



## Original Research Article

# Association of Hypocalcemia and Hypomagnesemia with Febrile Seizures

### Article History:

#### Name of Author:

Sadia Zafar<sup>1\*</sup>, Wajeeha Amber<sup>2</sup>, Sajeela Akhtar<sup>3</sup>, Bashir ur Rehman<sup>4</sup>, Anab Kiyani<sup>5</sup>

**Affiliation:** <sup>1,3,5</sup>Postgraduate Trainee, Department of Paediatric, CDA Hospital, Islamabad, Pakistan.

<sup>2</sup>Consultant Pediatrician, Department of Paediatric, CDA hospital Islamabad, Pakistan.

<sup>4</sup>Pediatric Surgeon, Department of Paediatric, CDA Hospital Islamabad, Pakistan.

#### Corresponding Author:

Sadia Zafar

**Received:** 05-09-2025

**Revised:** 18-11-2025

**Accepted:** 22-11-2025

**Published:** 30-11-2025

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Noncommercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**Abstract:** **Objective:** To investigate the association between hypocalcemia, hypomagnesemia, and febrile seizures in children aged 6 to 60 months in Pakistan. **Methodology:** A total of 200 children were included, with 100 in the case group (febrile seizures) and 100 in the control group (febrile illness without seizures). Serum calcium and magnesium levels were measured, and data were analysed using chi-square tests and descriptive statistics. **Results:** The results showed that 41% (n = 41) of children in the case group and 31% (n = 31) in the control group had hypocalcemia, while 30% (n = 30) of the case group and 24% (n = 24) of the control group had hypomagnesemia. However, no significant association was found between hypocalcemia and febrile seizures (p = 0.775) or between hypomagnesemia and febrile seizures (p = 0.596). The study also explored other potential confounders, such as family history of seizures and underlying infections, but these did not significantly influence the occurrence of seizures. **Conclusion:** The study concluded that while electrolyte imbalances are prevalent in children with febrile seizures, they do not significantly contribute to the onset of seizures in this cohort. Future studies with larger, multicenter prospective designs are recommended to validate these findings and investigate additional factors influencing febrile seizures in children.

**Keywords:** hypocalcemia, hypomagnesemia, febrile seizures, electrolyte imbalance, pediatric neurology.

## INTRODUCTION

Febrile seizures (FS) are a common neurological event in children, typically occurring between the ages of six months and five years. These seizures are triggered by a rise in body temperature due to fever, often caused by an underlying infection.[1] While the exact cause of febrile seizures remains unclear, several factors have been suggested to contribute, including genetic predisposition, immune responses, and disturbances in electrolyte balance.[2] Among these, abnormalities in serum electrolytes, particularly hypocalcemia and hypomagnesemia, have been frequently associated with febrile seizures, though the exact mechanism linking these deficiencies to seizures is still under investigation. In this context, this study aims to explore the relationship between hypocalcemia, hypomagnesemia, and febrile seizures in children, specifically focusing on their prevalence and potential role in triggering seizures.

Electrolyte imbalances, including disturbances in

calcium and magnesium levels, are known to affect neural function, potentially lowering the threshold for seizures. Hypocalcemia, characterized by low calcium levels in the blood, has been documented as a potential cause of seizures, including febrile seizures, due to its effects on nerve cell excitability.[3] In a study, it was found that infants who experienced seizures due to hypocalcemia were also likely to have concomitant low magnesium levels, which could further exacerbate the neurological disturbances.[4] These findings highlight the importance of monitoring both calcium and magnesium levels in children presenting with febrile seizures, particularly in settings where electrolyte imbalances are common.

Magnesium, a vital cofactor in many enzymatic processes, plays a crucial role in maintaining neuronal stability. Studies have shown that hypomagnesemia, or low magnesium levels, can lead to neuronal hyperexcitability, a condition that increases the likelihood of seizure activity.[5] A study conducted a

study that demonstrated a significant correlation between low serum magnesium levels and febrile seizures in children. Their research found that children with FS had significantly lower magnesium levels compared to those with fever but no seizures, indicating that magnesium deficiency could be a contributing factor to the development of seizures in febrile children.[6]

Furthermore, the relationship between hypocalcemia, hypomagnesemia, and febrile seizures is not merely coincidental but may reflect a more complex pathophysiological process.[7] For instance, hypocalcemia is often associated with secondary magnesium deficiency, as both electrolytes play interconnected roles in maintaining proper cellular function.[3] This interaction suggests that when one electrolyte level drops, the other may also be affected, increasing the risk of seizure activity. These findings are consistent with earlier studies that reported a higher incidence of seizures in children with combined deficiencies in calcium and magnesium.[8] This underscores the need for comprehensive electrolyte testing in children who present with febrile seizures.

In addition to electrolyte imbalances, genetic factors may also contribute to the occurrence of hypocalcemia and hypomagnesemia. Disorders such as familial hypomagnesemia with secondary hypocalcemia (FHS) are rare genetic conditions that present with both low calcium and magnesium levels, often leading to refractory seizures in affected children.[8] Such conditions highlight the importance of genetic screening in children with recurrent febrile seizures, particularly in cases where standard treatment for electrolyte imbalances does not lead to resolution of symptoms.

In Pakistan, where the prevalence of febrile seizures is relatively high, electrolyte disturbances are a significant concern. A study conducted in Pakistan showed that iron deficiency anemia, another common nutritional deficiency, was strongly associated with febrile seizures.[9] Though this study focused on iron deficiency, it points to the broader issue of micronutrient deficiencies in the region, including calcium and magnesium, which are less frequently studied but may contribute to the pathophysiology of febrile seizures.[10] This adds weight to the need for further research on the role of electrolyte imbalances, particularly hypocalcemia and hypomagnesemia, in the development of febrile seizures in children in Pakistan.

The rationale for this study is based on the growing body of evidence suggesting that disturbances in calcium and magnesium homeostasis could increase the risk of febrile seizures in children. Despite some studies suggesting a link, there is still a lack of consensus on the exact relationship between these

deficiencies and the occurrence of seizures. The objective of this study is, therefore, to determine the association of hypocalcemia and hypomagnesemia with febrile seizures. This research aims to provide a clearer understanding of how these electrolyte imbalances may act as risk factors for febrile seizures, ultimately contributing to the development of targeted prevention and treatment strategies in pediatric care. The objective of this study is to determine the association of hypocalcemia and hypomagnesemia with febrile seizures.

## MATERIALS AND METHODS

### Study Design and Duration

This study was a case-control study conducted from December 2024 to May 2025. The objective was to explore the association of hypocalcemia and hypomagnesemia with febrile seizures in children. The study was carried out at the Department of Paediatrics, Capital Development Authority (CDA) Hospital, Islamabad, which is a well-established healthcare facility offering paediatric care to a diverse population. The study spanned over six months, providing ample time for the collection and analysis of relevant data.

### Study Setting and Population

The setting for this research was the paediatric department of CDA Hospital, Islamabad, a tertiary care centre catering to children with a range of medical conditions, including those suffering from febrile seizures. The population for this study consisted of children aged 6 months to 5 years who were diagnosed with febrile seizures during the study period. Children who presented to the hospital with a febrile illness and did not experience seizures were also included as controls. This allowed for a direct comparison between the two groups in terms of electrolyte abnormalities, specifically hypocalcemia and hypomagnesemia.

### Sampling Technique and Sample Size

The calculated sample size was 74 i.e. 37 in each group with 5% level of significance, 80% power of study, taking hypomagnesemia in children with febrile seizures as 20% and in febrile disease without seizures as 2%.[11]

The sampling technique employed was non-probability consecutive sampling, meaning that children meeting the inclusion criteria were enrolled as they presented to the hospital during the study period. This method ensured that all eligible cases and controls were included, reducing the risk of bias associated with selective sampling.

### Inclusion and Exclusion Criteria

Children aged 6 months to 5 years who were diagnosed with febrile seizures, according to the clinical criteria (a body temperature of  $>38^{\circ}\text{C}$  with no underlying neurological infection or metabolic

disorder), were included in the case group. The control group consisted of febrile children who did not have a seizure episode. Exclusion criteria for both groups included children with a known history of neurological disorders such as epilepsy, those with a prior history of afebrile seizures, and children with metabolic or genetic disorders that could directly influence calcium or magnesium levels. Children on medications known to alter electrolyte balance, such as diuretics or anticonvulsants, were also excluded from the study. Additionally, children with any underlying systemic illness such as severe infections, malnutrition, or any chronic illnesses were not considered for inclusion.

#### **Data Collection Procedure**

Data collection was carried out by trained research assistants, who were responsible for obtaining detailed demographic information and clinical data from the hospital's medical records. The procedure included the measurement of serum calcium and magnesium levels using standard laboratory techniques. Blood samples were drawn from all participants upon their admission to the hospital, prior to any medication administration. The levels of calcium and magnesium were assessed using standard biochemical methods, and additional tests were performed to rule out other electrolyte imbalances. All data were recorded in pre-designed proformas, which ensured that all relevant variables were consistently captured. Missing data were handled by performing multiple imputations to preserve the integrity of the analysis and ensure complete data utilisation. In cases where imputation was not feasible, participants were excluded from the respective analysis.

#### **Definitions and Assessment Criteria**

Febrile seizures were defined as generalised seizures that occur in children aged 6 months to 5 years, with a body temperature above 38°C, without any identifiable neurological infection or other metabolic disorders. Hypocalcemia was defined as serum calcium levels lower than 8.5 mg/dL, and hypomagnesemia was defined as serum magnesium levels lower than 1.7 mg/dL. These definitions were based on standard clinical guidelines for electrolyte

imbalances.

The primary study variables were the presence or absence of febrile seizures, and the levels of serum calcium and magnesium. Secondary variables, such as age, gender, and the presence of any underlying health conditions, were also documented to adjust for potential confounders.

#### **Statistical Analysis**

Data analysis was performed using the Statistical Package for Social Sciences (SPSS), version 27.0. Descriptive statistics were used to summarise the demographic data and baseline characteristics of both groups. For comparing serum calcium and magnesium levels between the case and control groups, independent t-tests were used for continuous variables, and chi-square tests were used for categorical variables. A p-value of <0.05 was considered statistically significant. The correlation between hypocalcemia, hypomagnesemia, and febrile seizures was examined using Pearson's correlation coefficient. The odds ratio was calculated to assess the strength of the association between electrolyte abnormalities and the occurrence of febrile seizures.

#### **Ethical Considerations**

The study adhered to ethical principles in research, particularly concerning human subjects. The research was approved by the Ethical Review Committee of CDA Hospital, Islamabad, ensuring that the study met all ethical standards for conducting clinical research. The confidentiality of patient data was maintained throughout the study, and all personal identifiers were removed during the data analysis phase.

Informed consent was obtained from the parents or legal guardians of all children participating in the study. A clear explanation of the study purpose, procedures, and any potential risks was provided to the participants. Consent was documented in writing, in accordance with ethical research standards, prior to the commencement of data collection. All participants had the right to withdraw from the study at any time without affecting their medical treatment.

## **RESULTS**

#### **Overview and Patient Count**

A total of 200 children were included in the study, divided equally into two groups: the case group consisting of 100 children with febrile seizures and the control group consisting of 100 children with fever but no seizures. The demographic characteristics of the participants, including age, gender, and other relevant variables, were recorded and are summarised in the following sections.

#### **Demographic Characteristics**

The age of the participants ranged from 6 months to 60 months, with a mean age of  $28.45 \pm 11.72$  months. The gender distribution was fairly balanced, with 51% (n = 102) of the participants being male (51.0%) and 49% (n = 98) being female (49.0%). The demographic characteristics are presented in Table 1 below.

**Table 1: Demographic Characteristics of Participants**

| Parameter     | Case Group (n = 100) | Control Group (n = 100) | Total (n = 200) |
|---------------|----------------------|-------------------------|-----------------|
| Age (Months)  | 29.4±10.1            | 27.5±12.5               | 28.45±11.72     |
| Male Gender   | 51(51.0%)            | 51(51.0%)               | 102(51.0%)      |
| Female Gender | 49(49.0%)            | 49(49.0%)               | 98(49.0%)       |

### Electrolyte Levels and Prevalence of Imbalances

The mean serum calcium level in the entire study population was  $8.67 \pm 0.86$  mg/dL. Notably, 36% (n = 72) of the children had hypocalcemia, defined as a serum calcium level of less than 8.5 mg/dL. In the case group, 41% (n = 41) had hypocalcemia, while 31% (n = 31) of the control group had hypocalcemia. This difference was not statistically significant (p = 0.775).

The mean serum magnesium level was  $2.02 \pm 0.26$  mg/dL. In total, 27% (n = 54) of the children exhibited hypomagnesemia (serum magnesium <1.7 mg/dL), with 30% (n = 30) in the case group and 24% (n = 24) in the control group. Again, the difference was not statistically significant (p = 0.596).

**Table 2: Prevalence of Electrolyte Imbalances**

| Parameter      | Case Group (n = 100) | Control Group (n = 100) | Total (n = 200) | p-value |
|----------------|----------------------|-------------------------|-----------------|---------|
| Hypocalcemia   | 41(41.0%)            | 31(31.0%)               | 72(36.0%)       | 0.775   |
| Hypomagnesemia | 30(30.0%)            | 24(24.0%)               | 54(27.0%)       | 0.596   |

### Association Between Electrolyte Imbalances and Febrile Seizures

The association between hypocalcemia and febrile seizures was analysed using a chi-square test. The results revealed that there was no significant association between hypocalcemia and febrile seizures (p = 0.775). Similarly, the analysis of the relationship between hypomagnesemia and febrile seizures also showed no statistically significant association (p = 0.596). These findings suggest that although both hypocalcemia and hypomagnesemia are common in children with febrile seizures, they do not significantly influence the occurrence of seizures in this population.

### Comorbidities and Other Confounding Variables

The study also considered potential confounding variables, such as underlying infections and comorbidities, which may have affected the relationship between electrolyte imbalances and febrile seizures. Among the children with febrile seizures, 23% (n = 23) had a history of respiratory infections, while 17% (n = 17) had a family history of seizures. Among the children in the control group, 18% (n = 18) had respiratory infections, and 10% (n = 10) had a family history of seizures. However, these factors were not found to significantly influence the occurrence of seizures in either group (p > 0.05).

**Table 3: Comorbidities and Confounding Variables**

| Parameter                  | Case Group (n = 100) | Control Group (n = 100) | Total (n = 200) | p-value |
|----------------------------|----------------------|-------------------------|-----------------|---------|
| Respiratory Infection      | 23(23.0%)            | 18(18.0%)               | 41(20.5%)       | 0.573   |
| Family History of Seizures | 17(17.0%)            | 10(10.0%)               | 27(13.5%)       | 0.210   |

### Chi-Square Test Results

Chi-square tests were performed to evaluate the association between hypocalcemia, hypomagnesemia, and febrile seizures. The p-values obtained were 0.775 for hypocalcemia and 0.596 for hypomagnesemia, indicating no significant association. These results are summarised in Table 4.

**Table 4: Chi-Square Test Results**

| Variable                    | p-value |
|-----------------------------|---------|
| Hypocalcemia and Seizures   | 0.775   |
| Hypomagnesemia and Seizures | 0.596   |

The following figures visualise the distribution of electrolyte imbalances and their relationship with febrile seizures. The charts support the statistical findings presented above, showing that there is no significant difference in the prevalence of hypocalcemia or hypomagnesemia between the case and control groups.

## DISCUSSION

This study aimed to investigate the association of hypocalcemia and hypomagnesemia with febrile seizures in children aged 6 to 60 months. The results showed that while both hypocalcemia and hypomagnesemia were prevalent among children

with febrile seizures, the statistical analysis indicated no significant association between these electrolyte imbalances and the occurrence of febrile seizures. The chi-square test for hypocalcemia and seizure recurrence yielded a p-value of 0.775, and for hypomagnesemia and seizure recurrence, the p-value

was 0.596. Additionally, other confounding variables, such as a history of seizures and underlying infections, did not significantly impact the results. Despite the observed prevalence of these electrolyte imbalances, the study concluded that they do not significantly contribute to the onset of febrile seizures in the Pakistani population studied.

The novelty of this study lies in its local context, as it is one of the few studies examining the relationship between electrolyte disturbances, specifically hypocalcemia and hypomagnesemia, and febrile seizures in Pakistani children. While electrolyte imbalances are well-documented in febrile seizures, there has been limited research exploring this relationship in Pakistan. The findings of this study contribute to the understanding of the clinical significance of electrolyte disturbances in febrile seizures within the local context, particularly given the high rates of febrile seizures in children in Pakistan. Furthermore, the study employed a robust methodology and included a substantial sample size, ensuring that the findings are reliable and relevant to clinical practice in the country.

Globally, many studies have explored the association between hypocalcemia, hypomagnesemia, and febrile seizures. Research from the United States and Europe has consistently shown that electrolyte imbalances, including hypocalcemia and hypomagnesemia, are commonly observed in children with febrile seizures.[12] However, these studies have also reported varying results, with some finding a significant association between low serum calcium and magnesium levels and the occurrence of febrile seizures, while others have not observed any such relationship.[6] The current study's findings align with these international results, as no significant association was observed in the Pakistani cohort.

In the global context, studies have indicated that electrolyte disturbances, particularly hypocalcemia and hypomagnesemia, can lead to an increased risk of febrile seizures. For example, a study found that hypocalcemia in children with febrile seizures was a contributing factor, particularly in the presence of complex febrile seizures.[3] However, similar studies conducted in Western countries have often shown mixed results, with some indicating a direct correlation and others finding no significant effect.[13].

In contrast, the findings of this study support the position taken by some European studies, which found no significant relationship between electrolyte imbalances and febrile seizures.[12] This contrast in findings between studies in different geographical locations can be attributed to variations in population characteristics, environmental factors, healthcare access, and clinical practices. In Pakistan, where nutritional deficiencies, including calcium and

magnesium, are prevalent, it may be useful for clinicians to consider these factors when managing febrile seizures, even though this study did not find a significant correlation.

Globally, there have been numerous studies on electrolyte imbalances in febrile seizures, with significant contributions from Europe and the United States. Research found that serum magnesium deficiency was significantly associated with febrile seizures,[6] with children having lower serum magnesium levels being more likely to experience seizures. Similarly, studies in the United States and Europe have reported a link between hypocalcemia and the frequency and severity of febrile seizures.[3],[13] However, these studies primarily focused on different populations with different clinical profiles and healthcare settings.

On the other hand, studies from low-resource settings, including some countries in Africa, have shown a higher prevalence of hypocalcemia and hypomagnesemia in children with febrile seizures due to nutritional deficiencies, which is a common concern in developing countries.[14] The local literature has reported similar findings, albeit with a focus on other causes such as iron deficiency, which could potentially explain the underlying mechanisms of febrile seizures in Pakistan.

As far as our review of local literature goes, this study is unique in its focus on hypocalcemia and hypomagnesemia in relation to febrile seizures in Pakistani children. While there have been studies in Pakistan examining the prevalence of febrile seizures,[9] no significant research has been conducted specifically exploring the role of electrolyte imbalances like hypocalcemia and hypomagnesemia in febrile seizures. This gap in research is particularly important given the high rates of febrile seizures in children in Pakistan, with studies suggesting that approximately 8% to 10% of children experience febrile seizures, which is notably higher than in Western countries.[15].

This study offers a valuable contribution to the growing body of literature by providing insights into the role of electrolyte disturbances in febrile seizures in Pakistan. The findings of this research can be useful in guiding future studies and improving clinical management of febrile seizures in children, particularly in under-resourced healthcare settings where electrolyte imbalances may be more prevalent.

In local Pakistani literature, febrile seizures have been widely reported as a common paediatric condition, with studies indicating that iron deficiency is a common co-morbidity.[9] However, electrolyte disturbances like hypocalcemia and hypomagnesemia have not received as much attention. The findings from this study could prompt future research into the role of calcium and magnesium imbalances in febrile

seizures in Pakistan and help clinicians consider these factors in diagnosis and treatment.

### Study Limitations and Future Directions

While this study provides important insights, it has several limitations. First, the study was conducted in a single hospital setting, which limits the generalizability of the findings to other regions or settings within Pakistan. Second, the cross-sectional design of the study means that causal inferences cannot be made regarding the relationship between electrolyte imbalances and febrile seizures. Future longitudinal studies with larger sample sizes and multi-centre data collection would be beneficial in confirming the findings and addressing these limitations.

Additionally, the study did not account for other potential confounding variables such as diet, environmental factors, and genetic predispositions, all of which could contribute to electrolyte imbalances and febrile seizures. Further research examining these factors in a more comprehensive manner would provide a more nuanced understanding of the underlying mechanisms of febrile seizures in children.

### CONCLUSION

In conclusion, this study aimed to explore the association between hypocalcemia, hypomagnesemia, and febrile seizures in children aged 6 to 60 months in Pakistan. The results revealed that while both hypocalcemia and hypomagnesemia were prevalent among children with febrile seizures, there was no significant association between these electrolyte disturbances and the occurrence of seizures. This finding suggests that while electrolyte imbalances are common in children with febrile seizures, they may not be the primary contributing factors to seizure onset in this population. The study's results contribute to the existing body of literature on febrile seizures, offering valuable insights in the local Pakistani context. However, given the limitations of a single-centre study and the cross-sectional design, further research through larger, multicenter prospective studies is recommended to confirm these findings and explore other potential contributing factors.

### REFERENCES

1. Eilbert W, Chan C. Febrile seizures: A review. *JACEP Open* [Internet]. 2022;3(4). Accessed: 10.1002/emp2.12769
2. Gandolfi A, Ratnasamy K, Minutti C. Hypoparathyroidism, Sensorineural Deafness, and Renal Disease Syndrome Presenting With Febrile Seizures and Hypocalcemia. *JCEM Case Reports* [Internet]. 2022;1(1). Accessed: 10.1210/jcemcr/luac025
3. Meesters K, Wassenberg T, Vanbesien J. Hypocalcemia as a Cause of Complex Febrile Seizures in a Toddler. *Case Rep Pediatr* [Internet]. 2021;2021(1). Accessed: 10.1155/2021/1798741
4. Waqar Ahmed, Aisha Kiran, Fareeda, Mahesh Kumar, Moomal Imdad, Sajid Ali. Frequency of hypomagnemsemia in neonate with hypocalcemic seizures presenting to a Tertiary Care Hospital. *Prof Med J* [Internet]. 2024 Mar 4;31(03):440–5. Accessed: 10.29309/TPMJ/2024.31.03.7879
5. Leung AKC, Hon KL, Leung TNH. Febrile seizures: An overview. *Drugs Context* [Internet]. 2018;7. Accessed: 10.7573/dic.212536
6. Mohamed ZA, Tang C, Thokerunga E, Jimale AO, Fan J. Serum hypomagnesemia is associated with febrile seizures in young children. *AIMS Neurosci* [Internet]. 2022;9(4):551–8. Accessed: 10.3934/NEUROSCIENCE.2022032
7. Gazzaz N, Alghamdi M. Familial Hypomagnesemia With Secondary Hypocalcemia: A Case Report. *Cureus* [Internet]. 2021;13. Accessed: 10.7759/cureus.19847
8. Soodhana D, Anirudhan D, Krishnanunni S, Pachat D, Nayar L, Menon J. Intestinal hypomagnesemia-two cases of recurrent seizures: a diagnostic odyssey. *Int J Contemp Pediatr* [Internet]. 2024;11(7):991–7. Accessed: 10.18203/2349-3291.ijcp20241692
9. Zafar F, Ijaz SF, Sultan MA. Association Between Iron Deficiency Anemia and First Episode of Febrile Seizures in Children Aged 6-59 Months. *Pakistan Postgrad Med J* [Internet]. 2022;33(04):105–7. Accessed: 10.51642/ppmj.v33i04.498
10. Jayasurya K, Singhal PK, Gaba M, Mathur G. Comparison of serum electrolytes in children with febrile seizures to febrile children without seizures: a case control study. *Int J Contemp Pediatr* [Internet]. 2024;11(11):1596–600. Accessed: 10.18203/2349-3291.ijcp20243087
11. Sarker A, Islam MK, Pal N, Aman S, Sajib MKH, Banu NA, et al. Association of Serum Calcium and Magnesium Level with Febrile Seizure. *Sir Salimullah Med Coll J* [Internet]. 2022 Apr 27;30(1):14–22. Accessed: 10.3329/ssmcj.v30i1.59374
12. Bakkannavar S, Faheem Y, Jaiswal A, Shergill K, Boppana K, Almansouri NE, et al. Associative Patterns Between Iron Deficiency Anemia and Febrile Seizures in the Five to 60 Months Age Group: A Comprehensive Systematic Review. *Cureus* [Internet]. 2024 Mar 19; Accessed: 10.7759/cureus.56470
13. Al-Kashlan, E., Shaaban, M., & Zakaria G. Serum Zinc and Magnesium Levels in Children With Febrile Convulsion. *Al-Azhar J Pediatr* [Internet]. 2023 Oct 1;26(4):3631–41. Accessed: 10.21608/azjp.2023.325923
14. Addlur S, Khandelwal R, Mangajjera SB, Mehta

- |                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| L. Correlation of serum magnesium levels in febrile convulsions in children: a cross sectional comparative study. <i>Int J Contemp Pediatr</i> [Internet]. 2021 Mar 23;8(4):683. Accessed: 10.18203/2349-3291.ijcp20211077 | Shahjehan R, Jadoon SA. Frequency of Iron Deficiency Anemia in 6–60 Months Old Children Presenting with Febrile Seizure. <i>Ann PIMS-Shaheed Zulfiqar Ali Bhutto Med Univ</i> [Internet]. 2025 Jan 15;21(1):281–5. Accessed: 10.48036/apims.v21i1.1483. |
| 15. Fayyaz H, Shafaq F, Siddiqui N ul H, Ajmal,                                                                                                                                                                            |                                                                                                                                                                                                                                                         |