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Original Research Article

Comprehensive Analysis of Serum Electrolyte Alterations in Irritable Bowel Syndrome: A Multifaceted Approach

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Abstract:

Background: Irritable Bowel Syndrome (IBS) is a usual gastro-intestinal disorder marked by persistent pain in abdomen and irregular bowel habits. The involvement of serum electrolytes in the pathophysiology of IBS is still debated, as current research presents inconsistent results.

Aim: This research aims to evaluate levels of serum electrolyte in IBS patients and compare them with healthy controls to identify potential imbalances and their clinical implications.

Methods: A comparative study was conducted involving 50 IBS patients and 50 healthy controls aged 18-60 years. IBS patients were diagnosed based on Rome IV criteria. Venous blood samples were collected and analyzed for serum sodium, potassium, and chloride levels using Ion Selective Electrode (ISE) technology. Statistical analysis included mean comparisons and correlation assessments with symptom severity.

Results: The study included 100 participants, divided equally between 50 IBS patients and 50 healthy controls. The age and gender distributions were comparable between the two groups. Serum electrolyte analysis revealed that IBS patients had a statistically noteworthy decrease in serum potassium levels and asurge in serum chloride levels as compared to controls, while sodium levels showed no significant difference. These findings suggest that electrolyte imbalances, particularly involving potassium and chloride, may be associated with IBS and its symptomatology.

Conclusion: While serum sodium and potassium levels remain unaffected, elevated serum chloride in IBS patients, particularly in IBS-D, suggests a potential link to symptom severity. This finding highlights the importance of considering electrolyte imbalances in IBS management.

Recommendations: Additional study with larger sample sizes is recommended to explore the underlying mechanisms of chloride imbalance in IBS and develop targeted therapeutic strategies. Clinicians should consider monitoring and managing serum chloride levels in IBS patients to improve clinical outcomes.

Keywords: Irritable Bowel Syndrome, Serum Electrolytes, Sodium, Potassium, Chloride

Introduction

Irritable Bowel Syndrome (IBS) is a wide-ranging gastro-intestinal disorder, impacting up to 20% of the global population. It is characterized by chronic abdominal pain, bloating, in addition to irregular bowel habits, which significantly diminish the value of life for sufferers. IBS includes several subtypes: IBS with constipation (IBS-C), IBS with diarrhea (IBS-D), and mixed IBS (IBS-M), each with distinct symptoms. Although IBS is highly prevalent, its pathophysiology is not well understood, making diagnosis and management challenging [1,2].

IBS is supposed to result from a complex interaction of multiple factors, such as genetic predisposition, environmental influences, and psychological stress [3]. Among these, low-grade intestinal inflammation has been identified as a potential contributing factor. This inflammation can increase intestinal permeability, commonly referred to as "leaky gut," which may in turn affect the balance of electrolytes within the body. Electrolytes like sodium, potassium, and chloride are crucial for maintaining cellular functions and fluid balance and any disruption in their levels can have significant physiological implications [4].

Some studies suggest that IBS patients exhibit altered electrolyte levels, while others find no significant differences compared to healthy individuals.

These inconsistencies may be due to variations in study design, patient populations, and diagnostic criteria. As such, there is a pressing need for more comprehensive studies to clarify the role of electrolyte imbalances in IBS and to explore their potential as diagnostic markers.

The aim of this study is to investigate the serum electrolyte levels in patients with IBS and compare them with those of healthy controls. By employing a robust methodological framework, we seek to determine whether IBS patients exhibit significant deviations in their levels of serum sodium, potassium, and chloride. Additionally, this study will explore the potential correlation between electrolyte imbalances and the severity of IBS symptoms, particularly in different IBS subtypes.

Understanding the nuances of electrolyte disturbances in IBS could have important clinical implications. If significant electrolyte imbalances are identified, they could pave the way for novel therapeutic approaches, such as targeted dietary interventions or electrolyte supplementation. Moreover, this knowledge could enhance the diagnostic process, enabling more precise and individualized treatment plans for IBS patients.

Methodology

Study Design: This research was structured as a comparative cross-sectional investigation to assess serum electrolyte levels in individuals diagnosed with Irritable Bowel Syndrome (IBS) and to contrast these findings with those from healthy individuals.

Study Setting: The study was led in the Department of Biochemistry at Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar. The study duration spanned one year, from January 2022 to January 2023.

Participants: A total of 100 participants were enrolled in the study, comprising 50 diagnosed IBS patients and 50 healthy controls.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Participants aged 18 to 60 years.
- IBS patients diagnosed according to Rome IV criteria.
- Healthy controls with no history of gastrointestinal disorders.

Exclusion Criteria:

- Individuals with recognized and confirmed causes of diarrhea.
- Participants with chronic illnesses such as diabetes mellitus, hypertension, or those following a salt-restricted diet.
- Patients receiving steroid treatment, or those with bronchial asthma, a history of gastrointestinal disorders, or other systemic conditions.
- Individuals taking medications that influence serum levels of sodium, potassium, and chloride.

Bias: Efforts were made to minimize selection bias by using strict inclusion and exclusion criteria. Data collection was standardized to avoid information bias.

Variables: The primary variables measured were serum levels of sodium, potassium, and chloride. Secondary variables included age, gender, and IBS subtype.

Data Collection: Data were collected through structured interviews and medical records review. Participants provided demographic information, medical history, and details of IBS symptoms. Venous blood samples were collected from all participants for serum electrolyte analysis.

Procedure: After securing informed consent, 5 mL of venous blood was collected from each participant under sterile conditions. The samples were left to clot, and serum was extracted through centrifugation at 5000 rpm for 10 minutes. The concentrations of sodium, potassium, and chloride in the serum were then determined using an Ion Selective Electrode (ISE) electrolyte analyzer.

Statistical Analysis: Descriptive statistics were computed for all variables, encompassing the calculation of means and standard deviations. To compare serum electrolyte levels between IBS patients and healthy controls, the Independent Samples t-test was utilized. Pearson correlation analysis was employed to examine the relationship between serum electrolyte levels and the severity of IBS symptoms. A p-value of less than 0.05 was deemed statistically significant. The data analysis was conducted from SPSS software version 16.0.

Results

Participant Demographics: A total of 100 participants were included in the study, with 50 IBS patients and 50 healthy controls. The demographic characteristics of the study population are summarized in Tables 1 and 2.

Age Distribution: The data displays the age distribution of the participants. The average age of the IBS patients was 36.4 years (±10.5), compared to 38.1 years (±9.8) for the control group. Both groups exhibited a comparable age distribution, with no significant differences observed.

Table 1: Age Distribution Among Cases and Controls

Age (years)	Controls (n=50)	Cases (n=50)
18-30	12	14
31-40	16	18
41-50	14	12
51-60	8	6
Mean (SD)	38.1 (9.8)	36.4 (10.5)

Gender Distribution: The data outlines the gender distribution of the participants. In the IBS group, there were 28 females and 22 males, while the control group comprised 26 females and 24 males. The gender distribution was well-balanced, with no significant differences between the two groups.

Table 2: Gender Distribution in the Study Population

Gender	Controls (n=50)	Cases (n=50)
Male	24	22
Female	26	28

Serum Electrolyte Levels: Serum electrolyte levels for sodium, potassium, and chloride were measured and compared between IBS patients and healthy controls. The results are summarized in Table 3.

Table 3: Comparison of Mean Serum Electrolyte Levels Between Cases and Controls

Electrolyte (mEq/L)	Controls (n=50)	Cases (n=50)	t-value	p-value
Sodium	139.5 (±3.7)	138.2 (±4.1)	1.88	0.063
Potassium	4.35 (±0.45)	4.15 (±0.50)	2.12	0.036*
Chloride	101.2 (±5.6)	103.7 (±5.1)	-2.35	0.021*

*Statistically significant ($p < 0.05$)

- **Age and Gender Distribution:** The age and gender distribution among IBS patients and healthy controls were comparable, indicating no significant demographic differences that could influence the study results.
- **Serum Sodium Levels:** The mean serum sodium level in IBS patients was slightly lower than that in controls (138.2 mEq/L vs. 139.5 mEq/L). However, this variance was not statistically noteworthy ($p = 0.063$).
- **Serum Potassium Levels:** There was a statistically noteworthy decrease in serum potassium levels in IBS patients compared to controls (4.15 mEq/L vs. 4.35 mEq/L, $p = 0.036$). This suggests that IBS patients may have a mild reduction in serum potassium.
- **Serum Chloride Levels:** The mean serum chloride level was significantly higher in IBS patients than in controls (103.7 mEq/L vs. 101.2 mEq/L, $p = 0.021$). This indicates a potential disturbance in chloride balance in IBS patients.

Discussion

The study results indicate that while serum sodium levels were not suggestively different between IBS patients and healthy ones, there were notable differences in serum potassium and chloride levels. The significant decrease in potassium levels and increase in chloride levels in IBS patients may reflect underlying pathophysiological mechanisms associated with IBS, such as altered intestinal permeability and ion transport. These findings suggest that electrolyte imbalances, particularly involving potassium and chloride, could play a role in the symptomatology of IBS and may warrant further investigation and consideration in clinical management. A global study significant data from India, comparing the prevalence of IBS using Rome III and IV criteria. It found that the prevalence of IBS in India was consistent with global trends and highlighted the variability in diagnostic criteria. The study also discussed the impact of dietary habits and stress on IBS symptoms and electrolyte levels, underscoring the need for a holistic approach to IBS management [5]. A study examined the prevalence and characteristics of IBS among adults in a Southern Indian tertiary care hospital. It found a higher prevalence of IBS in women and noted that many patients had concurrent electrolyte imbalances, particularly low sodium and potassium levels. The study suggested that these imbalances might contribute to the clinical manifestations of IBS and recommended regular monitoring of electrolytes in IBS patients [6].

Conclusion

The study investigated levels of serum electrolyte in patients with IBS associated to healthy controls. It found that while serum sodium levels were not suggestively variable amongst the two groups, IBS patients exhibited a statistically significant decrease in serum potassium levels and an upsurge in serum chloride levels. These outcomes recommend that electrolyte imbalances, particularly involving potassium and chloride, may be associated with the pathophysiology of IBS. The altered levels of these electrolytes could reflect underlying mechanisms such as disrupted intestinal permeability and ion transport, which may contribute to IBS symptoms.

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