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Original Research Article

Assessing behavioural and nutritional outcomes in paediatric iron deficiency anaemia: an observational study

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ABSTRACT

Background: Iron deficiency anemia (IDA) is a prevalent nutritional disorder among children, significantly impacting their growth, development, and behavior. This study aims to assess the behavioral and nutritional outcomes in pediatric IDA in Bangladesh.

Methods: This observational study was conducted at Ad-din Barrister Rafique-ul Huq Hospital, along with various private hospitals, from June 2023 to June 2024. A total of 114 children diagnosed with IDA were included. Data on demographic characteristics, clinical parameters, nutritional habits, developmental milestones, and behavioral patterns were collected and analyzed.

Results: The majority of participants (60.53%) were aged between 6 to 12 months, with a mean age of 16.13±14.99 months. Boys constituted 75.44% of the sample. Significant symptoms included weakness (84.21%), frequent infections (82.46%), and fatigue (76.32%). The mean hemoglobin level was 8.51±0.95 g/dl, indicating severe anemia. Nutritional assessments revealed that 39.47% were breastfed for 6-12 months, and 31.58% were not given any formula. Developmental delays were observed in 55.26% of the children. Behavioral assessments showed 78.95% exhibited picky eating habits, 63.16% were frequently crying, and 60.53% had a strong attachment to their caregivers.

Conclusion: The study underscores the profound impact of IDA on the developmental and behavioral health of children. There is a critical need for targeted interventions, including improved iron supplementation programs and timely introduction of solid foods, to address the nutritional deficiencies and developmental delays associated with IDA. Future research should focus on long-term studies to evaluate the efficacy of these interventions.

Keywords: Iron deficiency anemia, Pediatric health, Developmental delays, Behavioral outcomes, Nutritional interventions

INTRODUCTION

Iron deficiency anemia (IDA) remains a significant global public health challenge, particularly affecting children in developing regions such as South Asia. In Bangladesh, the prevalence of IDA among children is alarmingly high, with an estimated 68% of children aged 6-59 months suffering from anemia.[1] This condition not only impairs physical growth but also has profound effects on cognitive development, behavioral health, and overall productivity. Iron is essential for numerous physiological functions, including hemoglobin synthesis, oxygen transport, and brain development. During childhood, adequate iron levels are critical for cognitive and physical development, as iron deficiency during this period can lead to irreversible deficits in cognitive functions such as memory, attention, and learning abilities.[2] IDA in children is primarily caused by dietary insufficiencies, socioeconomic factors, and health conditions that inhibit iron absorption or increase iron requirements. A study conducted in rural Bangladesh identified poor dietary intake, low socioeconomic status, and frequent infections as key determinants of IDA among children.[3] Furthermore, iron deficiency is exacerbated by poor nutritional practices and lack of access to iron-rich foods, which are common in impoverished regions.[4] The role of iron in the human body is multifaceted, it is a crucial component of hemoglobin, which is responsible for transporting oxygen from the lungs to tissues throughout the body. Iron also plays a vital role in brain development, influencing neurotransmitter production and myelination, processes essential for cognitive functions.[5]

Research has consistently shown that IDA negatively impacts cognitive development in children. For instance, Halterman et al found that iron-deficient children in the United States had significantly lower math scores compared to their non-anemic peers.[6] Similarly, a study by Carter et al. demonstrated that infants with IDA exhibited poorer object permanence and short-term memory encoding.[5]

These findings underscore the critical importance of preventing and treating IDA to support optimal cognitive development in children. Behavioral changes associated with IDA are equally concerning. Children with IDA often display irritability, decreased social interaction, and poor academic performance. Lozoff et al observed that preschool-aged children with IDA showed less social engagement and more hesitant behavior compared to their non-anemic counterparts.[7] Nutritional interventions are pivotal in addressing IDA. Various dietary strategies, including the consumption of iron-rich foods and food fortification, have been employed to combat IDA. A study in rural Vietnam identified instant noodles as an effective vehicle for iron fortification in school-feeding programs, significantly improving iron status and reducing anemia prevalence among school children.[8] Similarly, nutrition education and dietary modifications have proven beneficial.

Khoshnevisan et al reported that nutritional education significantly increased serum ferritin concentrations among iron-depleted preschool children. Supplementation programs have also shown promising results.[9] Rivera et al assessed the effectiveness of a large-scale iron-fortified milk distribution program in Mexico, finding significant improvements in hemoglobin levels and reductions in anemia prevalence among young children.[10] Public health strategies play a crucial role in reducing the incidence of IDA. In Bangladesh, home fortification using lipid-based nutrient supplements (LNSs) or micronutrient powders (MNPs) has been effective in reducing IDA among young children.[11] Additionally, combining iron supplementation with other micronutrients, such as vitamin A, can enhance the response to treatment. Ahmed et al demonstrated that concomitant supplementation with vitamin A, iron, and folic acid significantly reduced anemia and iron deficiency among anemic teenagers in urban Bangladesh.[12] The socioeconomic impact of IDA is substantial, affecting educational outcomes, productivity, and healthcare costs. Akpan et al conducted a cost-effectiveness analysis of iron supplementation and MNPs in rural Bangladesh, concluding that these interventions are not cost-effective for young children in this setting.[13] In summary, IDA in children is a multifaceted public health issue that requires comprehensive interventions.

Effective strategies include improving dietary intake through education and fortification, implementing supplementation programs, and addressing underlying socioeconomic factors. By mitigating the impact of IDA, we can enhance cognitive and behavioral outcomes in children, ultimately contributing to their overall development and well-being. The present study aims to assess both behavioral and nutritional outcomes in pediatric IDA cases in Bangladesh, providing insights that could inform public health policies and nutritional guidelines.

METHODS

Study design

This observational study was conducted at the Ad-din Barrister Rafique-ul Huq Hospital, along with various private hospitals.

Study period

Spanning a duration from June 2023 to June 2024. The study aimed to assess behavioral and nutritional outcomes in pediatric patients diagnosed with iron deficiency anemia (IDA).

Study population

A total of 114 children were included in the study. These participants were recognized and diagnosed cases of iron deficiency anemia, ensuring that the sample represented the target population effectively.

Inclusion criteria

Inclusion criteria for the study were children who had been clinically diagnosed with iron deficiency anemia based on established medical guidelines. The diagnosis was confirmed through hematological tests, including complete blood count (CBC) and serum ferritin levels.

Exclusion criteria

Exclusion criteria were strictly applied to ensure the validity of the study results. Children presenting with behavioral abnormalities but without anemia were excluded to isolate the effects of iron deficiency anemia on the observed outcomes.

The study involved comprehensive data collection, including demographic information, dietary assessments, and behavioral evaluations. Nutritional status was assessed using dietary recall methods and food frequency questionnaires, focusing on iron intake and overall nutritional adequacy. Behavioral assessments were conducted using standardized behavioral checklists and cognitive function tests, aimed at evaluating the impact of IDA on cognitive and behavioral development.

Statistical analysis

All collected data were systematically recorded and analyzed using appropriate statistical methods to draw relevant conclusions about the impact of iron deficiency anemia on children's health and development. The results from this study will provide critical insights into the multifaceted effects of IDA and inform strategies for effective management and intervention in similar settings.

RESULTS

Table 1: The Distribution of baseline characteristics among participants (n=114)).

Variables	Frequency	%
Age (in months)		
<6	9	7.89
6-12	69	60.53
13-24	27	23.6
25-48	3	2.63
>48	6	5.26
Mean age	16.13±14.99 months	
Range	1-72 months	
Sex		
Boy	86	75.44
Girl	28	24.56
Socioeconomic status		
Middle class	80	70.18
Poor	34	29.82
Residence		
Rural	43	37.72
Urban	71	62.28

The study included 114 pediatric participants diagnosed with iron deficiency anemia. The age distribution of the participants revealed that the majority, 60.53%, were aged between 6 to 12 months, with a mean age of 16.13±14.99 months. The age range of the participants spanned from 1 to 72 months. Children younger than 6 months constituted 7.89% of the sample, those aged 13 to 24 months made up 23.68%, while 2.63% were between 25 to 48 months, and 5.26% were older than 48 months. Regarding gender distribution, boys were predominant, accounting for 75.44% of the participants, whereas girls made up 24.56%. Socioeconomic status was another characteristic assessed, showing that a significant majority, 70.18%, belonged to middle-class families, while 29.82% were from poorer socioeconomic backgrounds. In terms of residence, the majority of the participants, 62.28%, resided in urban areas, whereas 37.72% were from rural settings.

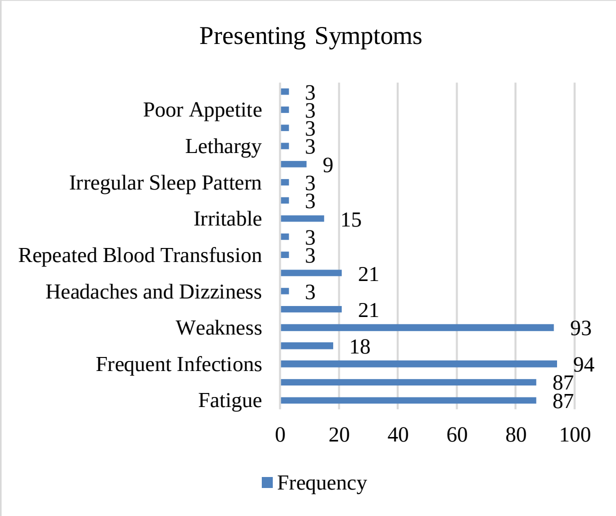

Figure 1: Distribution of participants by presenting symptoms (n=114).

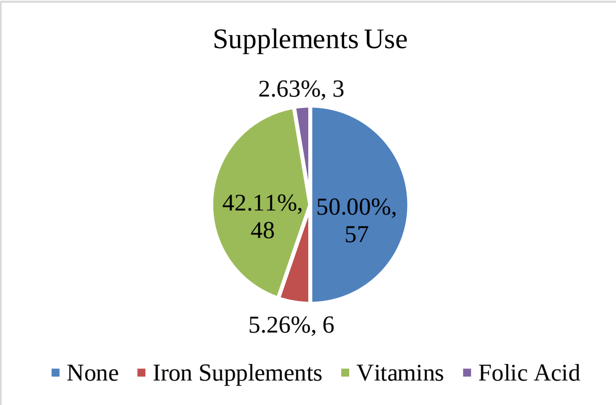

Figure 2: Distribution of various supplement use among participants (n=114).

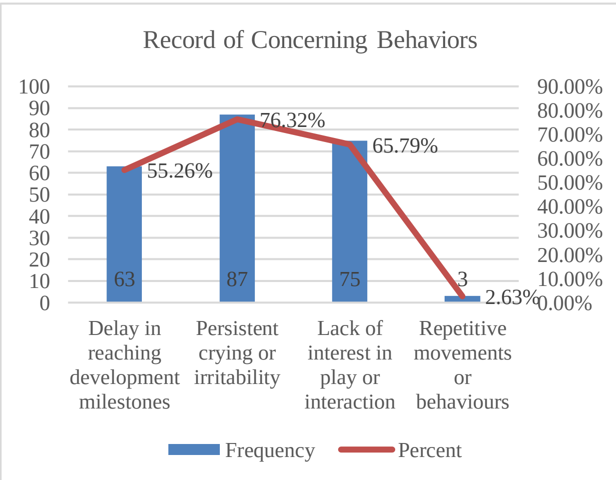

Figure 3: Record of various concerning behaviors among the participants (n=114).

The most common symptoms were weakness and frequent infections, reported in 84.21% and 82.46% of the participants, respectively. Fatigue and pale skin were also prevalent, affecting 76.32% of the children. Additionally, 18.42% of the participants experienced shortness of breath and cold hands and feet, while headaches and dizziness were noted in 2.63% of the children. Pica, a condition characterized by the craving for non-food substances, was observed in 15.79% of the participants. Irritability was reported by 13.16% of the children, and picky eating habits were noted in 7.89%. Other less common symptoms included repeated blood transfusions, glossitis, irregular sleep patterns, lethargy, pallor, poor appetite, and regular tantrums, each affecting 2.63% of the participants.

Table 2: Distribution of mean clinical parameters among the participants (n=114).

Clinical Parameters	Mean±SD	Range	Normal range
Haemoglobin (g/dl)	8.51±0.95	5.20-9.90	11.0-14.0 g/dl
Ferritin (µg/l)	32.66±23.33	6.73-77.05	7-140 µg/l
Total iron binding capacity (µg/dl)	374.29±75.93	267-557	240-450 µg/dl
Red cell distribution width (%)	19.44±2.29	15.10-23.70	11.5-14.5%
Packed cell volume (%)	28.44±2.24	21.80-32.30	33-39%
Red blood cell count (×10^12/l)	6.36±8.40	3.13-50.10	4.0-5.5×10^12/l
Mean corpuscular volume (fl)	63.84±6.87	54.00-86.80	70-86 fl
Mean corpuscular haemoglobin (pg)	23.07±24.13	12.90-168.00	24-30 pg
Mean corpuscular haemoglobin concentration (g/dl)	29.55±2.30	23.90-32.90	32-36 g/dl

Table 3: Distribution of food related habits among the participants (n=114).

Food habits	Frequency	%
Breastfeeding duration		
<6 months	39	34.21
6-12 months	45	39.47
>12 months	30	26.32
Breastfeeding frequency		
1-3 times	16	14.04
4-6 times	46	40.35
>6 times	52	45.61
Formula feeding type		
No Formula	36	31.58
Cow's milk based	21	18.42
Soy-based	3	2.63
Hypoallergic	6	5.26
Others	39	34.21
Artificial feeding	9	7.89
Age at introduction to solid foods		
Not yet introduced	6	5.26
<4 months	12	10.53
4-6 months	24	21.05
>6 months	72	63.16
Type of first given solid food		
Not yet introduced	6	5.26
Rice cereal	93	81.58
Oatmeal	33	28.95
Pureed fruits	21	18.42
Pureed vegetables	12	10.53
Pureed meat	9	7.89
Others	15	13.16
Meals per day		
1-2	16	14.04
3-4	85	74.56

Continued.

Food habits	Frequency	%
>4	13	11.40
Snacks per day		
No snacking	21	18.42
1-2	60	52.63
3-4	30	26.32
>4	3	2.63

Table 4: Distribution of various developmental milestones among the participants (n=114).

Development milestones	Frequency	%
Crawling started		
Not started yet	24	21.05
≤6 months	3	2.63
7-8 months	36	31.58
9-10 months	36	31.58
11-12 months	15	13.16
Walking started		
Not started yet	72	63.16
≤10 months	9	7.89
11-12 months	6	5.26
13-14 months	15	13.16
>14 months	12	10.53
Grasping objects		
Not started yet	27	23.68
<6 months	21	18.42
6-8 months	60	52.63
9-12 months	3	2.63
>12 months	3	2.63
First words spoken at		
Not started yet	69	60.53
<6 months	9	7.89
6-8 months	21	18.42
9-12 months	15	13.16
First smiled at		
1-2 months	58	50.88
3-4 months	52	45.61
>4 months	4	3.51
First direct eye contact made at		
1-2 months	70	61.40
3-4 months	39	34.21
>4 months	5	4.39
Started playing with others at		
Not started yet	66	57.89
≤6 months	15	13.16
7-8 months	12	10.53
9-10 months	12	10.53
11-12 months	3	2.63
>12 months	3	2.63
Problem solving (figuring out simple puzzles) at		
Not started yet	105	92.11
≤12 months	3	2.63
13-24 months	6	5.26
Playing with toys properly at		
Not started yet	63	

Continued.

Development milestones	Frequency	%
≤12 months	39	34.21
13-24 months	9	7.89
>24 months	3	2.63

Table 5: Distribution of various behavioral pattern related observations among the participants (n=114).

Behavioural Observations	Frequency	%
Sleep pattern		
Regular	58	50.88
Irregular	40	35.09
Sleep Disturbances	16	14.04
Eating habits		
Good appetite	16	14.04
Picky eating	90	78.95
Overeating	8	7.02
Play behaviour		
Interactive with others	65	57.02
Prefers playing alone	49	42.98
Emotional regulation		
Often calm	12	10.53
Frequently crying	72	63.16
Regular Tantrums	30	26.32
Response to caregivers		
Strong attachment	69	60.53
Experiences separation anxiety	42	36.84
Comfortable with separation	3	2.63

The clinical parameters of the 114 pediatric participants diagnosed with iron deficiency anemia were thoroughly assessed. The mean hemoglobin (Hb) level was 8.51±0.95 g/dl, which is significantly below the normal range of 11.0-14.0 g/dl, indicating the presence of anemia in all participants. Ferritin levels, which indicate the body's iron stores, had a mean value of 32.66±23.33 µg/L, within the normal range but indicative of low iron stores given the context of anemia. The total iron-binding capacity (TIBC) was elevated with a mean of 374.29±75.93 µg/dl, compared to the normal range of 240-450 µg/dl, reflecting the body's increased demand for iron. The red cell distribution width (RDW), which measures the variability in red blood cell size, was also elevated with a mean of 19.44±2.29%, exceeding the normal range of 11.5-14.5%, suggesting anisocytosis typically seen in iron deficiency anemia. The packed cell volume (PCV) had a mean of 28.44±2.24%, lower than the normal range of 33-39%, further supporting the diagnosis of anemia. The mean red blood cell (RBC) count was 6.36±8.40×10^12/l, which, despite appearing elevated, likely reflects the presence of microcytic erythrocytes rather than an increase in functional erythrocytes. The mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) were all below normal ranges. The mean MCV was 63.84 ± 6.87 fl (normal 70-86 fl), indicating microcytosis. The mean MCH was 23.07 ± 24.13 pg (normal 24-30 pg), and the mean MCHC was 29.55±2.30 g/dl (normal 32-36 g/dl), both indicative of hypochromia. The study investigated the food-related habits of 114 pediatric participants diagnosed with iron deficiency anemia. The breastfeeding duration varied among the participants, with 34.21% being breastfed for less than 6 months, 39.47% for 6-12 months, and 26.32% for more than 12 months. The frequency of breastfeeding also differed, with 45.61% being breastfed more than six times a day, 40.35% between four to six times a day, and 14.04% one to three times a day. Regarding formula feeding, 31.58% of the participants were not given any formula. Among those who were, 18.42% were given cow's milk-based formula, 2.63% soy-based formula, 5.26% hypoallergenic formula, and 34.21% other types of formula. A small proportion, 7.89%, were artificially fed. The age at which solid foods were introduced also varied. A majority, 63.16%, were introduced to solid foods after 6 months, while 21.05% were introduced between 4-6 months, 10.53% before 4 months, and 5.26% had not yet been introduced to solid foods.

The first solid foods given to these children included rice cereal (81.58%), oatmeal (28.95%), pureed fruits (18.42%), pureed vegetables (10.53%), pureed meat (7.89%), and other foods (13.16%). In terms of meal frequency, 74.56% of the participants consumed three to four meals per day, 14.04% had one to two meals per day, and 11.40% had more than four meals per day. Snack consumption was also recorded, with 52.63% having one to two snacks per day, 26.32% having three to four snacks per day, 18.42% not snacking at all, and 2.63% having more than four snacks per day. It is important to note that some participants were under six months of age, and many were under one year of age, which likely influenced the findings related to breastfeeding, formula feeding, and the introduction of solid foods. These food-related habits provide essential insights into the dietary patterns and nutritional intake of children with iron deficiency anemia, which could be contributing factors to their condition.

The study also assessed the use of supplements among the 114 pediatric participants diagnosed with iron deficiency anemia. The findings revealed that 50.00% of the children did not use any supplements. Among those who did use supplements, 42.11% were taking vitamins, making it the most common type of supplement used. Iron supplements were used by 5.26% of the participants, while 2.63% were taking folic acid.

The study evaluated the developmental milestones among 114 pediatric participants diagnosed with iron deficiency anemia. The data revealed a varied distribution of developmental achievements across different age groups. For crawling, 31.58% of the children started crawling at 7-8 months and another 31.58% at 9-10 months. A significant portion, 21.05%, had not started crawling yet, while smaller percentages began crawling at 11-12 months (13.16%) and ≤6 months (2.63%). Walking milestones indicated that 63.16% of the children had not started walking yet. Among those who had, 13.16% started walking at 13-14 months, 10.53% after 14 months, 7.89% at ≤10 months, and 5.26% at 11-12 months. Regarding the ability to grasp objects, 52.63% of the participants achieved this milestone between 6-8 months. However, 23.68% had not started grasping objects yet. Other children began grasping objects at <6 months (18.42%), 9-12 months (2.63%), and >12 months (2.63%). The development of speech was also assessed, with 60.53% of the participants not yet having spoken their first words.

Meanwhile, 18.42% spoke their first words at 6-8 months, 13.16% at 9-12 months, and 7.89% at <6 months. In terms of smiling, 50.88% of the children smiled for the first time at 1-2 months, while 45.61% did so at 3-4 months, and 3.51% after 4 months. Direct eye contact was established by 61.40% of the participants at 1-2 months and by 34.21% at 3-4 months, with 4.39% achieving this milestone after 4 months. Playing with others was another key milestone, with 57.89% of the children not yet engaging in this activity. Those who did start playing with others did so at ≤6 months (13.16%), 7-8 months (10.53%), and 9-10 months (10.53%). Problem-solving skills, such as figuring out simple puzzles, were not developed in 92.11% of the children. A small number showed these skills at ≤12 months (2.63%) and 13-24 months (5.26%).

Lastly, playing with toys properly was observed in 55.26% of the participants who had not yet developed this skill. However, 34.21% started playing with toys properly at ≤12 months, 7.89% at 13-24 months, and 2.63% after 24 months. It is important to note that some participants were under six months of age, and many were under one year of age, which likely influenced the findings related to these developmental milestones. These observations highlight the varied developmental progress among children with iron deficiency anemia, emphasizing the need for early intervention and support to promote optimal growth and development. The study also examined various behavioral patterns among the 114 pediatric participants diagnosed with iron deficiency anemia. The sleep patterns of the children were varied, with 50.88% exhibiting regular sleep patterns, 35.09% having irregular sleep patterns, and 14.04% experiencing sleep disturbances. Eating habits revealed that a significant majority of the participants, 78.95%, were picky eaters. In contrast, 14.04% had a good appetite, and 7.02% were prone to overeating. These findings indicate prevalent dietary challenges among children with iron deficiency anemia. Regarding play behavior, 57.02% of the children were interactive with others, while 42.98% preferred playing alone.

This distribution suggests a mix of social engagement levels among the participants. Emotional regulation observations showed that 63.16% of the children were frequently crying, 26.32% had regular tantrums, and only 10.53% were often calm. These results highlight a considerable level of emotional distress and behavioral difficulties among the children. When it came to their response to caregivers, 60.53% of the participants demonstrated a strong attachment to their caregivers. Meanwhile, 36.84% experienced separation anxiety, and 2.63% were comfortable with separation from their caregivers. It is important to note that some participants were under six months of age, and many were under one year of age, which likely influenced the findings related to sleep patterns, eating habits, and emotional regulation. These behavioral observations provide crucial insights into the challenges faced by children with iron deficiency anemia, underscoring the need for comprehensive care strategies to address both nutritional and psychological aspects of their well-being.

The study identified several concerning behaviors among the 114 pediatric participants diagnosed with iron deficiency anemia. A significant portion of the participants displayed developmental and behavioral issues that warrant attention. Delay in reaching developmental milestones was observed in 55.26% (n=63) of the children. This indicates that more than half of the participants experienced delays in key developmental stages such as crawling, walking, or grasping objects, highlighting the impact of iron deficiency anemia on their growth and development. Persistent crying or irritability was reported in 76.32% (n=87) of the participants, making it the most common concerning behavior.

This high prevalence suggests a strong association between iron deficiency anemia and increased emotional distress and irritability in children. Lack of interest in play or interaction was noted in 65.79% (n=75) of the participants. This behavior reflects potential social withdrawal and reduced engagement in interactive play, which are critical for social and cognitive development. Repetitive movements or behaviors were observed in 2.63% (n=3) of the participants. Although less common, this behavior indicates the presence of repetitive or stereotypical movements, which may be associated with developmental or neurological conditions exacerbated by anemia.

DISCUSSION

The present study aimed to assess the behavioral and nutritional outcomes in pediatric iron deficiency anemia (IDA) in Bangladesh, examining a sample of 114 children. The findings reveal significant developmental, behavioral, and nutritional issues associated with IDA, aligning with and expanding upon existing literature. Firstly, the age distribution showed a majority of participants were between 6 to 12 months old, with a mean age of 16.13±14.99 months. This finding is consistent with previous studies that indicate the prevalence of IDA is particularly high in infancy and early childhood due to increased iron requirements during rapid growth phases.[14] The high prevalence in boys (75.44%) compared to girls (24.56%) supports findings from earlier research that suggest gender differences in nutritional deficiencies, potentially due to cultural and dietary practices.[15] The socioeconomic status of participants indicated that 70.18% belonged to middle-class families, and 29.82% were from poorer backgrounds, emphasizing the socioeconomic disparities influencing nutritional health. This correlates with Elalfy et al findings that poor dietary habits and socioeconomic factors significantly contribute to IDA in infants.[16] Regarding presenting symptoms, the study found that 84.21% of participants reported weakness, and 82.46% had frequent infections. These symptoms are well-documented in literature as hallmark signs of IDA due to impaired immune function and reduced oxygen transport capacity.[17] Additionally, 76.32% of the children exhibited fatigue and pale skin, which are common clinical manifestations of IDA.[18] The clinical parameters showed a mean hemoglobin (Hb) level of 8.51±0.95 g/dl, significantly below the normal range (11.0-14.0 g/dl). This finding is consistent with multiple studies that report low Hb levels in children with IDA.[19] The mean ferritin level of 32.66±23.33 µg/l aligns with the normal range, suggesting that while iron stores are present, they are insufficient to meet the body’s demands, a common characteristic in IDA cases.[20] Nutritional habits revealed that 39.47% of participants were breastfed for 6-12 months, and 34.21% for less than 6 months. This distribution underscores the importance of breastfeeding duration in preventing IDA, as prolonged breastfeeding without appropriate iron supplementation can lead to deficiencies.[21] Additionally, 31.58% of the children were not given any formula, while 34.21% used other types of formula, highlighting variations in feeding practices and their impact on iron status.[22] The study also highlighted concerning behaviors, with 55.26% of participants exhibiting a delay in reaching developmental milestones, such as crawling and walking. This finding is corroborated by previous research indicating that IDA adversely affects motor development and delays in achieving developmental milestones.[23] Persistent crying or irritability was noted in 76.32% of the children, consistent with findings that IDA can lead to increased emotional distress and irritability due to impaired brain function.[24] Behavioral patterns indicated that 78.95% of participants exhibited picky eating habits, a common issue in children with IDA due to altered taste and appetite regulation.[25] Additionally, 57.02% were interactive with others, while 42.98% preferred playing alone, reflecting social withdrawal and reduced engagement often seen in children with IDA.[7] The use of supplements revealed that 50.00% did not use any supplements, while 42.11% were taking vitamins, and 5.26% used iron supplements. This highlights the need for improved supplementation programs to address iron deficiency in children, as supported by studies showing the efficacy of iron supplementation in improving hemoglobin levels and overall health outcomes.[26] In conclusion, the findings of this study underscore the multifaceted impact of iron deficiency anemia on the physical, developmental, and behavioral aspects of affected children. The high prevalence of developmental delays, emotional distress, and social withdrawal among the participants highlights the urgent need for comprehensive interventions that address both the nutritional and developmental needs of children with IDA. Future research should focus on longitudinal studies to further elucidate the long-term effects of IDA and the efficacy of various intervention strategies.

Limitations of the study was that study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

The findings of this study highlight the significant impact of iron deficiency anaemia (IDA) on the physical, developmental, and behavioural health of children in Bangladesh. The high prevalence of developmental delays, emotional distress, and social withdrawal underscores the urgent need for comprehensive public health interventions. Addressing both the nutritional and developmental needs through improved supplementation programs, timely introduction of solid foods, and consistent monitoring of iron levels is essential. Future research should focus on longitudinal studies to further elucidate the long-term effects of IDA and the efficacy of various intervention strategies. By tackling the multifaceted challenges posed by IDA, we can improve the overall health and developmental outcomes for affected children.

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