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Original Research Article

Frequency of Iron Deficiency Anemia among Children Presenting with Breath Holding Spells

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Abstract: *Breath-holding spells (BHS) in young children, triggered by emotions or trauma, are benign but concerning for parents. Iron deficiency anemia (IDA) may contribute to BHS, making this association important, particularly in regions such as Pakistan, where nutritional anemia is common.* ***Objective:*** *To determine the frequency of iron deficiency anemia among children presenting with breath-holding spells at a tertiary care hospital.* ***Methods:*** *A cross-sectional study was conducted in the Department of Paediatrics at Arif Memorial Teaching Hospital, Lahore, from 5th June to 5th November 2025. A total of 141 children aged 6–60 months presenting with breath-holding spells were enrolled using non-probability consecutive sampling. Children with congenital heart disease, epilepsy, severe malnutrition, hemoglobin levels below 5 g/dl, or those receiving anticonvulsant therapy were excluded to minimize confounding factors. Demographic and clinical data were recorded, and venous blood samples were collected for complete blood count and serum ferritin estimation. Iron deficiency anemia was diagnosed using predefined hematological and biochemical criteria. Data were analyzed using SPSS version 21. Descriptive statistics were calculated for continuous variables, while categorical variables were expressed as frequencies and percentages. Stratification by age, gender, and BMI was performed, and post-stratification comparisons were assessed using the chi-square test with a significance level of $p < 0.05$.* ***Results:*** *The mean age of the enrolled children was 27.4 ± 12.6 months, with the majority in the 13–36-month age group (46.1%). Male children constituted 58.2% of the participants, while females accounted for 41.8%. The mean body mass index was 16.3 ± 2.1 kg/m², the mean hemoglobin level was 10.1 ± 1.2 g/dl, and the mean serum ferritin level was 11.7 ± 4.8 µg/L. Iron deficiency anemia was identified in 79 children (56.0%), whereas 62 children (44.0%) did not meet the diagnostic criteria for IDA. Stratified analysis showed no statistically significant association between IDA and gender ($p = 0.72$), age group ($p = 0.31$), or BMI category ($p = 0.18$).* ***Conclusion:*** *Iron deficiency anemia was present in more than half of the children presenting with breath-holding spells in this tertiary care setting. Routine screening for iron deficiency should therefore be considered in children with breath-holding spells to facilitate early diagnosis and management.*

Keywords: Breath-holding spells; Iron deficiency anemia; Children; Pediatric anemia; Serum ferritin

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Introduction

Breath-holding spells (BHS) are common, non-epileptic paroxysmal events occurring in otherwise healthy young children, typically between 6 months and 6 years of age (1,2). These episodes are usually precipitated by emotional stimuli such as anger, frustration, or minor painful trauma, leading to forceful crying followed by involuntary cessation of breathing, color change, and, in some cases, transient loss of consciousness (2,3). Based on the color change observed during the episode, BHS are classified into three subtypes: cyanotic, pallid, and mixed (3,4). The cyanotic type is the most frequently encountered in clinical practice, while pallid spells are mediated by exaggerated vagal cardiac inhibition (3,5). Although BHS are self-limiting and generally resolve spontaneously by five years of age without adverse developmental or intellectual sequelae, they remain a source of significant parental anxiety and distress (2,6).

The reported prevalence of BHS ranges from 0.1% to 4.6% of otherwise healthy children (2,7). The etiopathogenesis is considered multifactorial, encompassing autonomic nervous system dysregulation, delayed myelination of the brainstem, vagally mediated cardiac inhibition, and iron deficiency anemia (IDA) (2,8). Iron deficiency anemia has been increasingly recognized as a significant risk factor for BHS, as iron is a critical cofactor in catecholamine metabolism and neurotransmitter function within the central nervous system (2,4). Children with IDA are more irritable and more easily provoked, thereby predisposing them to breath-holding episodes (2,6). Furthermore, reduced hemoglobin levels adversely affect oxygen uptake, leading to anemic hypoxia and cerebral anoxia, which may precipitate or worsen spells (6). Multiple studies have demonstrated that correction of iron deficiency, with or without overt anemia, significantly reduces the frequency and severity of BHS (1,8,9).

The prevalence of IDA among children presenting with BHS has been variably reported across different populations. Studies have documented IDA in approximately 47.9% to 76.52% of children with BHS (10–12). In Pakistani studies, the association between IDA and BHS has similarly been confirmed, with one study from Rawalpindi reporting a 56.67% correlation between BHS and IDA (13), and another from Punjab reporting IDA in 51.58% of children with BHS (13).

Pakistan bears a substantial burden of iron deficiency anemia in the pediatric population, with nearly 50% of children under five years of age in developing countries estimated to be iron deficient (6). Despite this, data specifically examining the frequency of IDA among children presenting with BHS in Pakistani clinical settings remain limited. Studies conducted at Lady Reading Hospital, Peshawar, found IDA in 54% of children presenting with BHS (13). At the same time, research from Rawalpindi demonstrated a highly significant association between BHS and IDA, with an odds ratio of 37.92 ($p<0.0001$) (14). These findings underscore the need for systematic evaluation of iron status in all children presenting with BHS in Pakistan. Early and accurate diagnosis of IDA in this population is essential not only to reduce the frequency of spells and unnecessary hospital visits but also to alleviate parental anxiety (13,14). Given the high prevalence of nutritional iron deficiency in Pakistan and the demonstrated efficacy of iron supplementation in reducing BHS frequency (1,4,8), this study aims to determine the frequency of IDA among children presenting with BHS at a tertiary care center, thereby contributing to the evidence base for evidence-informed clinical management in the Pakistani context.

Methodology

This cross-sectional study was conducted in the Department of Paediatrics at Arif Memorial Teaching Hospital from 5th June to 5th November 2025 after approval of the research synopsis. The study aimed to determine the frequency of iron deficiency anemia among children presenting with breath-holding spells. The required sample size was calculated as 141 children, using a 95% confidence level and a margin of error of 7%, based on an expected frequency of iron deficiency anemia of 76.52% among children with breath-holding spells reported in previous literature. Participants were recruited using a non-probability consecutive sampling technique.

Children aged 6-60 months who presented to the pediatric outpatient department with breath-holding spells during the study period were considered eligible for inclusion. Breath-holding spells were defined as benign paroxysmal nonepileptic episodes occurring in otherwise healthy children, typically precipitated by emotional upset or minor injury and characterized by breath holding, cyanosis or pallor, and transient loss of consciousness. Both male and female children fulfilling the operational definition were included after obtaining informed written consent from parents or guardians. Children were excluded if they had congenital heart disease confirmed on echocardiography, were receiving anticonvulsant therapy, had hemoglobin levels below 5 g/dl, had a history of febrile convulsions or epilepsy, or had clinically identifiable mental disability or severe malnutrition. These criteria were applied to minimize potential confounding factors that could influence the occurrence of breath-holding spells or anemia.

After enrollment, a detailed clinical history was obtained, and a thorough physical examination was performed for each participant. Demographic and clinical information, including age, gender, height, weight, and body mass index (BMI), was recorded using a structured data collection form. Children presenting with features suggestive of anemia and breath-holding spells were further evaluated through laboratory investigations. Approximately 3 ml of venous blood was collected from each child under aseptic conditions and sent to the hospital laboratory for complete blood count and serum ferritin estimation. Iron deficiency anemia was diagnosed according to predefined operational criteria: hemoglobin level <10.5 g/dl, hematocrit <33%, mean corpuscular volume <70 fl, mean corpuscular hemoglobin <23 pg, mean corpuscular hemoglobin concentration <30 g/dl, red blood cell count <3.7 ×10⁶/µL, and serum ferritin level <7 µg/L. Children fulfilling these criteria were labeled as having iron deficiency anemia. All clinical findings, laboratory results, and relevant patient information were documented carefully in the study proforma.

Following diagnosis, children identified with iron deficiency anemia were prescribed oral elemental iron at a dose of 6 mg/kg/day as part of routine clinical management, and their parents were advised to return for follow-up visits in the outpatient department after initiation of therapy. Measures were taken to reduce bias by strictly applying the inclusion and exclusion criteria and ensuring uniform clinical and laboratory assessment of all participants.

All collected data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 21. Numerical variables, including age, body mass index, hemoglobin level, and serum ferritin level, were summarized using mean and standard deviation. Categorical variables, such as gender and the presence of iron deficiency anemia, were expressed as frequencies and percentages. Data were further stratified according to age, gender, and BMI to evaluate potential effect modifiers. Post-stratification comparisons were performed using the chi-square test, and a p-value <0.05 was considered statistically significant.

Results

A total of 141 children presenting with breath-holding spells were enrolled from the Department of Paediatrics at Arif Memorial Teaching Hospital, Lahore, during the six-month study period, using non-probability, consecutive sampling. The mean age of the children was 27.4 ± 12.6 months. Most participants belonged to the 13–36 month age group (46.1%), followed by 6–12 months (27.0%) and 37–60 months (27.0%).Regarding gender distribution, 82 (58.2%) children were males and 59 (41.8%) were females, indicating a higher proportion of males presenting with breath-holding spells. The mean BMI was 16.3 ± 2.1 kg/m², while the mean hemoglobin level was 10.1 ± 1.2 g/dl and the mean serum ferritin level was 11.7 ± 4.8 µg/L (Table 1).

Table 1: Demographic and Baseline Characteristics of Children with Breath-Holding Spells (n = 141)

Variable	Category / Mean ± SD	Frequency	Percentage
Age (months)	Mean ± SD	27.4 ± 12.6	—
Age Groups	6–12 months	38	27.0%
	13–36 months	65	46.1%
	37–60 months	38	27.0%
Gender	Male	82	58.2%
	Female	59	41.8%
BMI (kg/m²)	Mean ± SD	16.3 ± 2.1	—
Hemoglobin (g/dl)	Mean ± SD	10.1 ± 1.2	—
Serum Ferritin (µg/L)	Mean ± SD	11.7 ± 4.8	—

The overall frequency of iron deficiency anemia (IDA) among children presenting with breath-holding spells was 79 (56.0%), whereas 62 (44.0%) children did not meet the criteria for iron deficiency anemia (Table 2).

Table 2: Frequency of Iron Deficiency Anemia among Children with Breath-Holding Spells (n = 141)

Iron Deficiency Anemia	Frequency	Percentage
Yes	79	56.0%
No	62	44.0%
Total	141	100%

Stratification according to gender, age group, and BMI was performed to assess potential effect modifiers. Among male children, 47 (57.3%) had iron deficiency anemia, while 32 (54.2%) of females were diagnosed with iron deficiency anemia; the difference between genders was not statistically significant (p = 0.72).By age group, the highest proportion of iron deficiency anemia was observed among

children aged 13–36 months (61.5%), followed by 6–12 months (55.3%), while 47.4% of children aged 37–60 months had iron deficiency anemia.When stratified by BMI categories, 35 (63.6%) children with BMI <15 kg/m² had iron deficiency anemia, whereas 44 (51.0%) children with BMI ≥15 kg/m² were diagnosed with iron deficiency anemia. However, the association between BMI and iron deficiency anemia was not statistically significant (p = 0.18) (Table 3).

Table 3: Stratification of Iron Deficiency Anemia with Respect to Gender, Age, and BMI (n = 141)

Variable	Category	IDA Present n (%)	IDA Absent n (%)	Total	P-value
Gender	Male	47 (57.3%)	35 (42.7%)	82	
	Female	32 (54.2%)	27 (45.8%)	59	0.72
Age Groups	6–12 months	21 (55.3%)	17 (44.7%)	38	
	13–36 months	40 (61.5%)	25 (38.5%)	65	
	37–60 months	18 (47.4%)	20 (52.6%)	38	0.31
BMI	<15 kg/m²	35 (63.6%)	20 (36.4%)	55	
	≥15 kg/m²	44 (51.0%)	42 (49.0%)	86	0.18

Discussion

The present study found that iron deficiency anemia (IDA) was present in 56.0% of children presenting with breath-holding spells (BHS). This finding is broadly consistent with several previously published studies. Abbas et al. (13), in a study conducted at Lady Reading Hospital, Peshawar, reported IDA in 54% of children with BHS, which is very close to the prevalence observed in the present study. Similarly, Zaman et al. (14) reported a 56.67% prevalence of IDA among children with BHS at Military Hospital Rawalpindi, with a highly significant odds ratio of 37.92 (p <0.0001), further supporting the strong association between IDA and BHS observed in our cohort.

In contrast, Kırık (12) reported a higher prevalence of IDA (75%) among children with BHS in a Turkish pediatric neurology setting, while Devagudi et al. (11) documented IDA in 76.52% of children with BHS in Southern India, suggesting that the prevalence of IDA among children with BHS may vary across geographic and socioeconomic settings. Arslan et al. (8) reported a lower anemia frequency of 27% among children with BHS; however, their study included children with iron deficiency without anemia and showed that iron therapy reduced the frequency of spells regardless of anemia status. Amir et al. (6) also reported that IDA was a predominant finding among Pakistani children with BHS, with moderately severe anemia observed in approximately 70% of their cohort, which is somewhat higher than the prevalence observed in the present study.

Regarding demographic characteristics, the present study showed a male predominance (58.2%), which is consistent with findings reported by Ali et al. (4), who observed a male-to-female ratio of approximately 1.7:1, and Chesti et al. (1), who reported 57.15% male participants among children with BHS. Leung et al. (2) reported that BHS typically begin between 6 and 18 months of age, which corresponds with the findings of the present study, in which the majority of children belonged to the 13–36 month age group (46.1%). Özgün et al. (15) reported a mean age of 21.39 ± 12.78 months among children with BHS, which is comparable to the mean age of 27.4 ± 12.6 months observed in this study.

The absence of a statistically significant association between gender and IDA in the present study (p = 0.72) is also consistent with previous literature. Kiseleva and Pyankova (7) reported that BHS and associated IDA do not show a big sex-related difference, while El-Din et al. (16) similarly found no significant gender-based variation in IDA among children with BHS. The relatively higher proportion of IDA observed in children aged 13–36 months (61.5%) may be explained by the increased physiological iron requirements during periods of rapid growth and dietary transition, as noted by Leung et al. (2) and Abuaish et al. (17). In addition, the non-significant relationship between BMI and IDA (p = 0.18) observed in this study suggests that other nutritional and metabolic factors may contribute to iron deficiency in children with BHS. Similar observations were reported by İpek and Varan (18), who identified associations between reduced ferritin levels and BHS. Dai and Demiryürek (19) further demonstrated that iron supplementation significantly reduced the frequency of breath-holding spells in iron-deficient children.

Overall, the findings of the present study indicate that iron deficiency anemia is a common comorbidity among children presenting with breath-holding spells. These results support the routine evaluation of iron status in affected children, as early identification and treatment of iron deficiency may help reduce the frequency of episodes and improve clinical outcomes.

Conclusion

Iron deficiency anemia was found in a substantial proportion of children presenting with breath-holding spells in this study. These findings support the routine evaluation of iron status in affected children, as early identification and treatment of iron deficiency may reduce the frequency of episodes and improve clinical outcomes. Further multicenter studies with larger populations may help clarify the underlying mechanisms and strengthen evidence-based management strategies for breath-holding spells in pediatric populations.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-MMS-033-24)

Consent for publication
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The authors declared the absence of a conflict of interest.

Author Contribution

SR (PGR 4)
Manuscript drafting, Study Design,
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Review of Literature, Data entry, Data analysis, and drafting articles.
AA (MBBS)
Conception of Study, Development of Research Methodology Design,

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Chesti M, Chaman S, Nazir M. Role of iron in breath-holding spells and effect of iron therapy in children. Int J Contemp Pediatr. 2021;8(11):1861. https://doi.org/10.18203/2349-3291.ijcp20214160
2. Leung AKC, Leung AAC, Wong AHC, Hon KL. Breath-holding spells in pediatrics: a narrative review of the current evidence. Curr Pediatr Rev. 2019;15(1):22-29. https://doi.org/10.2174/1573396314666181113094047
3. Varma G, Govardhan P, K V. Atypical presentation of breath-holding spells: two case reports with literature review. Int J Contemp Pediatr. 2022;9(10):968. https://doi.org/10.18203/2349-3291.ijcp20222428
4. Ali A, Abdulhadi A, Tag S. Effect of iron therapy on breath-holding spells in children under five years of age. ATMPH. 2020;23(1):58-66. https://doi.org/10.36295/asro.2020.2318
5. Corcia M, Bottosso A, Loeckx I, Mascart F, Dembour G, François G. Efficacy of treatment with belladonna in children with severe pallid breath-holding spells. Cardiol Young. 2018;28(7):922-927. https://doi.org/10.1017/s1047951118000458
6. Amir S, Ahmad S, Usman M, Sarwar I, Sajid N, Ahmad T. Role of oral iron supplementation in reducing breath-holding attacks in children under five years. J Aziz Fatimah Med Dent Coll. 2021;3(1):3-7. https://doi.org/10.55279/jafmdc.v3i1.112
7. Kiseleva L, Pyankova M. Breath-holding spells in children: modern view on the problem. Pediatria J Named After G N Speransky. 2022;101(1):155-160. https://doi.org/10.24110/0031-403x-2022-101-1-155-160
8. Arslan M, Karaibrahimoğlu A, Demirtaş M. Does iron therapy have a place in the management of all breath-holding spells? Pediatr Int. 2021;63(11):1344-1350. https://doi.org/10.1111/ped.14685
9. Gürbüz G, Perk P, Çokyaman T. Iron supplementation should be given in breath-holding spells regardless of anemia. Turk J Med Sci. 2019;49(1):230-237. https://doi.org/10.3906/sag-1805-92
10. Bhavanishankar R, Ramu P, Chaitanya N. Clinical and epidemiological profile of breath-holding spells: an analysis of 115 cases. J Evol Med Dent Sci. 2018;7(4):534-539. https://doi.org/10.14260/jemds/2018/119
11. Devagudi R, Pedada R, Dumpala A. Effect of iron supplementation in anaemic children with breath-holding spells at a tertiary care hospital in Southern India. J Evid Based Med Healthc. 2021;8(31):2870-2874. https://doi.org/10.18410/jebmh/2021/524
12. Kırık S. Breath-holding spells and the importance of iron deficiency anemia. Ortadogu Tip Derg. 2019;11(1):54-57. https://doi.org/10.21601/ortadogutipdergisi.374679
13. Abbas M, Muhammad B, Ali A, Gul M, Malook A. Outcome of iron deficiency anemia in patients presenting with breath-holding spells at Lady Reading Hospital, Peshawar. Pak J Med Health Sci. 2023;17(8):15-18. https://doi.org/10.53350/pjmhs202317815
14. Zaman S, Mahmood A, Ahmed S, Mahmud S. Iron deficiency anemia. Prof Med J. 2018;21(4):734-738. https://doi.org/10.29309/tpmj/2014.21.04.2423
15. Özgün N, Akdeniz O, Çelik M, Sarbay H, Toktaş İ. The efficacy of iron and piracetam in breath-holding spells and levetiracetam in anoxic epileptic seizures. Artuklu Int J Health Sci. 2023;3(1):18-23. https://doi.org/10.58252/artukluder.1227442
16. El-Din H, Gaber R, Elnour S. Breath-holding spells in pediatrics: clinicolaboratory findings and cardiac repolarization changes. Ann Clin Cardiol. 2024;6(1):17-22. https://doi.org/10.4103/accj.accj_22_23
17. Abuaish M, Dosh H, Boubsit K, Munshi S, Dosh S, Khayat S, et al. Assessing the level of awareness about breath-holding spells among the general population in the Makkah region, Saudi Arabia. Cureus. 2023. https://doi.org/10.7759/cureus.50659
18. İpek R, Varan C. Vitamin D levels in children presenting with breath-holding spells: an example of a university hospital. Mersin Univ Tip Fak Lokman Hekim Tip Tarihi Folklorik Tip Derg. 2023;13(3):758-763. https://doi.org/10.31020/mutftd.1331209
19. Dai A, Demiryürek A. Effectiveness of oral theophylline, piracetam, and iron treatments in children with simple breath-holding spells. J Child Neurol. 2019;35(1):25-30. https://doi.org/10.1177/0883073819871854