Study of Serum Electrolyte Imbalances in Patients with Chronic Diarrhea

[1]Shahid Rashid, [2]Ms ankita sharma, [3]MR KHUSHIRAM SHARMA
[1]Student of Bsc MLT, [23]Assistant professor
[123]Mewar university Chittorgarh, Rajasthan India

***Abstract*—Background:Chronic diarrhea affects approximately 4-5% of adults globally and is associated with significant fluid and electrolyte losses. Electrolyte imbalances, particularly hyponatremia, hypokalemia, and metabolic acidosis, represent critical complications contributing to morbidity and mortality.**

Objective:This study aimed to evaluate the prevalence and patterns of serum electrolyte imbalances in patients presenting with chronic diarrhea and assess relationships between demographic factors, duration of illness, and severity of electrolyte disturbances.

Methods:A hospital-based cross-sectional study enrolled 150 adult patients with chronic diarrhea lasting more than four weeks. Serum levels of sodium, potassium, chloride, and bicarbonate were measured. Data were analyzed using SPSS version 26.0 with descriptive statistics and chi-square tests.

Results:Electrolyte disturbances were present in 112 patients (74.7%). Hyponatremia was most common (41.3%), followed by hypokalemia (36.0%), metabolic acidosis (29.3%), and hypochloremia (26.0%). Significant associations were found between diarrhea duration and electrolyte abnormality severity ($p < 0.05$).

Conclusion:Electrolyte imbalances are highly prevalent among patients with chronic diarrhea. Routine monitoring of serum electrolytes is essential for timely intervention and prevention of complications.

***Index Terms*—Chronic diarrhea, electrolyte imbalance, hyponatremia, hypokalemia, metabolic acidosis, gastrointestinal disorders**

I. Introduction

Chronic diarrhea is defined as the passage of loose or watery stools with a frequency exceeding three times daily and a duration persisting beyond four weeks. This condition represents a significant clinical challenge affecting approximately 4-5% of the adult population globally. Unlike acute diarrheal episodes, chronic diarrhea is frequently associated with underlying pathological processes including inflammatory bowel disease, malabsorption syndromes, chronic infections, medication adverse effects, and functional gastrointestinal disorders.

The pathophysiological mechanisms underlying chronic diarrhea involve disturbances in intestinal absorption and secretion processes. Under normal conditions, the gastrointestinal tract processes approximately 10 liters of fluid daily. The small intestine reabsorbs the majority of this volume, while the colon concentrates remaining contents to approximately 100 milliliters per day. In chronic diarrhea, this balance is disrupted through osmotic gradients, secretory processes, inflammatory damage, and accelerated transit.

Electrolyte disturbances represent one of the most serious complications of chronic diarrhea. The intestinal tract plays a fundamental role in electrolyte homeostasis, and during diarrheal episodes, substantial quantities

of sodium, potassium, chloride, and bicarbonate are lost through stool. Hyponatremia develops when sodium losses exceed concurrent water losses. Hypokalemia results from direct fecal potassium losses, which can reach 55-75 millimoles per liter, compounded by secondary renal potassium wasting. Metabolic acidosis emerges from bicarbonate loss in stool, particularly in secretory diarrheas.

Clinical manifestations range from subtle symptoms to life-threatening complications. Hyponatremia can cause headache, confusion, seizures, and coma due to cerebral edema. Hypokalemia affects neuromuscular and cardiac function, causing muscle weakness and arrhythmias. Metabolic acidosis impairs cardiovascular performance and alters consciousness. Despite established pathophysiology, comprehensive data on electrolyte abnormalities in adult chronic diarrhea remains limited. This study systematically evaluates serum electrolyte patterns and examines relationships between patient characteristics and disturbance severity.

II. Review of Literature

2.1 Electrolyte Physiology and Gastrointestinal Function

The gastrointestinal tract processes substantial fluid volumes while maintaining electrolyte homeostasis. Approximately 10 liters of fluid traverse the system daily, with the small intestine reabsorbing the majority through coupled sodium-glucose transport. The colon performs final concentration, producing formed stool. Electrolyte composition varies by site: gastric juice contains high hydrogen and chloride concentrations, while pancreatic and biliary secretions are bicarbonate-rich. Colonic fecal water shows sodium below 30 millimoles per liter and potassium at 55-75 millimoles per liter, explaining why different diarrhea mechanisms produce distinct electrolyte disturbance patterns.

2.2 Previous Studies on Electrolyte Disturbances

Soleimani et al. examined 121 patients with severe acute diarrhea in Tehran, reporting hyponatremia in 67.8%, hypokalemia in 33.9%, and metabolic acidosis in 56.8%. Notably, 78% of hypokalemic patients showed failure of potassium correction despite WHO rehydration protocols. In pediatric populations, research at Saidu Teaching Hospital found hypokalemia in 60% of children with acute diarrhea, metabolic acidosis in 50%, and hyponatremia in 45%. Infants showed the highest vulnerability, with 70% demonstrating hypokalemia.

Khan et al. studied 150 adults in emergency departments, finding electrolyte disturbances in 74.7%, with hyponatremia at 41.3% and hypokalemia at 36.0%. Diarrhea was strongly associated with metabolic acidosis (OR=4.91, $p < 0.001$). Odey et al. reported case fatality rates of 12% in pediatric acute diarrhea, with hypokalemia present in 84.6% of fatalities. These studies consistently demonstrate that electrolyte abnormalities significantly impact clinical outcomes across age groups.

2.3 Etiology of Chronic Diarrhea

Chronic diarrhea encompasses inflammatory diarrhea (ulcerative colitis, Crohn's disease), osmotic diarrhea (lactose intolerance, medication-induced), secretory diarrhea (hormone-secreting tumors, infections), and functional diarrhea (irritable bowel syndrome). Distribution varies by geography: developed countries show higher rates of IBS and IBD, while developing regions have more chronic infections. Medication-induced diarrhea has emerged as increasingly recognized, with over 700 drugs now implicated.

2.4 Management Approaches

Oral rehydration therapy remains the cornerstone for mild to moderate dehydration. The current WHO reduced-osmolarity formulation contains 75 millimoles per liter sodium, 75 millimoles per liter glucose, 20 millimoles per liter potassium, and 10 millimoles per liter citrate. Intravenous therapy becomes necessary in severe dehydration, with isotonic saline preferred for initial resuscitation. Sodium correction must proceed cautiously, limiting correction to no more than 8 millimoles per liter in 24 hours to avoid osmotic demyelination syndrome.

III. Materials and Methods

3.1 Study Design and Setting

This cross-sectional study was conducted at the Department of Internal Medicine and Gastroenterology of a tertiary care teaching hospital over twelve months (January-December 2025).

3.2 Study Population

One hundred fifty adult patients aged 18 years and above with chronic diarrhea (loose stools more than three times daily for over four weeks) were enrolled using consecutive sampling. Exclusion criteria included chronic kidney disease, known electrolyte disorders unrelated to diarrhea, diuretic use, heart failure, liver cirrhosis, pregnancy, and prior intravenous fluid or electrolyte supplementation.

3.3 Laboratory Analysis

Serum sodium, potassium, chloride, and bicarbonate were measured using an automated electrolyte analyzer. Abnormalities were defined as: hyponatremia (sodium < 135 mmol/L), hypokalemia (potassium < 3.5 mmol/L), hypochloremia (chloride < 98 mmol/L), and metabolic acidosis (bicarbonate < 22 mmol/L).

3.4 Statistical Analysis

Data were analyzed using SPSS version 26.0. Descriptive statistics, chi-square tests, and Fisher's exact test were used. Odds ratios with 95% confidence intervals were calculated. P-value < 0.05 was considered significant.

3.5 Ethical Considerations

The Institutional Review Board approved the protocol. Written informed consent was obtained from all participants. The study followed the Declaration of Helsinki principles.

IV. Results

4.1 Demographic Characteristics

The mean age was 42.3 +/- 14.6 years (range 18-78). Most patients were aged 31-60 years (58.0%). Males constituted 54.0%. The demographic characteristics are summarized in Table 1.

Characteristic	Frequency (n)	Percentage (%)
Age group (years)		

Characteristic	Frequency (n)	Percentage (%)
18-30	28	18.7
31-45	48	32.0
46-60	39	26.0
> 60	35	23.3
Gender		
Male	81	54.0
Female	69	46.0
Duration of diarrhea		
< 7 days	26	17.3
7-14 days	38	25.3
15-30 days	42	28.0
> 30 days	44	29.3

4.2 Prevalence of Electrolyte Imbalances

Electrolyte disturbances were present in 112 patients (74.7%). Hyponatremia was most common at 41.3% (95% CI: 33.4-49.5), followed by hypokalemia at 36.0% (95% CI: 28.4-44.2), metabolic acidosis at 29.3% (95% CI: 22.0-37.6), and hypochloremia at 26.0% (95% CI: 19.3-34.0). Only 38 patients (25.3%) had normal electrolyte profiles (Figure 1).

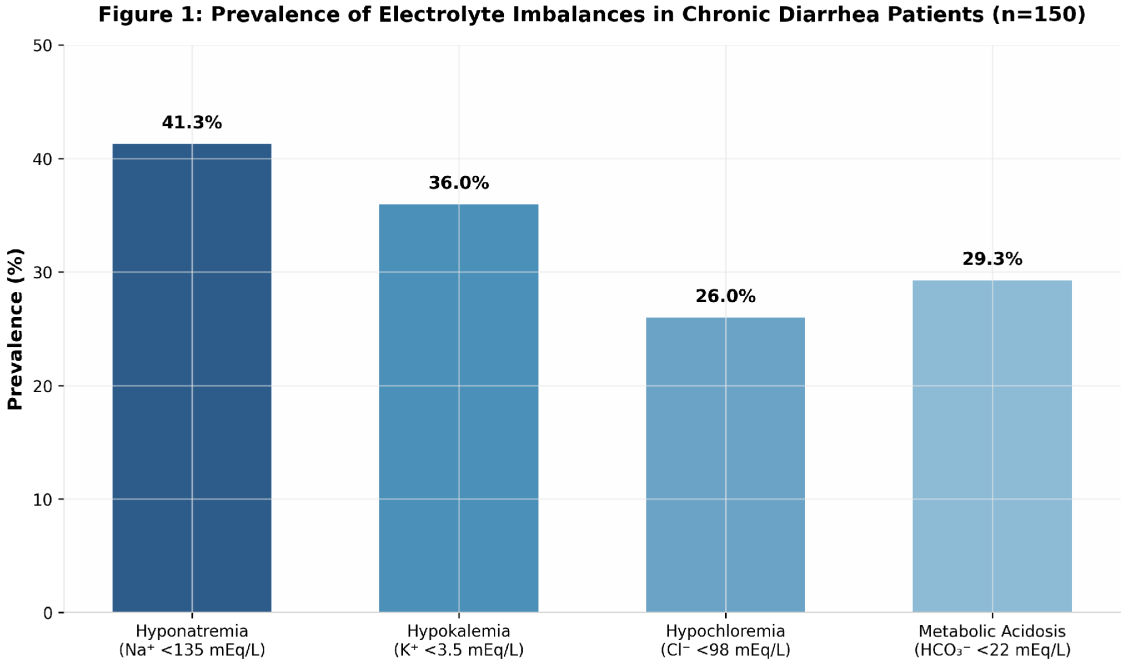

Figure 1: Prevalence of Electrolyte Imbalances in Chronic Diarrhea Patients (n=150

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4.3 Electrolyte Abnormalities by Age Group

Patients aged 46-60 years showed highest rates of hyponatremia (43.8%) and hypokalemia (38.5%). Differences between age groups were not statistically significant ($p > 0.05$), indicating all adult age groups are similarly affected (Table 2, Figure 2).

Age Group	Hyponatremia (%)	Hypokalemia (%)	Metabolic Acidosis (%)
18-30 years	38.5	32.1	26.9
31-45 years	42.1	35.7	30.4
46-60 years	43.8	38.5	32.1
> 60 years	40.0	36.8	28.6
p-value	0.82	0.78	0.89

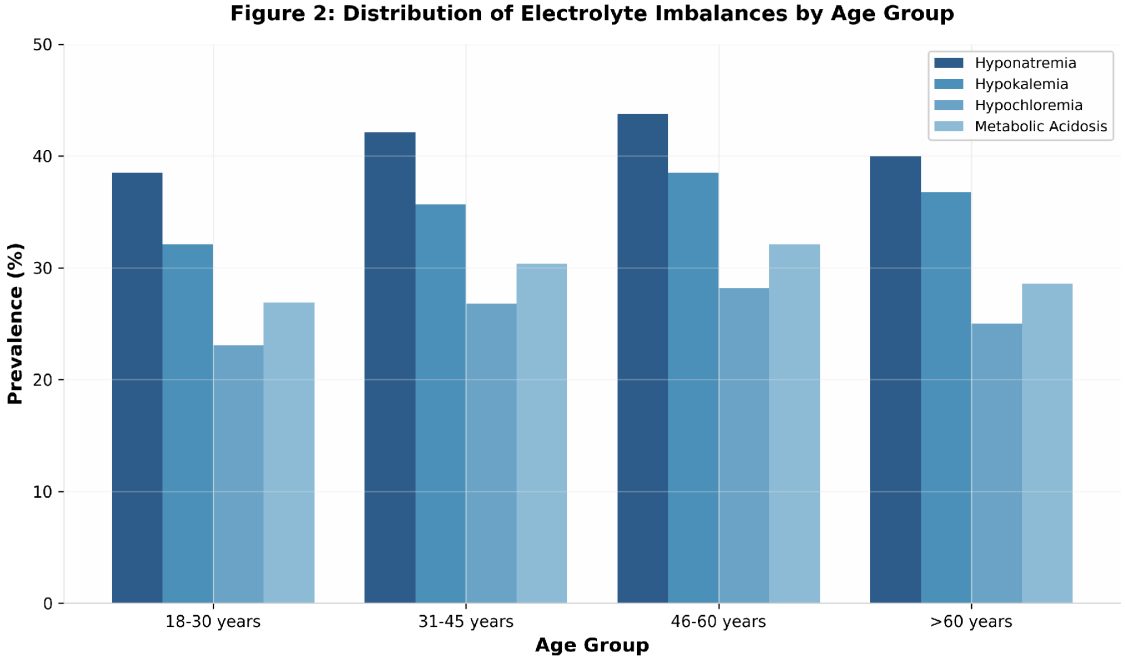

Figure 2: Distribution of Electrolyte Imbalances by Age Group

4.4 Duration of Diarrhea and Electrolyte Disturbances

Significant associations were found between diarrhea duration and electrolyte abnormalities. Patients with symptoms exceeding 30 days showed the highest rates: hyponatremia 52.3%, hypokalemia 44.1%, and metabolic acidosis 38.5%. In contrast, those with symptoms under 7 days showed lower rates: 35.2%, 28.6%, and 22.4% respectively ($p < 0.05$ for all, Table 3, Figure 3).

Duration	Hyponatremia (%)	Hypokalemia (%)	Metabolic Acidosis (%)
< 7 days	35.2	28.6	22.4
7-14 days	42.1	34.5	28.9
15-30 days	48.6	40.2	35.7
> 30 days	52.3	44.1	38.5

Duration	Hyponatremia (%)	Hypokalemia (%)	Metabolic Acidosis (%)
p-value	0.032	0.041	0.028

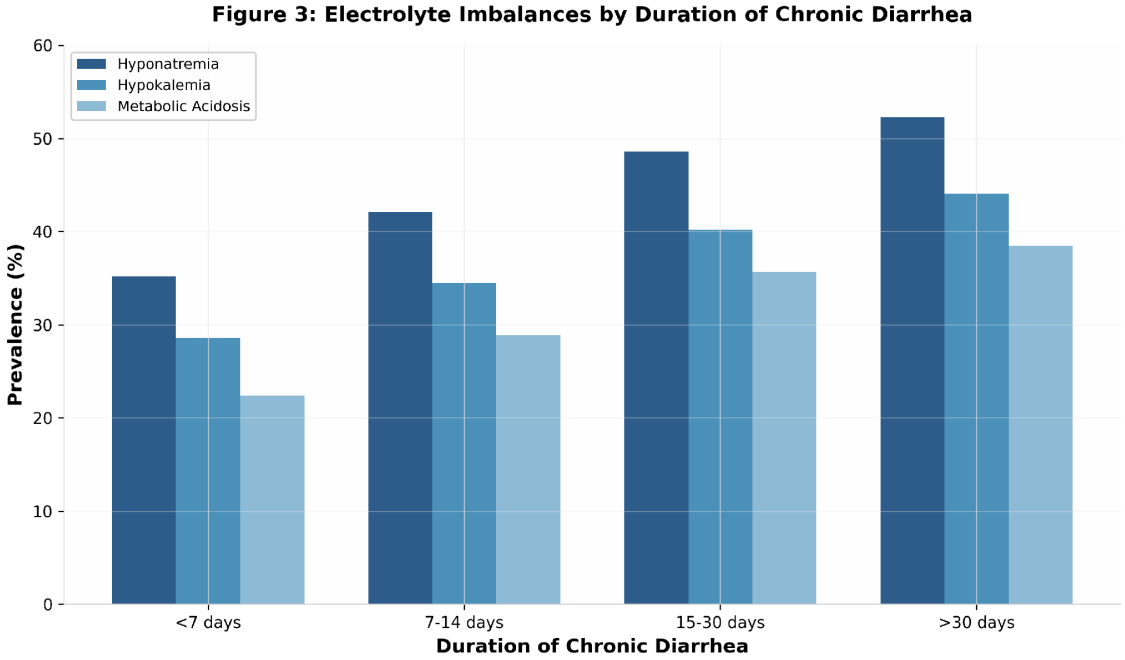

Figure 3: Electrolyte Imbalances by Duration of Chronic Diarrhea

4.5 Gender Distribution and Severity

No significant gender differences were observed. Hyponatremia occurred in 40.5% of males versus 42.4% of females (p=0.82). Hypokalemia was 36.9% in males and 34.8% in females (p=0.78). Among hyponatremic patients, 42.0% had mild (120-134 mmol/L) and 1 had severe (< 120 mmol/L) hyponatremia. For hypokalemia, 21.3% had mild (3.0-3.5 mmol/L) and 14.7% had moderate-to-severe (< 3.0 mmol/L) deficiency.

V. Discussion

The present study reveals a strikingly high prevalence of electrolyte disturbances among adult patients with chronic diarrhea, with nearly three-quarters exhibiting at least one abnormality. Hyponatremia emerged as the most frequent disturbance at 41.3%, closely followed by hypokalemia at 36.0%. These findings align with previous research documenting electrolyte complications in diarrheal diseases while providing novel insights specific to the adult chronic diarrhea population.

The predominance of hyponatremia is consistent with Soleimani et al. who reported 67.8% prevalence in severe acute diarrhea in Tehran, and Khan et al. who found 41.3% in adult emergency department patients. The lower prevalence compared to Soleimani's acute diarrhea cohort may reflect differences in disease severity and gradual physiological adaptation in chronic presentations. Regional studies from Pakistan and Nepal have documented similar hyponatremia rates ranging from 45% to 67.8%.

The mechanisms underlying electrolyte loss depend on diarrhea etiology and anatomical site. Secretory diarrheas involve active chloride secretion and sodium absorption inhibition, with stool sodium reaching 130 mmol/L in severe cholera. Inflammatory diarrheas combine impaired absorption with mucosal damage. The

significant association between duration and electrolyte severity reflects cumulative losses overwhelming renal compensatory capacity, coupled with reduced oral intake in chronic illness.

Our hypokalemia prevalence (36.0%) aligns with adult studies and pediatric reports of 23-60%. The lack of gender differences contrasts with some pediatric series suggesting male predominance, possibly reflecting equalized vulnerability in adulthood. Metabolic acidosis at 29.3% falls within the reported 21-56% range, with variation attributable to differences in diarrhea etiology.

These findings support routine electrolyte screening in all chronic diarrhea patients, as selective testing based on clinical impression would miss significant numbers of affected individuals given the 74.7% abnormality rate. Patients with symptoms exceeding 30 days warrant particularly careful monitoring, showing hyponatremia rates over 50% and hypokalemia above 44%. Current guidelines should emphasize serial monitoring throughout illness rather than single admission values.

Study limitations include the cross-sectional design precluding causal determination, single-center setting potentially limiting generalizability, lack of systematic etiology characterization, and exclusion of comorbid patients possibly underestimating true prevalence. Future research should prospectively evaluate systematic electrolyte monitoring impact on outcomes and examine cost-effectiveness of routine versus selective testing.

VI. Conclusion

This study demonstrates that electrolyte imbalances are exceedingly common among adult patients with chronic diarrhea, affecting nearly three out of four individuals. Hyponatremia and hypokalemia represent the most prevalent abnormalities, with significant increases observed in patients with prolonged symptom duration. These findings underscore the critical importance of routine electrolyte assessment and vigilant monitoring, particularly for patients with symptoms persisting beyond several weeks. Timely recognition and appropriate correction can prevent serious complications and improve clinical outcomes. These results provide evidence-based support for integrating comprehensive electrolyte evaluation into standard care protocols for chronic diarrhea management.

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