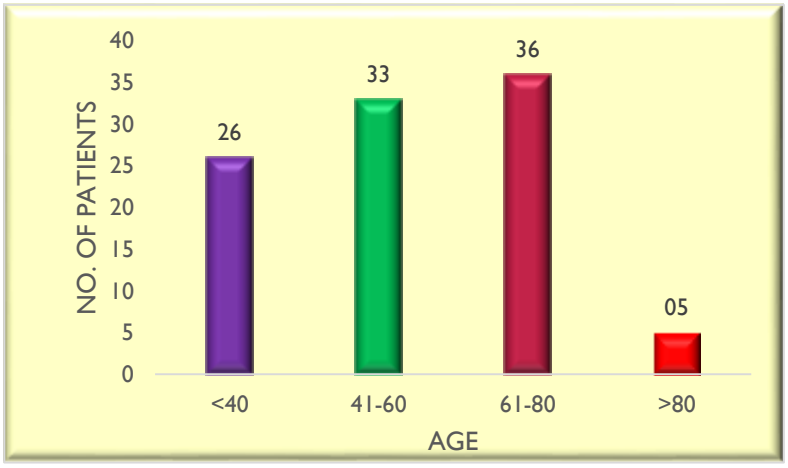


Figure 1: Comparison of age with electrolytes (sodium, potassium, chloride)

Table 3: Sodium compared with gender and age group

GENDER	NORMAL	INCREASED	DECREASED
MALE	23	06	25

FEMALE	14	05	27
P VALUE 0.421 NS			

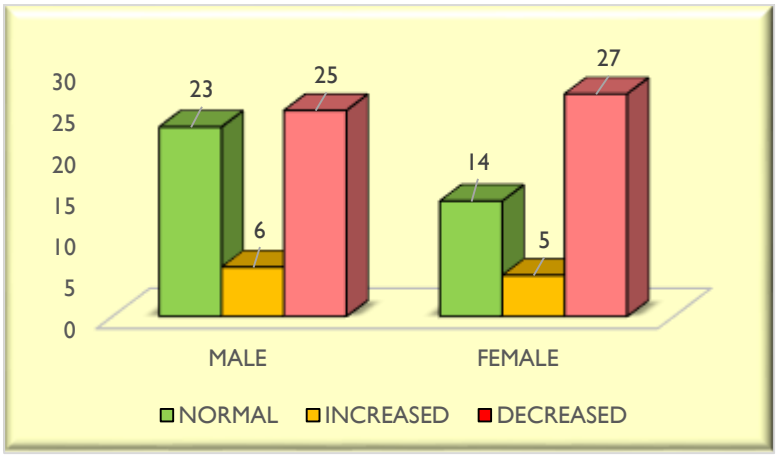


Figure 2: Comparison of sodium with age categories for CKD patients and the control group. There is no significant association between gender and sodium.

Table 4: Potassium compared with gender and age group

GENDER	NORMAL	INCREASED	DECREASED
MALE	21	12	21
FEMALE	23	08	15
P VALUE 0.53 NS			

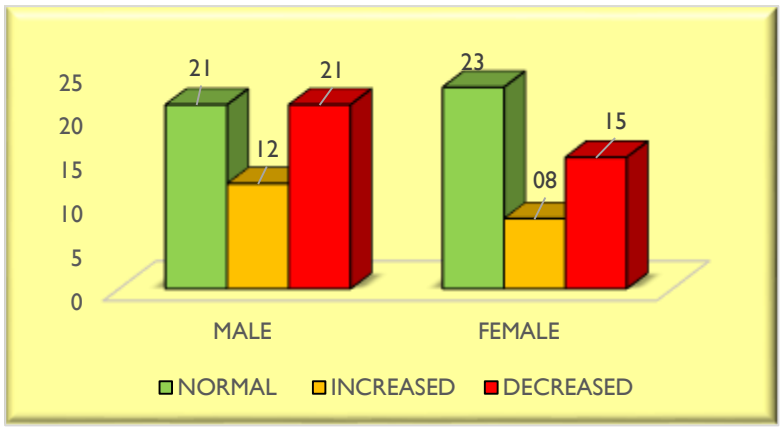


Figure 3: Comparison of potassium with age categories for CKD patients and the control group. There is no significant association between gender and potassium.

Table 5: Chloride compared with gender and age groups

GENDER	NORMAL	INCREASED	DECREASED

MALE	28	02	24
FEMALE	23	06	17
P VALUE 0.216 NS			

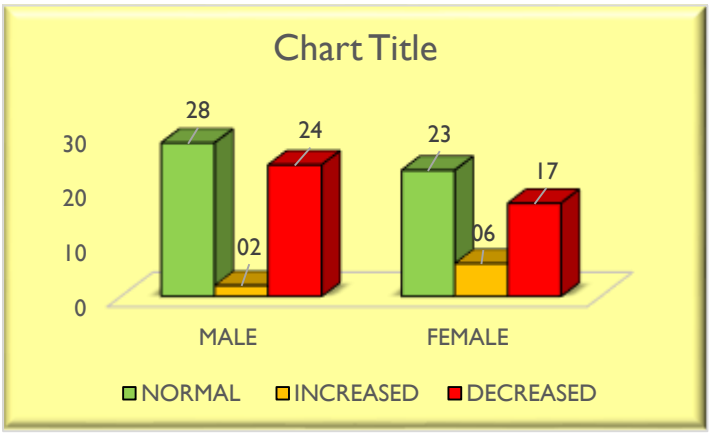


Figure 4: Comparison of chloride with age categories for CKD patients and the control group. There is no significant association between gender and chloride.

4. DISCUSSION

Electrolyte abnormalities are both a cause and consequence of chronic kidney disease (CKD). Patients with CKD and end-stage renal disease frequently develop metabolic disturbances, particularly electrolyte imbalances, which significantly contribute to morbidity and mortality. Metabolic derangements such as metabolic acidosis can manifest early in the disease course, while more severe stages are often marked by hyperkalemia and disturbances in sodium and water balance. Each case highlights the importance of understanding the underlying pathophysiology, accurate diagnosis, and effective treatment strategies. The kidneys play a central role in maintaining body fluid balance, electrolyte levels, and acid-base homeostasis. The present study focuses on identifying electrolyte abnormalities among chronic kidney disease patients. In some individuals, existing electrolyte imbalances may contribute to the progression of kidney dysfunction. The study confirms that electrolyte levels vary across different stages of CKD. These imbalances were measured using a semi-auto analyzer (Elyte 5i machine).

A total of 100 blood samples were analyzed, including 50 from the control group and 50 from the CKD study group. The samples were evaluated for key biochemical parameters, particularly electrolytes. Statistical analysis revealed no significant association between gender and electrolyte levels, with p-values for sodium ($p = 0.42$), potassium ($p = 0.53$), and chloride ($p = 0.216$).

5. CONCLUSION

Progressive chronic kidney disease is associated with numerous complications, which become more frequent and severe in the advanced stages. These complications, including electrolyte imbalances, contribute to increased morbidity, mortality, and a decline in the patient's quality of life. The electrolyte parameter values were increased and decreased in chronic kidney patients as compared to the control group. An increase in sodium level is hypernatremia. A decreased sodium level is hyponatremia. An increase in potassium level is hyperkalemia. A decreased potassium level is hypokalemia. An increase in chloride level is hyperchloremia. A decrease in chloride level is hypochloremia. Therefore, we have to drink a lot of water and electrolyte supplements to avoid chronic kidney disease. There is no significant association between gender and electrolytes sodium, potassium, and chloride.

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