



Study of serum sodium and serum potassium level in chronic renal failure

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Abstract

C.R.F. Chronic renal failure is a progressive loss in renal function over a period of months or years. It is a long term condition caused by damage to both kidneys. There is no single cause and damage is usually irreversible and can lead to ill health. It is associated with significant morbidity and mortality. **Methods :** The present study included 30 chronic renal failure patients of both sexes and 30 healthy controls of both sexes. Special care were taken to ensure that females were neither on contraceptive pills and nor pregnant. **Result:** The comparison of serum sodium and serum potassium levels between control cases and CRF cases were found to be statically significant ($p < .005$). **Conclusion:** Serum sodium level decrease and serum potassium level were found elevated in CRF cases as compare to control cases. **Summary:** In renal disease with CRF shows low serum sodium level and high serum potassium level as compare to control. This is due to malfunctioning of aldosterone and rennin-angiotensin system, glomerular filtration and decreased reabsorption. So these patients sometime need replacement therapy.

Keywords: C.R.F., serum sodium and serum potassium levels, replacement therapy.

Introduction

Chronic kidney disease (CKD), also known as chronic renal disease, is a progressive loss in renal function over a period of months or years. It is a long term condition caused by damage to both kidneys. There is no single cause and damage is usually irreversible and can lead to ill health. It is associated with significant morbidity and mortality. (Khanagavi J et.al. 2015)

The symptoms of worsening kidney function are unspecific, and might include feeling generally unwell and experiencing a reduced appetite. Often, chronic kidney disease is diagnosed as a result of screening of people known to be at risk of kidney problems, such as those with high blood pressure or diabetes and those with a blood relative with chronic kidney disease.

Chronic kidney disease may also be identified when it leads to one of its recognized complications, such as cardiovascular disease, anemia or pericarditis. (Ahn SEE, 2013)

Chronic kidney disease is identified by a blood test for creatinine. Higher levels of creatinine indicate a lower glomerular filtration rate and as a result a decreased capability of the kidneys to excrete waste products. Creatinine levels may be normal in the early stages of CKD, and the condition is discovered if urinalysis (testing of a urine sample) shows that the kidney is allowing the loss of protein or red blood cells into the urine. To fully investigate the underlying cause of kidney damage, various forms of medical imaging,

blood tests and often renal biopsy reversible cause for the kidney malfunction.

Electrolyte metabolism and its pathological alteration in relation to clinical features is a subject of interest.

Potassium (K⁺) is the most abundant cation within intracellular fluid. Therefore patients with chronic renal failure, who have impaired regulatory mechanisms, are prone to hyperkalaemia.

Sodium is the chief cation of the extracellular fluid. Sodium is a mineral that helps balance fluids in our body. It also helps our nerves and muscles work properly. Kidneys help the body to maintain the right amount of sodium. Impaired renal concentrating mechanisms leads extra renal fluid losses by such as vomiting, diarrhea or pyrexia and may rapidly cause hypovolaemia and hypotension. (Ash SR, 2017)

Aims and Objectives

Aim :- Study of serum electrolytes level in Chronic renal failure...

Objectives:-

- (1) To estimate the serum sodium level in the patients of chronic renal failure.
- (2) To estimate the serum potassium level in the patients of chronic renal failure.
- (3) To find out a statistical correlation of serum sodium and potassium level in CKD and to demonstrate its future utility in the management of CKD if any.

Materials and Methods

The present study is conducted in the Department of Medical Biochemistry, R.D. Gardi Medical college, Ujjain in association with Department of Medicine, C. R. Gardi hospital, Ujjain. The study includes 30 chronic renal failure (30 C.R.F.) patients of both sexes, diagnosed on the basis of clinical findings. The control group included 30 healthy individuals of both sexes.

The cases were grouped as follows:

GROUP I : Normal Healthy Controls = 30 cases.

GROUP II: Chronic Renal failure Cases = 30 cases

Group I

30 healthy individuals were studied were selected from the resident staff, medical students and members of the hospital staff, in all the control cases following precaution were taken: Healthy controls were screened to exclude the presence of malnutrition, metabolic diseases and other diseases like CRF with Hypertension, cardiovascular disease, and diabetes. Special cares were taken to see that the healthy controls were not under any stress at the time of collection of blood samples. Special care were taken to ensure that females were neither on contraceptive pills and nor pregnant.

Groups II

All patients were subjected to a thorough history taking with special emphasis to exclude the presence of other diseases which are known to alter the sodium and potassium levels in serum except hypertension, cardiovascular disease and diabetes.

Collection of sample: Under aseptic precautions, blood sample taken in the plain vial was incubated at 37°C for 45 min. After that clot was removed and serum was centrifuged at 2000 rpm for 10 min. Supernatant was collected in the fresh tube, for the analysis.

Criteria for selection of cases:

Diagnosis of chronic renal failure was established by measuring raised blood urea nitrogen (BUN) and serum creatinine with clinical sign and symptoms of renal failure.

In both group 1 and group 2 following investigations are done:-Sodium & Potassium

Observation

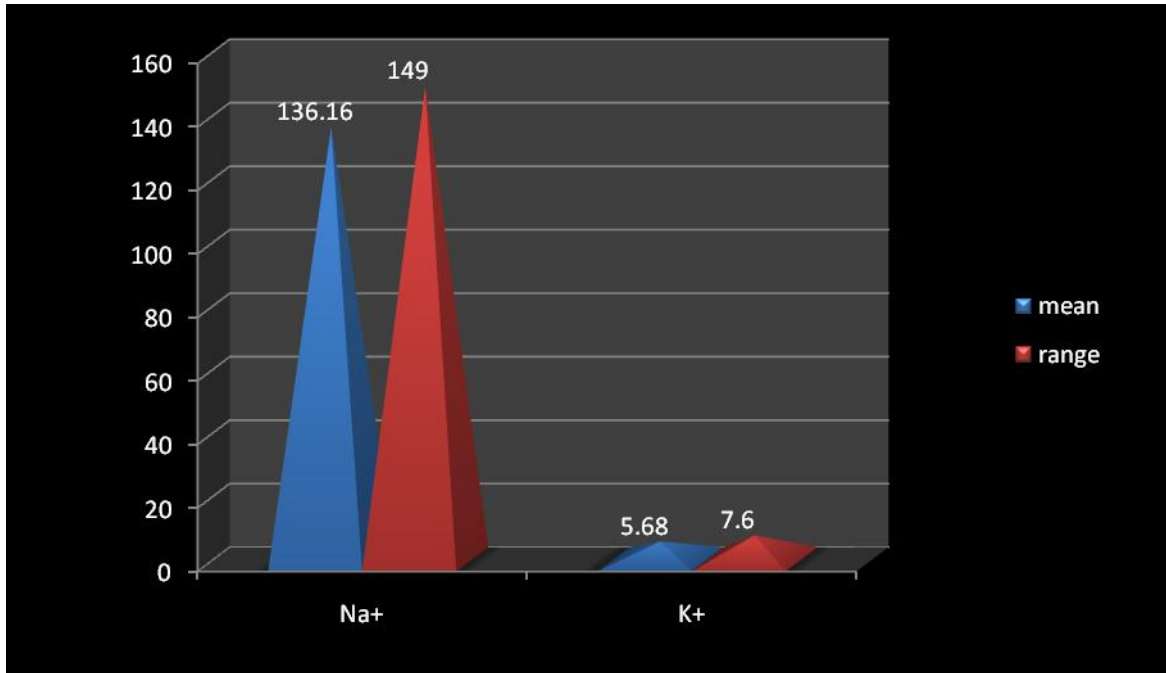
The present study was done in the Department of medical biochemistry, R.D. Gardi medical college, ujjain in association with department of Medicine, C.R. Gardi hospital Ujjain. The work comprises total 60 cases out of which 30 cases of chronic renal failure and 30 control healthy between 18 to 85 years of both sexes. The analysis of various data is accessible as follows:

Table 1

Values of Na⁺/K⁺ Level in cases

The table shows the data with reference to range observed in cases.

S.No	Parameters	Range (mEq/L)	Mean±SD
1	Na ⁺	114-149	136.16±8.97
2	K ⁺	5.1-7.6	5.68±0.67



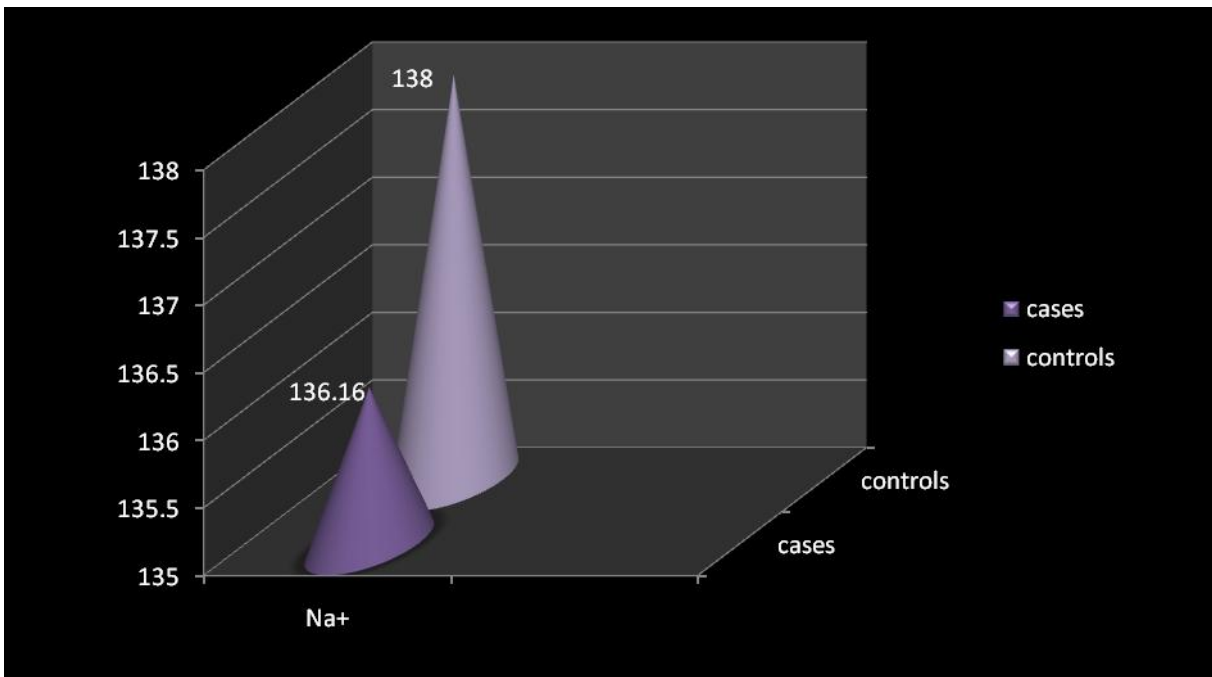
Form the above Graph it is observed that the value of sodium and potassium is observed elevated in cases when compared to normal range

Table 4

Comparison of cases with controls for Na⁺ Level

The table shows that Na⁺ level determined in cases and control is statistically significant

Parameter	Cases	Controls	'P' Value
Na ⁺	136.16±8.97	138.0±2.13	<0.05



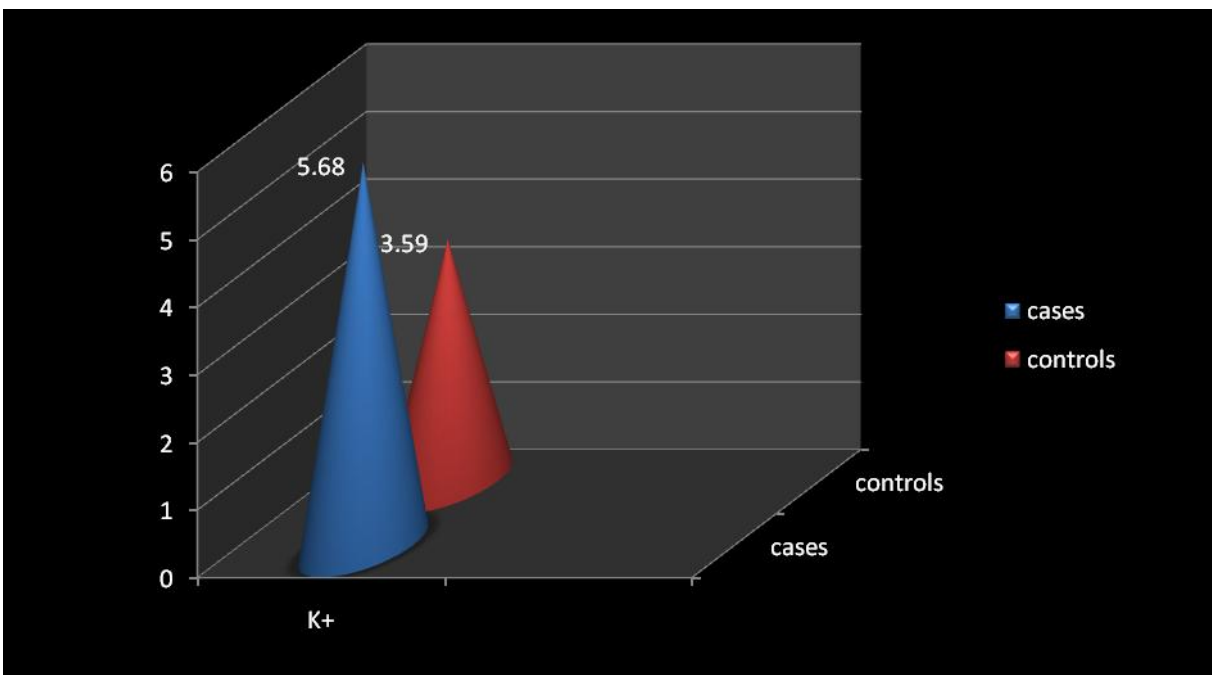
The above graph show that the value of sodium is observed raised in cases when compared to controls.

Table 3

Comparison of cases with controls FOR K⁺ Level

The table shows that K⁺ level determined in cases and control is statistically significant.

PARAMETER	Cases	Controls	'P' Value
K ⁺	5.68±0.67	3.59±0.10	<0.05



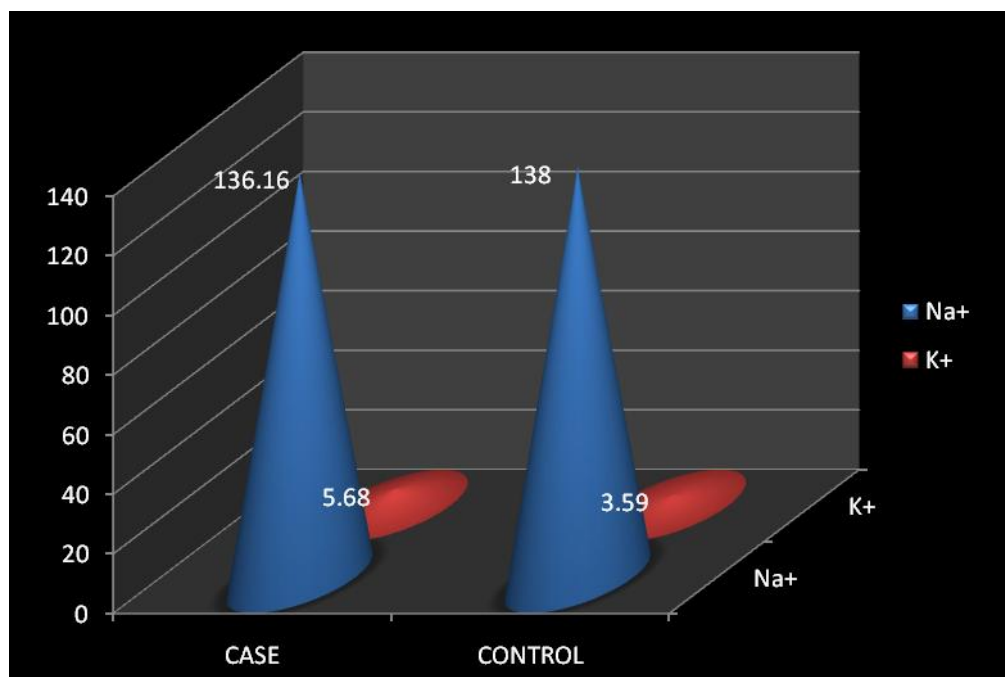
The above graph reveal that the value of serum potassium increase in the case when compared with the healthy control.

Table 4

Comparison between Na⁺/K⁺ Level in cases and control

S.No	Parameters	Mean ± SD CASE	Mean±SD CONTROL	'P' Value
1	Na ⁺	136.16±8.97	138.0±2.13	<0.001
2	K ⁺	5.68±0.67	3.59±0.10	

It is evident from the above table that the comparison between Na⁺/K⁺ levels in cases and control is highly statistically significant.



Results and Discussion

The present study was done with an aim to study of serum sodium and serum potassium in chronic renal failure patients. The studies of electrolyte disturbances have opened up a new chapter in the understanding of disease processes.

Control : The mean value of serum sodium and serum potassium were 138.0 ± 2.13 mg/dl and 3.59 ± 0.10 mg/dl respectively.

CRF Cases: It has been observed that in the present study of 30 cases of CRF of different etiology, the mean value of serum sodium was 136 .16 ± 8.97 (normal range 137.0 – 145.0 mg/dl) and serum potassium was 5.68 ± 0.67 (normal range 3.5 – 5.1 mg/dl).

The comparison of serum sodium and serum potassium levels between control cases and CRF cases were found to be statically significant (p<.005). Serum sodium level decrease and serum potassium level were found elevated in CRF cases as compare to control cases.

In this study the decreased level of sodium observed and which may be due to malfunctioning of aldosterone and renin-angiotensin system. Also the elevated level of serum potassium were observed in CRF because of GFR<60 mL/min/1.73 m² and decreased reabsorption.

Aldosterone play a key role by regulating Na⁺/ECF volume. Its release causes kidneys to conserve water and sodium which results in increase ECF volume.

The findings in CRF patients has been observed in the present work is in agreement with findings of following :

According to **Am J Clin Nutr 1984** there was a significant increase of the mean values of both nitrogen and potassium.

According to **Annette V.M. Alfonzo 2005** Potassium disorders are common and may precipitate cardiac arrhythmias .They are anticipated complication in patients with renal failure, but may also occur in patients with no previous history of renal disease.

According to **Bernard CHARRA 2007** the total amount of sodium present in the body controls the extracellular volume. In advanced renal failure, sodium balance becomes positive and the extracellular volume expands. This leads to hypertension and vascular changes that lead to adverse cardiovascular consequences in dialysis patients.

According to **Nepal Journal of Epidemiology 2011;** With the progression of stages of CKD, sodium levels were found to be decreased ($p < 0.001$). In contrast to that potassium and phosphorus levels were found to be increased with the stages of CKD.

According to **Chang Gung Med J 2011** the average K^+ level increased along with renal function deterioration in the late stages of CKD. Men and patients with diabetes mellitus, a low eGFR might have higher levels of serum K^+ .

A total of 60 patients were enrolled in the study. 30 control and 30 CRF patients were included in our study. There was showing decreased in serum sodium level and an increase in serum K^+ level.

Na is a Primary regulator of ECF volume. Careful regulation of sodium balance is critical. There is an inverse relationship between the fractional excretion of sodium and GFR. Typically, 95% of filtered Na reabsorbed. May fall to 50% or less in advanced kidney disease. Secretion plays no role in Na handling – sodium is handled by filtration and tubular reabsorption. Proximal tubular reabsorption is not suppressed. The reduction in reabsorption occurs in the distal nephron: the collecting tubule and collecting duct. Aldosterone is not suppressed, and remains a dynamic participant in sodium homeostasis. Atrial natriuretic peptide (ANP) appears to play a major regulatory role in tubular adaptation. With increased atrial stretch from sodium retention and hypervolemia,

circulating ANP levels rise and suppress tubular sodium reabsorption. Sodium restriction and anti-hypertensive therapy play an important role in treatment.

In this study we found that for chronic renal failure there is no single cause and damage is usually irreversible and can lead to ill health. We also found that there were more patients with hypertension, and diabetes mellitus and cardiovascular disease in CKD.

Summary and Conclusion

Summary:

Control Cases:-The means value of Serum Na, and serum K were 138.0 ± 2.13 mEq/L, 3.59 ± 0.10 mEq/L respectively.

Types of Cases:- 30 cases of different types of renal diseases were studied. The mean value of serum Na level was 136.16 ± 8.97 mEq/L (Range 114.0 – 149.0 mEq/L), and mean value of serum K was 5.68 ± 0.67 (Range 5.1 – 7.6 mEq/L).

Conclusion:

Serum sodium level and serum potassium level have some prognostic significance in chronic renal diseases i.e. when patient improves, the level returns towards normal and the level rises when patient deteriorates.

In renal diseases the cause of decreased sodium and increased K is related with low glomerular filtration rate and passive back diffusion through damaged tubular cells. In renal disease with CRF shows low serum sodium level and high serum potassium level as compare to control. This is due to malfunctioning of aldosterone and rennin–angiotensin system, glomerular filtration and decreased reabsorption. So these patients sometime need replacement therapy.

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