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ASSESSMENT OF HEALTH CARE PRACTICES FOR PEDIATRIC IRON DEFICIENCY ANEMIA (IDA) IN AZAD JAMMU AND KASHMIR: A MULTICENTER STUDY OF DIAGNOSIS, TREATMENT, AND OUTCOMES

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Abstract

Background- Iron deficiency anemia (IDA) remained the most prevalent nutritional disorder in children worldwide, with significant consequences for growth, cognition, and development. Despite widespread awareness, gaps identified in diagnosis and management, particularly in district Azad Jammu & Kashmir (AJK), Pakistan. This study evaluated the diagnostic practices, treatment patterns, and clinical outcomes of IDA in children of three districts of AJK. **Aim / Objectives-** The study aimed to assess the diagnosis and treatment patterns of IDA in children aged 6 months to 14 years, to identify associated risk factors and clinical manifestations leading to IDA.**Design/Methods-** A descriptive cross-sectional study design using self-structured questionnaire consisted of demographics, clinical symptoms, diagnostic tests, and treatment modalities based on WHO anemia classification was conducted at four hospitals in District Mirpur, Bhimber, and Kotli. Where 160 children with IDA were approached conveniently. Data were analyzed using SPSS version 20, applying descriptive and inferential statistics for significant associations.- **Results** The study was comprised of 160 children having IDA among which 56.3% were males and 43.8% were females. Majority respondents (56.3%) aged 6–59 months. Low birth weight (35%) and urban residence (86.9%) were prevalent. Fatigue (93.8%), pallor (65%), tachycardia (59.4%), and poor appetite (65.6%) were common. Severe IDA (Hb <7 g/dL) affected 23.8%. Serum ferritin was low in 97.5%, however TIBC, transferrin saturation rarely performed. 76.3% received oral ferrous fumarate, 25.6%), yet 98.8% of caregivers were unaware of the correct dosage. IV iron sucrose was given to 31.9%, with 91.3% receiving adjunct Vitamin C. Poor diet (49.4%), malabsorption (40.6%), and low birth weight (33.1%) were significant contributors **Conclusion-** IDA remained a major public health concern in AJK, driven by improper diagnosis and treatment. Despite oral iron being first-line therapy, poor monitoring and inconsistent dosing highlighted the need for implementing protocols, healthcare worker training,

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and community awareness.

1.0. INTRODUCTION

A lack of iron in the body that does not stop the body from producing hemoglobin is known as an iron deficiency, and a drop in hemoglobin levels brought on by ID is known as ID anemia [1]. Iron deficiency, iron depletion, and iron deficiency anemia are the three stages that occur when the body's iron levels are diminished. Iron depletion occurs when the body needs more iron than is consumed, which causes iron stores to gradually decrease. Low serum ferritin levels indicate a decrease in iron reserves. Low stored iron, low absorption of iron to replenish normal bodily losses, and low levels of serum ferritin, mean corpuscular hemoglobin (MCH), and mean corpuscular volume (MCV) are all signs of iron insufficiency. Iron deficiency anemia is the final and most severe stage, which is typified by red blood cells (RBCs) with lower iron levels, low mean MCV, low mean MCH, low hemoglobin (Hb) levels, and a decrease in serum ferritin [2]. Children are more susceptible to iron insufficiency throughout the growth spurts of infancy and adolescence. Anemia can result from long-term blood loss caused by parasite infections, gastrointestinal disorders, or heavy menstruation in older girls [3].

Iron deficiency is the most often reported nutritional deficit in the world. According to the WHO, iron deficiency affects up to 39% of children under the age of five and 48% of children aged five to fourteen in the non-industrialized world, compared to 20% of children under five and 5.9% of children aged five to fourteen in the industrialized world. It affects 2.4 million children in the United States, 5.4 percent of children in Spain, 14.0 percent of children in Estonia, and 30.8 percent of children in Brazil, however prevalence estimates differ by nation [4].

The American Academy of Pediatrics advises supplementing because iron is the most prevalent single-nutrient deficit. The child's age and nutrition determine when to start supplementation and the appropriate dosag [5].

The oxygen-transporting hemoproteins hemoglobin and myoglobin contain about 75% of the body's total iron concentration. The remainder is found in ferritin and hemosiderin, two iron storage proteins that bind excess iron in cells and shield them from its harmful effects. These proteins are primarily found in the liver. About 3 percent of iron is utilized as a cofactor by a variety of enzymes, including those in the mitochondria that produce energy [6]. Interventions must focus on dietary and non-dietary risk factors, particularly in pregnant women and babies, in order to effectively prevent iron deficiency anemia (IDA). In addition to tackling issues including chronic infections, vitamin A insufficiency, and hookworm infestation, strategies should concentrate on sustainable and reasonably priced remedies, especially in developing nations [7].

Delayed Cord Clamping (DCC) or Umbilical Cord Milking (UCM) are important non-dietary interventions that can avoid early infant anemia. By delaying one to three minutes prior to clamping the umbilical cord, DCC improves the baby's oxygen supply and blood volume by allowing up to 100 milliliters of additional blood to pass from the placenta. Nevertheless, the chord is frequently constricted in 15 seconds, which results in a 40% decrease in cardiac output. Another

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technique called UCM involves actively pushing blood toward the baby from the umbilical cord before clamping. In situations where immediate resuscitation is required, this procedure is advantageous. Both DCC and UCM are easy-to-use, reasonably priced methods that can greatly lower infant anemia [8].

Oral iron salts, usually over-the-counter ferrous sulphate, are used to treat iron deficiency because they are reasonably priced and well absorbed. The elemental iron is used to determine dosages; children are given 3–6 mg/kg daily, whereas adolescents are given 60 mg/dose. If the iron deficit is dietary, the response to iron therapy is usually quick. Intramuscular iron injections are typically inappropriate; if oral iron is not tolerated, parenteral form is used. If hypovolemia or severe cardiovascular impairment are present, erythrocyte transfusion is recommended. If the anemia is corrected quickly, cardiac dilatation could occur [9]. Iron Deficiency Anemia (IDA) was a widespread health problem among children, particularly in developing countries. A significant number of children suffered from IDA due to poor nutritional intake, frequent infections, and lack of public and caregiver awareness. Despite the high prevalence of IDA, there was considerable variability in how it was diagnosed and treated across different healthcare settings. In many cases, children were either not tested appropriately or were misdiagnosed, leading to delays in initiating effective treatment. Some healthcare providers administered iron supplements without proper assessment of the child's clinical condition or laboratory confirmation of deficiency. These inconsistencies in diagnosis and treatment negatively impacted the child's recovery and overall health outcomes. There was a lack of standardized, guideline-based protocols being followed uniformly by clinicians in managing IDA in pediatric populations.

The study aimed to assess current diagnostic and treatment practices and identify gaps or deviations from standard recommendations. It also sought to understand the challenges faced by healthcare providers in the diagnosis and management of IDA in children. Research on the diagnosis and treatment patterns of IDA in children was very limited in Azad Jammu and Kashmir (AJK), making this study regionally significant. Findings from this study contributed to improving clinical practices, promoting accurate diagnosis, safe treatment, and better health outcomes for children suffering from IDA. This study provided valuable insight into the current diagnostic and treatment practices of iron deficiency anemia (IDA) in children, highlighting both strengths and gaps in clinical management.

It emphasized the high prevalence of IDA among children, especially those aged 6–59 months, with fatigue, dizziness, and poor appetite being the most common symptoms indicating a strong need for early detection and symptom-based screening. The research revealed that most diagnostic practices were limited, often relying only on hemoglobin and serum ferritin levels, while important tests like peripheral smear and transferrin saturation were neglected. This indicated a critical need for standardized diagnostic protocols. By evaluating the treatments used, especially the high use of oral iron (mainly ferrous fumarate) and Vitamin C supplementation, the study brought attention to both the commonly used therapies and the knowledge gaps among caregivers regarding dosing and side effects. The findings also stressed the need for better education and counseling for caregivers, as many were unaware of correct treatment

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dosages and therapy plans. Importantly, the study identified inconsistencies in management, with some children not receiving appropriate tests or treatments. This underlined the need for guideline-based and individualized care for better health outcomes. The results were especially significant for healthcare providers and policymakers, suggesting where training and resources should be focused to reduce the burden of IDA in children. As very limited research was available from the Azad Jammu and Kashmir (AJK) region, this study filled a crucial knowledge gap and could serve as a foundation for future regional health interventions and policymaking.

2.0. Methodology

2.1. Study Design

A descriptive cross-sectional study design was used.

2.2. Study Settings

This study was conducted in the following hospitals: Divisional Headquarter Hospital, Mirpur, AJK, Divisional Headquarter Hospital, Bhimber, AJK, Maroof International Hospital, Mirpur, AJK, Rehman Children Hospital, Bhimber, AJK.

2.3. Study Population

The study population was comprised of children diagnosed with iron deficiency anemia and the doctors or healthcare staff involved in their care based on following inclusion and exclusion criteria:

2.4. Inclusion Criteria

Following was the inclusion criteria of the study:

Children aged 6 months to 14 years diagnosed with iron deficiency anemia. Children visiting the selected hospitals during the study period. Parents/guardians who give consent for participation.

2.5. Exclusion Criteria

Following was the exclusion criteria of the study: Children with anemia due to causes other than iron deficiency, Children with chronic diseases like kidney or liver disorders, Parents/guardians who do not agree to participate and Children above the age of 14 years.

2.6. Sampling Method

Convenient sampling technique, a type of non-probability sampling was used to collect data.

2.7. Sample Size

Sample size was calculated using Raosoft sample size calculator at 95% confidence interval and 5% margin of error, which was 385 and N=160 sample was collected conveniently.

2.8. Data Collection Tool

A self-structured, closed-ended questionnaire was used for data collection, comprising five sections. The questionnaire was comprised of the following sections:

Section 1: Patient Demographics Included child's age, gender, birth weight, and geographical region.

Section 2: Disease Characteristics and Symptoms Focused on diagnosis status, symptom duration, possible causes (e.g., poor diet, chronic blood loss, malabsorption), and presence of various risk factors and physical

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symptoms across body systems (general, cardiovascular, respiratory, gastrointestinal, skin, musculoskeletal, neurological).

Section 3: Clinical Findings Covered past medical conditions and specific clinical symptoms like fatigue, pallor, breathlessness, brittle nails, pica, etc.

Section 4: Diagnostic Investigations Asked about diagnostic tests conducted, hemoglobin levels, and severity classification (mild, moderate, severe).

Section 5: Treatment Patterns Investigated types of treatments used (oral and IV), the type and dosage of iron supplements, side effects, use of Vitamin C with iron, and outcomes [10].

2.9. Statistical Analyses

Data was analyzed using SPSS version 20. Descriptive statistics was used to calculate frequency, percentage and cross tabulation whereas inferential statistics such as Chi Square test was used to assess association between demographics and disease variables with significance $p < 0.05$.

2.10. Ethical Considerations

This study was conducted with the permission of the respective institute Akson College of Pharmacy joint venture with Mirpur University of Science and Technology, Mirpur, AJK bearing reference number 601/04/Ex/ACP/25. The permission from executive Directors of aforementioned study setting was also taken prior to the conduction of the study.

3.0. RESULTS

3.1. DEMOGRAPHIC CHARACTERISTICS

The total study was comprised 160 respondents, in which 90 (56.3%) were male and 70 (43.8%) were female. In terms of age distribution, 90 (56.3%) were between 6–59 months, 58 (36.3%) were aged 5–11 years, and 12 (7.5%) were aged 12–14 years. Regarding birth weight, 56 (35.0%) had low birth weight (<2.5 kg), 103 (64.4%) had normal birth weight (2.5–4.0 kg), and 1 (0.6%) had high birth weight (>4.0 kg). With respect to geographical region, 139 (86.9%) were from urban areas, 20 (12.5%) from rural areas, and 1 (0.6%) from semi-urban areas. A detailed description is given in Table 1 below.

Table 1: Demographic Characteristics

Demographic variables		Frequency (n)	Percentage (%)
Gender	Male	90	56.3
	Female	70	43.8
Age	6-59 month	90	56.3
	5-11 years	58	36.3
	12-14 years	12	7.5

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Birth Weight	Low (<2.5 kg)	56	35.0
	Normal (2.5–4.0 kg)	103	64.4
	High (>4.0 kg)	1	0.6
Geographical Region	Urban	139	86.9
	Rural	20	12.5
	Semi-urban	1	0.6

3.2. Disease Characteristics

Among the 160 respondents, 151 (94.4%) children had been diagnosed with iron deficiency anemia (IDA), while 9 (5.6%) had not. Regarding the duration of symptoms, 58 (36.3%) had symptoms for less than 1 month, 77 (48.1%) for 1–3 months, 19 (11.9%) for 4–6 months, and 6 (3.8%) for more than 6 months. As for the initial known cause of IDA, 79 (49.4%) cases were attributed to poor diet, 14 (8.8%) to chronic blood loss, 65 (40.6%) to malabsorption, and 2 (1.3%) to increased need for iron. Risk factors experienced included premature birth in 8 (5.0%) children, low birth weight in 53 (33.1%), poor nutrition in 83 (51.9%), frequent infections in 49 (30.6%), blood loss in 14 (8.8%), and malabsorption issues in 67 (41.9%). No child reported having none of these risk factors. A detailed description is given in Table 2 below;

Table 2. Disease Characteristics

Disease Characteristics Variables		Frequency (n)	Percentage (%)
Has the child been diagnosed with iron deficiency anemia?	Yes	151	94.4
	No	9	5.6
Duration of symptoms	Less than 1 month	58	36.3
	1–3 months	77	48.1
	4–6 months	19	11.9
	More than 6 months	6	3.8

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Initial cause of IDA (if known)	Poor diet	79	49.4
	Chronic blood loss	14	8.8
	Malabsorption	65	40.6
	Increased need for iron	2	1.3
	Yes	8	5

3.3. Clinical Findings

Among the 160 children assessed, the most commonly reported general or systemic symptom was fatigue or weakness, observed in 150 (93.8%) participants. Fainting occurred in 129 (80.6%), while 42 (26.3%) reported cold hands or feet. Reduced activity or lethargy was noted in 45 (28.1%) cases, and irritability in 105 (65.6%). Cardiovascular symptoms included tachycardia in 95 (59.4%) children, palpitations in 33 (20.6%), chest pain in 19 (11.9%), and low blood pressure in 24 (15.0%). Respiratory issues were also reported, with 125 (78.1%) experiencing shortness of breath with exertion, 43 (26.9%) breathlessness even at rest, and 49 (30.6%) showing signs of rapid breathing (tachypnea). Gastrointestinal symptoms included poor appetite in 105 (65.6%), nausea or vomiting in 34 (21.3%), difficulty swallowing in 50 (31.3%), glossitis in 38 (23.8%), abdominal pain or cramping in 32 (20.0%), diarrhea in 18 (11.3%), and constipation in 27 (16.9%). Skin-related symptoms were pale or ashen skin in 104 (65%), dry or flaky skin in 49 (30.6%), brittle nails (koilonychia) in 42 (26.3%), jaundice in 28 (17.5%), and itchy skin or rashes in 37 (23.1%). Musculoskeletal complaints included muscle weakness and cramping in 103 (64.4%) children each, unusual tiredness after physical activity in 87 (54.4%), and generalized body pain in 73 (45.6%). Neurologically, 112 (70.0%) children experienced dizziness or lightheadedness, 113 (70.6%) had headaches, and 79 (49.4%) reported difficulty concentrating or poor memory. Tinnitus was noted in 35 (21.9%) children, while restlessness or anxiety was present in 41 (25.6%). Past conditions included frequent infections in 45 (28.1%), gastrointestinal problems in 13 (8.1%), and a history of anemia in 50 (31.3%). Only 2 (1.3%) reported none of these conditions. A detailed description is given in Table 3 below;

Table 3. Clinical Findings

Clinical Finding variables	Frequency	Percentage

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		(n)	(%)
Symptoms: General/Systemic: Fatigue or weakness	Yes	150	93.8
	No	10	6.3
Fainting	Yes	129	80.6
	No	31	19.4
Cold hands or feet	Yes	42	26.3
	No	118	73.8
Reduced activity or lethargy	Yes	45	28.1
	No	115	71.9
Irritability	Yes	105	65.6
	No	55	34.4
Cardiovascular: Tachycardia	Yes	95	59.4
	No	65	40.6
Palpitations	Yes	33	20.6
	No	127	79.4
Chest pain	Yes	19	11.9
	No	141	88.1
Low blood pressure	Yes	24	15.0
	No	136	85
Respiratory: Shortness of breath with exertion	Yes	125	78.1
	No	35	21.9
Breathlessness even at rest	Yes	43	26.9
	No	117	73.1
	Yes	49	30.6

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Rapid breathing (tachypnea)	No	111	69.4
Gastrointestinal: Poor appetite (anorexia)	Yes	105	65.6
	No	55	34.4
Nausea or vomiting	Yes	34	21.3
	No	126	78.8
Difficulty swallowing	Yes	50	31.3
	No	110	68.8
Glossitis (Inflammation of the tongue)	Yes	38	23.8
	No	122	76.3
Abdominal pain or cramping	Yes	32	20
	No	128	80
Diarrhea	Yes	18	11.3
	No	142	88.8
Constipation	Yes	27	16.9
	No	133	83.1
Skin: Pale or ashen skin	Yes	104	65
	No	56	35
Dry or flaky skin	Yes	49	30.6
	No	111	69.4

3.4. Diagnostic criteria

Regarding diagnostic criteria, serum ferritin levels were below normal in 156 (97.5%) children, while only 4 (2.5%) had normal levels; none were above normal. Serum iron, TIBC, transferrin saturation, and stool for occult blood tests were not performed in any of the 160 (100%) cases. Reticulocyte count was below normal in 1 (0.6%) child, while 159 (99.4%) did not undergo the test. Hemoglobin (Hb) levels were below normal in 156 (97.5%)

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children and normal in 4 (2.5%). Hematocrit levels were also below normal in 158 (98.8%) cases and normal in 2 (1.3%). The mean corpuscular volume (MCV) was below normal in 154 (96.3%) and normal in 6 (3.8%), while the mean corpuscular hemoglobin (MCH) was below normal in 159 (99.4%) and normal in only 1 (0.6%). A complete blood count (CBC) test was performed in all 160 (100%) cases. Peripheral blood smear was not performed in any case (100%). In terms of severity, 53 (33.1%) children had mild anemia, 69 (43.1%) had moderate anemia, and 38 (23.8%) had severe anemia. A detailed description is given in Table 4 below;

Table 4. Diagnostic criteria

Diagnostic criteria variables		Frequency (n)	Percentage (%)
Serum Ferritin	Below normal	156	97.5
	Normal	4	2.5
	Above normal	0	0
	Not performed	0	0
Serum Iron	Below normal	0	0
	Normal	0	0
	Above normal	0	0
	Not performed	160	100
TIBC	Below normal	0	0
	Normal	0	0
	Above normal	0	0
	Not performed	160	100
Transferrin Saturation	Below normal	0	0
	Normal	0	0
	Above normal	0	0
	Not performed	160	100
	Below normal	0	0

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Stool for occult blood	Normal	0	0
	Above normal	0	0
	Not performed	160	100
Reticulocyte count	Below normal	1	0.6
	Normal	0	0
	Above normal	0	0
	Not performed	159	99.4
Hb level	Below normal	156	97.5
	Normal	4	2.5
	Above normal	0	0
	Not performed	0	0
Hematocrit level	Below normal	158	98.8
	Normal	2	1.3
	Above normal	0	0
	Not performed	0	0
MCV level	Below normal	154	96.3
	Normal	6	3.8
	Above normal	0	0
	Not performed	0	0
MCH level	Below normal	159	99.4
	Normal	1	0.6
	Above normal	0	0
	Not performed	0	0
Was a CBC test	Yes	160	100

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performed?	No	0	0
Peripheral Blood Smear	Normal	0	0
	Shows microcytic cells	0	0
	Shows hypochromic cells	0	0
	Not performed	160	100
Severity of anemia	Mild	53	33.1
	Moderate	69	43.1
	Severe	38	23.8

3.5. Treatment

Among the 160 children, 122 (76.3%) were currently receiving oral iron supplements, while 38 (23.8%) were not. The most commonly used oral iron supplement was ferrous fumarate, taken by 41 (25.6%) children, followed by ferrous sulfate in 7 (4.4%), ferrous gluconate in 3 (1.9%), and other types in 109 (68.1%). The majority of respondents (158 or 98.8%) were unaware of the exact dosage; only 1 (0.6%) child each received 1–2 mg/kg/day and 3–5 mg/kg/day, respectively. Side effects of oral iron were reported in 19 (11.9%) cases. Among them, constipation was noted in 11 (6.9%), stomach upset in 10 (6.3%), nausea in 7 (4.4%), dark stool in 15 (9.4%), and diarrhea in 4 (2.5%). Intravenous (IV) iron therapy had been administered to 51 (31.9%) children, while 109 (68.1%) had not received it. Among those treated, iron sucrose was the most common form (42 or 56.3%), followed by ferric carboxymaltose and sodium ferric gluconate (3 or 1.9% each), with other formulations used in 5 (3.1%) cases. Most caregivers (115 or 71.9%) were unaware of the number of IV sessions; 34 (21.3%) reported 1–2 sessions, and 11 (6.9%) reported 3–4 sessions.

Regarding the response to IV therapy, 19 (11.9%) children showed significant improvement, 32 (20%) showed moderate improvement, and 106 (66.3%) were either not treated or the outcome was unknown. In terms of future treatment plans, oral iron was expected to continue in 82 (51.3%) cases, IV iron was planned in 21 (13.1%), no further treatment was required in 2 (1.3%), and 55 (34.4%) were unsure. Blood transfusions had been given to 37 (23.1%) children, while 123 (76.9%) had not received one. A majority of the children (146 or 91.3%) were receiving iron combined with Vitamin C. Among these, the most common form of Vitamin C was liquid (90 or 56.3%), followed by chewables (30 or 18.8%), tablets (24 or 15%), and other forms (16 or 10%). However, 156 (97.5%) caregivers were unaware of the exact dosage; only 4 (2.5%) reported a dosage of 101–200 mg/day. Regarding the response to iron and Vitamin C therapy, 77 (48.1%) children showed significant improvement, 69 (43.1%) showed moderate improvement, and 14 (8.8%) showed no improvement. Side effects of

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combination therapy were noted in 26 (16.3%) children, including stomach upset (10 or 6.3%), constipation (14 or 8.8%), and nausea (2 or 1.3%). A detailed description is given in Table 5 below;

Table 5. Treatment

Treatment variables		Frequency (n)	Percentage (%)
Is the child currently on oral iron supplements	Yes	122	76.3
	No	38	23.8
Type of oral iron supplement	Ferrous sulfate	7	4.4
	Ferrous gluconate	3	1.9
	Ferrous fumarate	41	25.6
	Other	109	68.1
Dosage of oral iron	1–2 mg/kg/day	1	0.6
	3–5 mg/kg/day	1	0.6
	6 mg/kg/day	0	0
	Unknown	158	98.8
Side effects of oral iron	Yes	19	11.9
	No	141	88.1
If yes, side effects observed: Constipation	Yes	11	6.9
	No	149	93.1
Stomach upset	Yes	10	6.3
	No	150	93.8
	Yes	7	4.4

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Nausea	No	153	95.6
Dark stool	Yes	15	9.4
	No	145	90.6
Diarrhea	Yes	4	2.5
	No	156	97.5
IV Treatment: Has the child received IV iron therapy	Yes	51	31.9
	No	109	68.1
Type of IV iron therapy	Iron sucrose	42	56.3
	Ferric carboxymaltose	3	1.9
	Sodium ferric gluconate	3	1.9
	Other	5	3.1
	No	107	66.9
Number of IV sessions	1–2	34	21.3
	3–4	11	6.9
	>4	0	0
	Unknown	115	71.9
Response to IV iron therapy	Significant improvement	19	11.9
	Moderate improvement	32	20
	No improvement	0	0

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	Unknown	3	1.9
	No	106	66.3
Future treatment plans	Oral iron to continue	82	51.3
	IV iron planned	21	13.1
	No further treatment needed	2	1.3
	Unknown	55	34.4
Has the child received a blood transfusion?	Yes	37	23.1
	No	123	76.9
Is the child receiving iron + Vitamin C?	Yes	146	91.3
	No	14	8.8

3.6. CROSS TABULATION & ASSOCIATION USING CHI SQUARE TEST

3.6.1. Age verses Disease Characteristics

Out of the total participants, 151 children were diagnosed with iron deficiency anemia, most commonly among those aged 6–59 months (88), followed by 5–11 years (54), and 12–14 years (9). A total of 97 children were not diagnosed with IDA. A significant association was observed between age group and IDA diagnosis ($p = 0.005$). Regarding symptom duration, the majority of cases reported symptoms for 1–3 months, including 45 children aged 6–59 months, 27 aged 5–11 years, and 5 aged 12–14 years. Symptoms lasting less than 1 month were reported by 40, 18, and 0 children respectively, followed by 4–6 months (4, 11, and 4). The fewest participants reported symptoms lasting more than 6 months (1, 2, and 3 respectively). This association was highly significant ($p = 0.001$). Among known causes of iron deficiency anemia, malabsorption was reported in 46 children aged 6–59 months, 17 aged 5–11 years, and 2 aged 12–14 years. Poor diet was next (36, 35, and 8), followed by chronic blood loss (6, 6, and 2). Increased need for iron was rarely reported (2 in 6–59 months, none in other groups). A significant association was found between initial cause and age ($p = 0.048$). Premature birth was reported as a risk factor in 5 children aged 6–59 months, 3 aged 5–11 years, and none in 12–14 years. A total of 151 children had not experienced premature birth. No significant association was found ($p = 0.829$). Low birth weight was significantly more common among younger children, with 42 in the 6–59 months group, 7 in 5–11 years, and 4 in 12–14 years reporting this factor. A total of 107 children did not have low birth weight. This was statistically significant ($p = 0.001$). Poor nutrition as a risk

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factor was reported by 35 children aged 6–59 months, 39 aged 5–11 years, and 9 aged 12–14 years. A total of 77 participants did not report poor nutrition. The association between age and poor nutrition was significant (p = 0.001). Frequent infections were reported by 27 children aged 6–59 months, 16 aged 5–11 years, and 6 aged 12–14 years, whereas 111 children had no frequent infections. No significant association was found (p = 0.303). Blood loss was noted in 7 children aged 6–59 months, 4 in 5–11 years, and 3 in 12–14 years. A total of 146 children did not report blood loss. This association was not statistically significant (p = 0.115). Malabsorption issues were reported by 46 participants in the 6–59 months age group, 19 in 5–11 years, and 2 in 12–14 years. A total of 93 children did not report malabsorption issues. A statistically significant association was found (p = 0.016). None of the children were marked as having "none of these" risk factors; 160 children had at least one known risk factor. A detailed description is given in Table 6below

Table 6. Age Verses Disease Characteristics

Variables regarding disease characteristics		Age			P-Value
		6-59 months	5-11 years	12-14 years	
Has the child been diagnosed with iron deficiency anemia?	Yes	88	54	9	0.005
	No	90	4	3	
Duration of symptoms	Less than 1 month	40	18	0	0.001
	1–3 months	45	27	5	
	4–6 months	4	11	4	
	More than 6 months	1	2	3	
Initial cause of IDA	Poor diet	36	35	8	
	Chronic blood loss	6	6	2	

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(if known)	Malabsorption	46	17	2	
	Increased need for iron	2	0	0	0.048
Risk factors experienced: Premature birth	Yes	5	3	0	
	No	84	55	12	0.829
Poor nutrition	Yes	35	39	9	
	No	55	19	3	0.001
Frequent infections	Yes	27	16	6	
	No	63	42	6	0.303
Blood loss	Yes	7	4	3	
	No	83	54	9	0.115
Malabsorption issues	Yes	46	19	2	
	No	44	39	10	0.016
Low birth weight	Yes	42	7	4	
	No	48	51	8	0.001

3.6.2. Age verses Clinical Findings

Among general or systemic symptoms, fatigue or weakness was the most commonly reported, seen in 84 children aged 6–59 months, 55 aged 5–11 years, and 11 aged 12–14 years. Only 10 children did not report this symptom with a p-value of 0.891 > 0.05 being non-significant Fainting occurred in 74 children aged 6–59 months, 45 aged 5–11 years, and 10 aged 12–14 years. A total of 31 children reported no fainting. This was not statistically significant (p = 0.761). Cold hands or feet were reported by 25 children in the youngest group, 11 aged 5–11 years, and 6 aged 12–14 years. The remaining 118 children did not report this symptom. No significant association was noted (p = 0.074). Reduced activity or lethargy was seen in 22 children aged 6–59 months, 17 aged 5–11 years, and 6 aged 12–14 years, while 115 children did not report this issue (p = 0.175). Irritability was common, found in 57 children aged 6–59 months, 42 aged 5–11 years, and 6 aged 12–14 years. A total of 55 children did not report irritability. This association was not significant (p = 0.260). Tachycardia was noted in 59 participants in the youngest group, 32 in 5–11 years, and 4 in 12–14 years, while 65 children did not report it. This approached significance (p = 0.073).

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Palpitations were reported in 15 children aged 6–59 months, 13 aged 5–11 years, and 5 aged 12–14 years. A total of 127 did not report palpitations (p = 0.121). Chest pain occurred in 10 children in the 6–59-month group, 5 in 5–11 years, and 4 in 12–14 years, with 141 reporting no such symptom. This was borderline significant (p = 0.052). Low blood pressure was reported by 11 children aged 6–59 months, 6 in 5–11 years, and 7 in 12–14 years, while 136 participants did not report this. This association was statistically significant (p = 0.001). Shortness of breath with exertion affected 74 children aged 6–59 months, 44 aged 5–11 years, and 7 aged 12–14 years. A total of 35 children did not report this symptom (p = 0.149). Breathlessness at rest was seen in 21 children in the youngest group, 17 in 5–11 years, and 5 in 12–14 years. This was not significant, with 117 children unaffected (p = 0.352). Rapid breathing (tachypnea) was reported by 29 children aged 6–59 months, 13 in 5–11 years, and 7 in 12–14 years. A total of 111 did not report this symptom. This association was significant (p = 0.043). Poor appetite (anorexia) was common among younger children, seen in 63 aged 6–59 months, 33 aged 5–11 years, and 9 aged 12–14 years. A total of 55 participants did not report it (p = 0.203). This association was not significant. Nausea or vomiting occurred in 16 children in the youngest group, 11 in 5–11 years, and 7 in 12–14 years, while 126 children did not report this. The association was statistically significant (p = 0.005). Difficulty swallowing was reported by 31 participants in the 6–59-month group, 15 in 5–11 years, and 4 in 12–14 years. A total of 110 children did not report this symptom (p = 0.539). This association was not significant. Glossitis was present in 23 children aged 6–59 months, 12 aged 5–11 years, and 3 aged 12–14 years, while 122 participants were unaffected so this association was not significant (p = 0.790). Abdominal pain or cramping was reported in 16 children aged 6–59 months, 15 aged 5–11 years, and 1 aged 12–14 years. A total of 128 children did not experience this (p = 0.280). This association was not significant. Diarrhea occurred in 8 children aged 6–59 months, 8 aged 5–11 years, and 2 aged 12–14 years. The rest 142 children did not report it (p = 0.540) which shows no significant association. Constipation was seen in 15 children in the 6–59 months group, 9 in 5–11 years, and 3 in 12–14 years. A total of 127 children were unaffected (p = 0.725). This association was not significant. Pale or ashen skin was found in 61 children aged 6–59 months, 37 aged 5–11 years, and 6 aged 12–14 years, while 56 children did not exhibit this symptom (p = 0.466). This association was not significant. Dry or flaky skin occurred in 20 children aged 6–59 months, 23 aged 5–11 years, and 6 aged 12–14 years. A total of 111 participants did not report it. This association was significant (p = 0.026). Brittle nails (koilonychia) were noted in 21 children aged 6–59 months, 16 aged 5–11 years, and 5 aged 12–14 years. The remaining 118 children did not report this condition (p = 0.382). This association was not significant. Jaundice was reported in 12 children aged 6–59 months, 12 aged 5–11 years, and 4 aged 12–14 years. A total of 132 children did not have jaundice (p = 0.167). This association was not significant. Itchy skin or rashes were seen in 21 children aged 6–59 months, 13 aged 5–11 years, and 3 aged 12–14 years, while 123 children did not report this symptom (p = 0.979). This association was not significant. Muscle weakness was experienced by 65 children aged 6–59 months, 33 aged 5–11 years, and 5 aged 12–14 years. A total of 57 participants did not report muscle weakness.

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This was statistically significant (p = 0.038). Cramping in the legs or other muscles occurred in 62 children aged 6–59 months, 35 aged 5–11 years, and 6 aged 12–14 years, while 57 did not report this issue (p = 0.318). This association was not significant. Unusual tiredness after physical activity was seen in 44 children in the youngest group, 37 in 5–11 years, and 6 in 12–14 years. A total of 113 children did not report it (p = 0.196). This association was not significant. Generalized body pain was reported by 39 children aged 6–59 months, 28 aged 5–11 years, and 6 aged 12–14 years. A total of 87 participants did not report this symptom (p = 0.800). This association was not significant. Dizziness or lightheadedness was present in 65 children aged 6–59 months, 42 aged 5–11 years, and 5 aged 12–14 years. A total of 48 children did not report this symptom (p = 0.084). This association was not significant. Headaches were reported in 68 children aged 6–59 months, 37 aged 5–11 years, and 8 aged 12–14 years, while 47 children did not experience headaches (p = 0.294). This association was not significant. Difficulty concentrating or poor memory was noted in 42 children aged 6–59 months, 30 in 5–11 years, and 7 in 12–14 years. A total of 81 did not report this issue (p = 0.678). This association was not significant. Tinnitus was seen in 22 children in the 6–59-month group, 11 in 5–11 years, and 2 in 12–14 years. A total of 125 children were unaffected (p = 0.662). This association was not significant. Restlessness or anxiety was experienced by 28 children aged 6–59 months, 10 aged 5–11 years, and 3 aged 12–14 years. The remaining 119 children did not report this symptom (p = 0.168). This association was not significant. Frequent infections in the past were reported by 25 children aged 6–59 months, 14 aged 5–11 years, and 6 aged 12–14 years. A total of 115 did not report such a history (p = 0.192). This association was not significant. Gastrointestinal problems in the past were noted in 4 children aged 6–59 months, 6 in 5–11 years, and 3 in 12–14 years. A total of 147 children did not report past GI issues. This was statistically significant (p = 0.037). Previous anemia was reported in 25 children in the 6–59 months group, 23 in 5–11 years, and 2 in 12–14 years, while 110 children did not report prior anemia (p = 0.165). This association was not significant. Only 2 children (1 in the youngest and 1 in the oldest age group) had none of these findings, while 158 had at least one clinical feature (p = 0.060). This association was not significant. A detailed description is given in Table 7 below;

Table 7. Age verses Clinical Findings

Variables regarding Clinical Findings		Age			P-Value
		6-59 months	5-11 years	12-14 years	
Symptoms: General/Systemic Fatigue or weakness	Yes	84	55	11	0.891
	No	6	3	1	

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Fainting	Yes	74	45	10	0.761
	No	16	13	2	
Cold hands or feet	Yes	25	11	6	0.074
	No	65	47	6	
Reduced activity or lethargy	Yes	22	17	6	0.175
	No	68	41	6	
Irritability	Yes	57	42	6	0.260
	No	33	16	6	
Cardiovascular: Tachycardia	Yes	59	32	4	0.073
	No	31	26	8	
Palpitations	Yes	15	13	5	0.121
	No	75	45	7	
Chest pain	Yes	10	5	4	0.052
	No	80	53	8	
Low blood pressure	Yes	11	6	7	0.001
	No	79	52	5	
Respiratory: Shortness of breath with exertion	Yes	74	44	7	0.149
	No	16	14	5	
Breathlessness even at rest	Yes	21	17	5	0.352
	No	69	41	7	
	No	65	35	10	
	No	89	58	11	

3.6.3. Age Verses Treatment

Among the participants, 63 children aged 6–59 months, 52 aged 5–11 years, and 7 aged 12–14 years were currently receiving oral iron supplements. A total of 38 children were not on oral supplementation. This difference was statistically significant (p = 0.007). Regarding

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the type of oral iron supplement, "Other" preparations were most frequently used, reported by 65 children aged 6–59 months, 37 aged 5–11 years, and 7 aged 12–14 years. Ferrous fumarate was used by 25 children in the youngest group and 16 in 5–11 years, with none in the oldest group. Ferrous sulfate and ferrous gluconate were least reported. This variable showed a significant association with age (p = 0.001). For dosage of oral iron, only one child aged 5–11 years received 1–2 mg/kg/day, and one in the 6–59-month group received 3–5 mg/kg/day. All other dosages were unknown across all age groups (89, 57, and 12 respectively). This association was not significant (p = 0.638). Side effects of oral iron therapy were reported by 4 children aged 6–59 months, 9 aged 5–11 years, and 6 aged 12–14 years. A total of 141 children did not report any side effects. This relationship was statistically significant (p = 0.001). Among those experiencing side effects, constipation was reported by 1 child aged 6–59 months, 4 aged 5–11 years, and 5 aged 12–14 years. Stomach upset occurred in 2, 3, and 5 respectively. Nausea was reported in 1 child aged 6–59 months, 2 in 5–11 years, and 4 in 12–14 years. Dark stools were seen in 3 children aged 6–59 months, 6 aged 5–11 years, and 6 aged 12–14 years. Diarrhea was least common, with only 1 child in 5–11 years and 3 in the oldest group. All were statistically significant (p = 0.001). Intravenous (IV) iron therapy had been administered to 30 children aged 6–59 months, 11 aged 5–11 years, and 10 aged 12–14 years. A total of 109 participants had not received IV iron. This association was highly significant (p = 0.001). Among types of IV iron used, iron sucrose was the most frequently reported (26 in 6–59 months, 9 in 5–11 years, and 7 in 12–14 years), followed by ferric carboxymaltose (1 each across all age groups), and sodium ferric gluconate (1 in 5–11 years, 2 in 12–14 years). A few children received "Other" formulations. This was statistically significant (p = 0.001). Regarding the number of IV sessions, 1–2 sessions were most common (24, 7, and 3 respectively), followed by 3–4 sessions (4, 2, and 5). No children received more than 4 sessions, and many cases had unknown session counts (62, 49, and 4). This was statistically significant (p = 0.001). Response to IV iron therapy showed significant improvement in 9 children aged 6–59 months, 4 in 5–11 years, and 6 in 12–14 years. Moderate improvement was reported by 21, 7, and 4 respectively. A few responses were unknown. This association was significant (p = 0.001). Future treatment plans included continued oral iron for 51 children aged 6–59 months, 24 in 5–11 years, and 7 in 12–14 years. IV iron was planned for 14, 4, and 3 respectively. Very few children were marked as needing no further treatment, while a significant number had unknown plans. This association was statistically significant (p = 0.004). Blood transfusion had been administered to 20 children aged 6–59 months, 7 aged 5–11 years, and 10 aged 12–14 years. A total of 123 children had not received a transfusion. This association was highly significant (p = 0.001). Iron plus Vitamin C therapy was being given to 81 children aged 6–59 months, 54 aged 5–11 years, and 11 aged 12–14 years, with 14 not receiving this combination. No significant association was found (p = 0.807). Regarding the form of Vitamin C, liquid form was most common among younger children (75 in 6–59 months, 12 in 5–11 years, 3 in 12–14 years). Chewable tablets were used more in the older groups (4, 21, and 5 respectively), while 3 children in the youngest group and 18 in 5–11 years used regular tablets. A few used other forms. This was statistically significant (p = 0.001). Vitamin C dosage was unknown in nearly all cases (87,

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57, and 12). A few children received 50–100 mg/day (3 in 6–59 months, 1 in 5–11 years), and none were reported to take higher doses. This was not statistically significant (p =0.702). Regarding response to iron + Vitamin C therapy, significant improvement was observed in 39 children aged 6–59 months, 34 aged 5–11 years, and 4 aged 12–14 years. Moderate improvement was seen in 43, 19, and 7 respectively. A few children (5 each in the first two age groups) showed no improvement. This association was not statistically significant (p = 0.136). Side effects of the iron + Vitamin C combination therapy were reported by 11 children aged 6–59 months, 8 aged 5–11 years, and 7 aged 12–14 years, while 134 children reported no side effects. This association was significant (p = 0.001). Among side effects, stomach upset occurred in 6 children aged 6–59 months, 4 in 5–11 years, and 4 in 12–14 years. Nausea was rare (1 in 5–11 years, 1 in 12–14 years). Constipation was reported by 9 children aged 6–59 months, 3 in 5–11 years, and 2 in 12–14 years. Diarrhea was not explicitly recorded in this section. This association was statistically significant (p = 0.001). A detailed description is given in Table 8 below;

Table 8. Age Verses Treatment

Variables regarding Treatment		Age			P-Value
		6-59 months	5-11 years	12-14 years	
Is the child currently on oral iron supplements	Yes	63	52	7	0.007
	No	27	6	5	
Type of oral iron supplement	Ferrous sulfate	0	3	4	0.001
	Ferrous gluconate	0	2	1	
	Ferrous fumarate	25	16	0	
	Other	65	37	7	
Dosage of oral iron	1–2 mg/kg/day	0	1	0	0.638
	3–5 mg/kg/day	1	0	0	
	6 mg/kg/day	0	0	0	
	Unknown	89	57	12	
Side effects of oral iron	Yes	4	9	6	

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	No	86	49	6	0.001
If yes, side effects observed: Constipation	Yes	1	4	5	0.001
	No	89	54	6	
Stomach upset	Yes	2	3	5	0.001
	No	88	55	7	
Dark stool	Yes	3	6	6	0.001
	No	87	52	6	
Diarrhea	Yes	0	1	3	0.001
	No	90	57	9	
IV Treatment: Has the child received IV iron therapy?	Yes	30	11	10	0.001
	No	60	47	2	
Type of IV iron therapy	Iron sucrose	26	9	7	0.001
	Ferric carboxymaltose	1	1	1	
	Sodium ferric gluconate	0	1	2	
	Other	4	0	1	
	No	59	47	1	
Number of IV sessions	1–2	24	7	3	0.001
	3–4	4	2	5	
	>4	0	0	0	
	Unknown	62	49	4	
	No	89	56	8	

3.6.4. Gender verses Disease Characteristics

Out of the total participants, iron deficiency anemia was diagnosed in 85 males and 55 females. Only 9 children (5 males and 4

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females) had not been diagnosed. No significant association was observed between gender and diagnosis (p = 0.966). This association was not significant. Regarding duration of symptoms, 44 males and 33 females had symptoms for 1–3 months. Symptoms for less than 1 month were reported by 33 males and 25 females. A smaller number experienced symptoms for 4–6 months (11 males, 8 females) or more than 6 months (2 males, 4 females). The association with gender was not significant (p = 0.721). When considering the initial cause of IDA, poor diet was reported in 39 males and 40 females. Malabsorption was noted in 39 males and 26 females. Chronic blood loss occurred in 10 males and 4 females, while increased need for iron was rarely cited, only among 2 males. This association was not statistically significant (p = 0.190). Premature birth was reported in 4 males and 4 females. A total of 152 children (87 males and 65 females) were not born prematurely. This difference was not significant (p = 0.486). Low birth weight was experienced by 30 males and 23 females. A total of 107 participants (60 males and 47 females) did not report low birth weight. This was not statistically significant (p = 0.949). Poor nutrition as a risk factor was reported in 38 males and 45 females, while 77 children (52 males and 25 females) did not report it. This association was statistically significant (p = 0.006). Frequent infections were noted in 25 males and 24 females, while 111 participants (65 males and 46 females) did not report infections. No significant association was observed (p = 0.376). Blood loss was reported in 11 males and 3 females. A total of 146 children (79 males and 67 females) did not report blood loss. This was not statistically significant (p = 0.780). Malabsorption issues were seen in 42 males and 25 females. A total of 93 children (48 males and 45 females) did not report malabsorption. No significant association was found (p = 0.164). All participants were exposed to at least one known risk factor. None were categorized as having "none of these." A total of 90 children had at least one identifiable risk factor. A detailed description is given in Table 9 below;

Table 9. Gender verses Disease Characteristics

Variables regarding Disease Characteristics		Gender		P-Value
		Male	Female	
Has the child been diagnosed with iron deficiency anemia?	Yes	85	55	0.996
	No	5	4	
Duration of symptoms	Less than 1 month	33	25	0.721
	1–3 months	44	33	
	4–6 months	11	8	

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	More than 6 months	2	4	
Initial cause of IDA (if known)	Poor diet	39	40	0.190
	Chronic blood loss	10	4	
	Malabsorption	39	26	
	Increased need for iron	2	0	
Risk factors experienced: Premature birth	Yes	4	4	0.486
	No	87	65	
Low birth weight	Yes	30	23	0.949
	No	60	47	
Poor nutrition	Yes	38	45	0.006
	No	52	25	
Frequent infections	Yes	25	24	0.376
	No	65	46	
Blood loss	Yes	11	3	0.78
	No	79	67	
Malabsorption issues	Yes	42	25	0.164
	No	48	45	
None of these	Yes	0	0	
	No	90	70	

3.6.5. Gender verses Diagnostic Criteria

In terms of serum ferritin levels, 87 males and 68 females had levels below normal. Only 4 participants (3 males and 1 female) had normal ferritin levels. No cases were reported with above-normal ferritin levels. This difference between genders was not statistically significant ($p = 0.395$). Hemoglobin levels were below normal in 87 males and 68 females. Four

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participants (2 males and 2 females) had normal hemoglobin, and none had levels above normal. The association between gender and hemoglobin status was not significant (p = 0.656). Regarding mean corpuscular volume (MCV), 89 males and 68 females had levels below normal. Only 2 children (1 male and 1 female) had normal MCV, and one female's test was not performed. This association was not statistically significant (p = 0.514). For hematocrit levels, 85 males and 68 females had values below normal. A total of 6 participants (5 males and 1 female) had normal hematocrit, while one test in a female participant was not performed. This association also showed no statistical significance (p = 0.212). In terms of mean corpuscular hemoglobin (MCH), 89 males and 68 females had levels below normal. One male had normal MCH, and one female's test was not performed. This was not statistically significant (p = 0.339). The severity of anemia, based on hemoglobin concentration, showed that mild anemia (Hb between normal and 10 g/dL) was reported in 34 males and 19 females. Moderate anemia (Hb 10–7 g/dL) was seen in 33 males and 36 females, while severe anemia (Hb <7 g/dL) was present in 23 males and 15 females. No significant association was observed between gender and anemia severity (p = 0.164). A detailed description is given in Table 10 below;

Table 10. Gender verses Diagnostic Criteria

Variables regarding Diagnostic criteria		Gender		P-Value
		Male	Female	
Serum Ferritin	Below normal	87	68	0.395
	Normal	3	1	
	Above normal	0	0	
Hb level	Below normal	87	68	0.656
	Normal	2	2	
	Above normal	0	0	
Hematocrit level MCV level	Below normal	89	68	0.514
	Normal	1	1	
	Not performed	0	1	
Hematocrit level MCV level	Below normal	85	68	0.212
	Normal	5	1	
	Not performed	0	1	

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MCH Level	Below normal	89	68	0.339
	Normal	1	0	
	Not performed	0	1	
Severity of anemia: Reference range (Hb concentration)	Mild (normal to 10 g/dl)	34	19	0.164
	Moderate (10 to 7 g/dl)	33	36	
	Severe (<7.0 g/dl)	23	15	

3.6.6. Gender verses Treatment

Oral iron supplements were being administered to 58 male and 54 female children. A total of 38 children (22 males and 16 females) were not receiving oral iron. No statistically significant association was found (p = 0.815). Among the types of oral iron supplements used, "Other" types were most common—reported in 61 males and 48 females. Ferrous fumarate was taken by 26 males and 15 females. Ferrous sulfate was used by 1 male and 6 females, while ferrous gluconate was reported by 2 males and 1 female. This distribution showed no significant difference by gender (p = 0.112). Regarding dosage, only one male participant each received 1–2 mg/kg/day and 3–5 mg/kg/day. The vast majority had unknown dosage values (88 males and 70 females). This association was not significant (p = 0.455). Side effects of oral iron were reported in 11 males and 8 females. A total of 141 children did not report side effects. This association was not statistically significant (p = 0.878). Among those reporting side effects, constipation was noted in 5 males and 6 females (p = 0.455). This association was not significant. Stomach upset was reported by 5 males and 5 females (p = 0.681). This association was not significant. Nausea occurred in 3 males and 4 females (p = 0.465). This association was not significant. Dark stools were observed in 10 males and 5 females (p = 0.393). This association was not significant. Diarrhea was reported in 1 male and 3 females (p = 0.202). This association was not significant. Intravenous (IV) iron therapy had been administered to 29 male and 22 female participants, while 109 children (61 males and 48 females) had not received IV therapy. This difference was not statistically significant (p = 0.915). Among the types of IV iron therapy used, iron sucrose was administered to 24 males and 18 females. Ferric carboxymaltose was used in 3 males and none of the females. Sodium ferric gluconate was used in 3 females and none of the males. "Other" types were used in 4 males and 1 female. No significant association was observed (p = 0.116). The number of IV sessions was 1–2 in 22 males and 12 females. Between 3–4 sessions were reported in 6 males and 5 females. No participant received more than 4 sessions. The number of sessions was unknown for 63 males and 52 females. The association

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was not statistically significant (p = 0.444). Regarding response to IV therapy, significant improvement was noted in 15 males and 4 females. Moderate improvement was seen in 14 males and 18 females. No participant reported a lack of improvement. Three responses were unknown (2 males and 1 female). For future treatment plans, oral iron was planned to continue in 44 males and 38 females. IV iron therapy was planned in 13 males and 8 females. Two males were considered to need no further treatment. The treatment plan was unknown for 31 males and 24 females. This difference was not statistically significant (p = 0.562). Blood transfusion had been received by 20 males and 17 females, while 123 children (70 males and 53 females) had not received a transfusion. This association was not significant (p = 0.759). Iron with Vitamin C therapy was being given to 80 males and 56 females. A total of 14 children (10 males and 4 females) were not receiving this combination. The association with gender was not statistically significant (p = 0.231). Regarding the form of Vitamin C used, the liquid form was most common and reported by 48 males and 42 females. Chewable tablets were used by 16 males and 14 females, regular tablets by 17 males and 7 females, and other forms by 9 males and 7 females. No significant association was found (p = 0.477). The dosage of Vitamin C was unknown in 89 males and 67 females. Only four participants (1 male and 3 females) reported receiving 101–200 mg/day. No children received dosages above 200 mg/day. This association was not significant (p = 0.202). Significant improvement with iron and Vitamin C therapy was reported by 47 males and 30 females. Moderate improvement was seen in 31 males and38 females. No improvement was reported in 9 males and 2 females. This association was statistically significant (p = 0.023). Side effects of the iron and Vitamin C combination were reported in 11 males and 15 females, while 134 children (79 males and 55 females) did not experience any side effects. This difference was not statistically significant (p = 0.117). Among those reporting side effects, stomach upset was reported in 1 male and 9 females, showing a significant association (p = 0.014). Nausea was reported in 2 males only. Constipation was reported by 8 males and 6 females. Diarrhea was not reported by any participants. A detailed description is given in Table 11 below;

Table 11. Gender verses Treatment

Variables regarding Treatment		Gender		P-Value
		Male	Female	
Is the child currently on oral iron supplements?	Yes	58	54	0.815
	No	22	16	
Type of oral iron supplement	Ferrous sulfate	1	6	0.112
	Ferrous gluconate	2	1	
	Ferrous fumarate	26	15	
	Other:	61	48	

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Dosage of oral iron	1–2 mg/kg/day	1	0	0.455
	3–5 mg/kg/day	1	0	
	6 mg/kg/day	0	0	
	Unknown	88	70	
Side effects of oral iron	Yes	11	8	0.878
	No	79	62	
If yes, side effects observed: Constipation	Yes	5	6	0.455
	No	85	64	
Stomach upset	Yes	5	5	0.681
	No	85	65	
Nausea	Yes	3	4	0.465
	No	87	66	
Dark stool	Yes	10	5	0.393
	No	80	65	
Diarrhea	Yes	1	3	0.202
	No	89	67	
IV Treatment: Has the child received IV iron therapy?	Yes	29	22	0.915
	No	61	48	
Type of IV iron therapy	Iron sucrose	24	18	0.116
	Ferric carboxymaltose	3	0	
	Sodium ferric gluconate	0	3	
	Other	4	1	

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	No	59	48	

3.6.7. Birth weight verses Disease Characteristics

Based on birth weight categories, 48 children with low birth weight, 102 with normal weight, and 1 with high weight were diagnosed with iron deficiency anemia. Only 9 children (8 low birth weight, 1 normal weight) were not diagnosed. A significant association was observed (p = 0.002). Symptom duration varied, with most cases under 1–3 months: 17 low birth weight, 41 normal; and longer durations like 4–6 months were reported by 5 low, 13 normal, and 1 high weight child. This association was significant (p = 0.019). For the initial cause of IDA, poor diet was most common (24 low, 55 normal). Malabsorption was reported in 25 low and 40 normal weight children. Chronic blood loss was noted across all groups. A significant association was observed (p = 0.019). Premature birth occurred in 6 low and 2 normal weight children (p = 0.170). This association was not significant. Low birth weight itself was highly associated with IDA (p = 0.001). Poor nutrition was reported in 24 low and 59 normal weight children, but not significantly associated (p = 0.128). Frequent infections were significantly associated (p = 0.006), seen in 26 low and 23 normal weight cases. Blood loss also showed a significant association (p = 0.002), reported in 7 low, 6 normal, and 1 high weight child. Malabsorption issues were common (26 low, 41 normal) but not significantly associated (p = 0.502). All children had identifiable risk factors none reported "none of these." A detailed description is given in Table 12 below;

Table 12. Birth weight Verses Disease Characteristics

Variables regarding Disease Characteristics		Birth weight			P-Value
		Low (<2.5 kg)	Normal (2.5–4.0 kg)	High (>4.0 kg)	
Has the child been diagnosed with iron deficiency anemia?	Yes	48	102	1	0.002
	No	8	1	0	
Duration of symptoms	Less than 1 month	17	41	0	0.019
	1–3 months	29	48	0	
	4–6 months	5	13	1	
	More than 6	5	1	0	

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	months				
Initial cause of IDA (if known)	Poor diet	24	55	0	0.019
	Chronic blood loss	5	8	1	
	Malabsorption	25	40	0	
	Increased need for iron	2	0	0	
Risk factors experienced: Premature birth	Yes	6	2	0	0.170
	No	50	100	1	
Low birth weight	Yes	49	4	0	0.001
	No	7	99	1	
Frequent infections	Yes	26	23	0	0.006
	No	30	60	1	
Blood loss	Yes	7	6	1	0.002
	No	49	97	0	
Malabsorption issues	Yes	26	41	0	0.502
	No	30	62	1	
None of these	Yes	0	0	0	0.160
	No	56	103	1	
Poor nutrition	Yes	24	59	0	0.128
	No	32	44	1	

3.6.8. Birth weight verses Diagnostic criteria

Among children with low birth weight (<2.5 kg), 55 had serum ferritin levels below normal, while 99 normal weight children and 1 high birth weight child also showed low levels. Only 4 children (1 low and 3 normal weight) had normal ferritin values. There was no statistically significant association between birth weight and serum ferritin levels (p = 0.941). Hemoglobin levels were below normal in 54 low birth weight children, 101 normals, and none from the

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high birth weight category. Only four children (2 from each low and normal weight groups) had normal hemoglobin levels. This association was statistically significant (p = 0.001). Regarding hematocrit levels, 54 children in the low-birth-weight group, 102 in the normal group, and 1 in the high weight group had values below normal. Only two children had normal levels, one each from the low and normal categories. The difference was not statistically significant (p = 0.720). In terms of mean corpuscular volume (MCV), 54 children with low birth weight, 98 with normal weight, and 1 with high weight had values below normal. Six children had normal MCV levels, with 1 low and 5 normal birth weight cases. No significant association was observed (p = 0.589). For mean corpuscular hemoglobin (MCH), 55 children in the low-birth-weight group, 101 in the normal group, and 1 in the high group had values below normal. Only one child from the normal weight group had normal MCH. The difference was not statistically significant (p = 0.813). The severity of anemia, based on hemoglobin concentration, showed that mild anemia (Hb from normal to 10 g/dL) was observed in 9 low birth weight and 44 normal weight children. Moderate anemia (Hb 10 to 7 g/dL) was most common, with 33 low and 36 normal weight cases. Severe anemia (Hb <7.0 g/dL) was noted in 14 low, 23 normal, and 1 high birth weight child. This association between birth weight and anemia severity was statistically significant (p = 0.003). A detailed description is given in Table 13 below;

Table 13. Birth weight verses Diagnostic criteria

Variables regarding Diagnostic criteria		Birth weight			P-Value
		Low (<2.5 kg)	Normal (2.5-4 kg)	High (>4 kg)	
Serum Ferritin	Below normal	55	99	1	0.941
	Normal	1	3	0	
Hb level	Below normal	54	101	0	0.001
	Normal	2	2	0	
Hematocrit level	Below normal	54	102	1	0.720
	Normal	1	1	0	

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MCV level	Below normal	54	98	1	0.589
	Normal	1	5	0	
MCH Level	Below normal	55	101	1	0.813
	Normal	0	1	0	
Severity of anemia: Reference range	Mild (normal to 10 g/dl)	9	44	0	0.003
(Hb concentration)	Moderate (10 to 7 g/dl)	33	36	0	0.002
	Severe (<7.0 g/dl)	14	23	1	

3.6.9. Birth weight verses Treatment

Among children with low birth weight (<2.5 kg), 42 were receiving oral iron supplements, compared to 80 with normal weight and none in the high birth weight category. A total of 38 children (14 low, 23 normal, and 1 high birth weight) were not on supplements. No significant association was observed (p = 0.185). Ferrous fumarate and other types were the most commonly used oral iron supplements. Ferrous sulfate was used only among low-birth-weight children (7 cases), while ferrous fumarate was reported in 13 low and 28 normal weight cases. The majority received other types—34 low, 74 normal, and 1 high birth weight child. This association was statistically significant (p = 0.016). Regarding dosage, only one child each in the normal weight group received 1–2 mg/kg/day or 3–5 mg/kg/day. The dosage was unknown for the vast majority (56 low, 121 normal, and 1 high birth weight child). The association was not significant (p = 0.891). Side effects from oral iron therapy were reported by 12 children with low birth weight and 7 with normal weight. A total of 141 children did not report side effects. The difference was statistically significant (p = 0.023). Among those reporting side effects, constipation was more common among low-birth-weight children (9 cases compared to 2 normal weight children), with a significant association (p = 0.003). Stomach upset and nausea were also more frequent in low-birth-weight children, both statistically significant with p-values of 0.001, respectively. Dark stool and diarrhea were not significantly associated (p = 0.101 and p =

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0.236, respectively). IV iron therapy was received by 26 low, 24 normal, and 1 high birth weight child. A total of 109 children had not received IV iron therapy (p = 0.004). This association was significant. Among types of IV iron, iron sucrose was used in 18 low, 23 normal, and 1 high birth weight child. Other forms included ferric carboxymaltose and sodium ferric gluconate, use exclusively in low-birth-weight cases. The association was significant (p = 0.011). As for the number of IV sessions, 1–2 sessions were most common (16 low, 17 normals, 1 high). Some children had 3–4 sessions, while none received more than four. The association was not statistically significant (p = 0.096). A significant improvement with IV therapy was reported in 13 low and 6 normal weight children. Moderate improvement was seen in 13 low, 18 normal, and 1 high weight child. No one reported no improvement. Three responses were unknown. This association was statistically significant (p = 0.010). Regarding future treatment, 32 low, 49 normal, and 1 high birth weight child were to continue with oral iron. IV iron was planned for 11 low and 10 normal weight children, while 2 low birth weight children needed no further treatment. The plan was unknown in 11 low and 44 normal weight children. This association was statistically significant (p = 0.034). Blood transfusion had been administered to 20 low, 16 normal, and 1 high birth weight child, while 123 children had not received transfusions. This was statistically significant (p = 0.003). Iron + Vitamin C supplementation was being used by 51 low, 94 normal, and 1 high birth weight child. A total of 14 children (5 low and 9 normal) were not on this regimen. The association was not statistically significant (p = 0.952). Regarding the form of Vitamin C, liquid form was most common (38 low and 52 normal weight children). Tablets and chewable forms were also used, while 4 low and 12 normal weight children took other forms. No significant association was found (p = 0.106). Vitamin C dosage was unknown in nearly all children (54 low, 101 normal, and 1 high birth weight). Only 4 children received 101–200 mg/day. No participants received more than 200 mg/day. The association was not statistically significant (p = 0.810). Significant improvement with iron + Vitamin C therapy was reported in 25 low and 52 normal weight children. Moderate improvement was seen in 27 low, 41 normal, and 1 high birth weight child. Three low and 8 normal weight children reported no improvement. This association was not significant (p = 0.870). Side effects from the combination therapy were reported in 15 low and 11 normal weight children, while 134 children did not experience side effects. This difference was statistically significant (p = 0.029). Among the specific side effects, stomach upset in low-birth-weight children's was observed in 7 children's whereas 3 children's with normal birth weight also reported, though not statistically significant (p = 0.098). Nausea was reported only in 2 low birth weight children. Constipation was observed in 6 low and 8 normal birth weight children. No cases of diarrhea were reported. A detailed description is given in Table 14 below;

Table 14. Birth weight verses Treatment

Treatment Variables		Birth weight			P-Value
		Low (<2.5 kg)	Normal (2.5–4.0 kg)	High (>4.0 kg)	
Is the child currently on oral iron	Yes	42	80	0	0.185
	No	14	23	1	

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supplements?					
Type of oral iron supplement	Ferrous sulfate	7	0	0	0.016
	Ferrous gluconate	2	1	0	
	Ferrous fumarate	13	28	0	
	Other	34	74	1	
Dosage of oral iron	1–2 mg/kg/day	0	1	0	0.891
	3–5 mg/kg/day	0	1	0	
	6 mg/kg/day	0	0	0	
	Unknown	56	121	1	
Side effects of oral iron	Yes	12	7	0	0.023
	No	44	96	1	
If yes, side effects observed: Constipation	Yes	9	2	0	0.003
	No	47	101	1	
Stomach upset	Yes	10	0	0	0.001
	No	46	103	1	
Nausea	Yes	7	0	0	0.001
	No	49	103	1	
Dark stool	Yes	9	6	0	0.101
	No	47	97	1	
Diarrhea	Yes	3	1	0	0.236
	No	53	102	1	
IV Treatment: Has the child received IV iron therapy?	Yes	26	24	1	0.004
	No	30	79	0	
	Iron sucrose	18	23	1	

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Type of IV iron therapy	Ferric carboxymaltose	3	0	0	0.011
	Sodium ferric gluconate	3	0	0	
	Other	3	2	0	
	No	29	78	0	
Number of IV session	1–2	16	17	1	0.096
	3–4	5	6	0	
	>4	0	0	0	
	Unknown	35	80	0	
Response to IV therapy	Significant improvement	13	6	0	0.010
	Moderate improvement	13	18	1	

4.0. DISCUSSION

In the present study, out of 160 children, 56.3% were males and 43.8% were females. This gender pattern is consistent with previous research that also observed a higher prevalence of IDA in male children during early childhood. For instance, a retrospective study conducted in Korea found that IDA was most commonly reported in boys aged 6 to 23 months [11]. Similarly, another study reported a higher rate of IDA among male children (60.12%), although the overall prevalence was ultimately higher in females. These mixed results indicated that while male children may initially present in greater numbers, gender-related risk can vary depending on age and region [12]. The majority of children in this study (56.3%) were between 6–59 months of age, followed by 36.3% aged 5–11 years and only 7.5% aged 12–14 years. This age pattern reflected a higher risk of iron deficiency in younger children, consistent with literature highlighted that children under five are more vulnerable due to increased iron requirements during rapid growth phases. A cross-sectional study show similar findings were reported that IDA prevalence was highest in the 1–5 years age group [13-15]. The study also reported the low birth weight (<2.5 kg) in 35% of the children. This is a notable risk factor, as consistent with earlier findings that associate low birth weight with inadequate iron stores at birth and poor compliance with iron supplementation. Similar findings were reported that LBW infants often fail to receive adequate iron through diet or supplements, making them more prone to severe forms of anemia [16, 17]. Geographically, 86.9% of this study participants were from urban areas, while only 12.5% were from rural backgrounds. Although rural children are often considered at

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higher risk due to limited resources, similar findings have been reported in a study conducted in Egypt, where urban children and those with educated mothers showed a higher prevalence of IDA, possibly due to dietary patterns and lifestyle choices. In contrast, a cross-sectional descriptive study was conducted in Pakistan which report a higher burden of IDA among rural and low-income populations, suggesting that both urban and rural groups can be at risk depending on local context [18]. In the present study, a high proportion of children (94.4%) were diagnosed with iron deficiency anemia (IDA), reflecting a significant burden of the condition in the study population. This finding is consistent with results from multiple regional studies. For instance, a cross-sectional study conducted at a tertiary hospital in Rawalakot, Azad Kashmir, reported an IDA prevalence of 54.5% among hospitalized children [19], while another cross-sectional study in Karachi reported an even higher prevalence in certain age groups, especially among females. The considerably higher rate observed in this study may be due to targeted sampling of already symptomatic or anemic children. In terms of symptom duration, most children (48.1%) had experienced symptoms for 1–3 months, while 36.3% had symptoms for less than a month. A cross-sectional descriptive study shows only a small proportion (15.7%) reported symptoms lasting longer than three months. These findings highlighted the potential for delayed recognition and management of IDA. Similar findings are reported that importance of early detection and intervention in children presenting with non-specific symptoms such as pallor, fatigue, and irritability symptoms that often go unnoticed until anemia becomes moderate to severe [20]. According to present study finding regarding the underlying causes of IDA, poor diet was the leading cause (49.4%), followed by malabsorption (40.6%) and chronic blood loss (8.8%). This finding is consistent with findings from multiple studies. It is found that 72% of IDA cases in Bangladeshi children were due to poor dietary iron intake, while identified dietary deficiency and maternal anemia as key contributors Similarly, in a cross-sectional study it was noted that high consumption of milk and tea, combined with low intake of leafy greens and meat, increased the risk of IDA in Sri Lankan children. These results reinforced the need for dietary education and public health efforts focused on nutritional improvement [21].

Analysis of risk factors conducted in this study showed that poor nutrition was present in 51.9% of children, followed by malabsorption in 41.9%, low birth weight in 33.1%, frequent infections in 30.6%, and blood loss in 8.8%. Premature birth was also reported in 5% of children. These findings are consistent with findings of a cross-sectional study which reported that malnutrition, parasitic infections, and poor dietary habits significantly contributed to IDA in school-aged Egyptian children Moreover, the high rate of low birth weight as a contributing factor aligned with the findings that low-birth-weight infants are at heightened risk due to inadequate iron reserves and poor adherence to supplementation. Additionally, another cross-sectional study identified that maternal anemia and frequent infections as significant associated factors, further supporting the multifactorial nature of IDA observed in this study [22].

In the current study, the most frequently reported systemic symptom among children with iron deficiency anemia (IDA) was fatigue or weakness, found in 93.8% of participants. Other common symptoms included fainting (80.6%), irritability (65.6%), and lethargy or reduced activity (28.1%). These findings are consistent with previous observational narrative review which have identified fatigue, pallor, and irritability as hallmark signs of IDA in pediatric populations. Furthermore, another study noted that fatigue, pallor, and poor feeding behavior are commonly reported, especially in younger children. The high frequency of fainting episodes in this study reflected the presence of moderate-to-severe

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anemia among participants, emphasizing the urgent need for early diagnosis and intervention. Cardiovascular manifestations were also evident, with 59.4% of children experiencing tachycardia, 20.6% reporting palpitations, and a smaller proportion showing chest pain (11.9%) and low blood pressure (15.0%). Similar findings were reported in an observational narrative review, which highlighted that moderate-to-severe IDA can affect cardiovascular function, sometimes leading to compensatory mechanisms such as tachycardia and hypotension [23]. Similarly, a cross-sectional descriptive study also noted cardiovascular symptoms, particularly in cases where anemia had persisted for several months without appropriate treatment [24].

In this study respiratory symptoms were present in a substantial portion of the children, with 78.1% experiencing shortness of breath with exertion, and 26.9% reporting breathlessness even at rest. Tachypnea was observed in 30.6% of the participants. These symptoms are often underreported but can reflect compensatory respiratory responses to low oxygen-carrying capacity in the blood. Similar findings are reported in a cross-sectional study which identified respiratory distress and rapid breathing as notable features among Egyptian school children diagnosed with IDA [25]. Gastrointestinal complaints were also prevalent in this study, with poor appetite affecting 65.6% of children, difficulty swallowing in 31.3%, glossitis in 23.8%, and abdominal discomfort in approximately one-fifth of the group. These findings are consistent with cross-sectional study which reported that children with IDA often present with reduced appetite and oral or abdominal symptoms, especially when iron deficiency becomes chronic. The appearance of glossitis and swallowing difficulties further supported the systemic impact of iron depletion on mucosal health [26].

In this study skin-related manifestations such as pallor (65%), dry or flaky skin (30.6%), brittle nails (26.3%), and jaundice (17.5%) were also reported. These symptoms are consistent with classical dermatological features of IDA. Koilonychia, or spoon-shaped nails, observed in over a quarter of the children, has long been recognized as a physical sign of iron deficiency. These findings mirror those in cross sectional study that emphasized the clinical relevance of such observable signs for early screening in low-resource settings [27]. Musculoskeletal complaints, including muscle weakness and cramping (both 64.4%), and unusual tiredness after physical activity (54.4%), were also prominent. These results are aligned with a cross-sectional descriptive study findings observed similar functional impairments in children with severe anemia, particularly those with low birth weight and poor dietary compliance. Generalized body pain, reported in 45.6%, further highlighted the systemic toll of iron deficiency [28]. Neurological and behavioral symptoms were also significantly reported, with headaches (70.6%), dizziness (70%), and difficulty concentrating (49.4%) being particularly notable. These findings are consistent with the study which demonstrated significantly lower cognitive performance in children with IDA compared to non-anemic peers [29]. Additionally, 25.6% of children in the cross-sectional study reported restlessness or anxiety, a trend also observed by Betsy Lozoff and Sunil Sazawal (2007), who linked IDA in preschool-aged children with altered emotional regulation and higher wariness in social settings [30].

Finally, when examining medical history, 28.1% of the children had frequent infections, 8.1% had past gastrointestinal issues, and 31.3% had a previous history of anemia. These findings support earlier reports which highlighted a strong association between recurrent infections, maternal anemia, and previous episodes of IDA. Notably, no children in this study reported an absence of any contributing symptoms or conditions, emphasizing the multifactorial nature of pediatric IDA [31]. Laboratory analysis in this study revealed that hemoglobin levels were below

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normal in 97.5% of children, confirming a high burden of anemia. Hematocrit was also reduced in 98.8% of cases, while mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) were below normal in 96.3% and 99.4% of children, respectively. These hematological parameters are hallmark indicators of microcytic hypochromic anemia, commonly seen in iron deficiency. Similar findings are reported, which found a significant proportion of school children presenting with low MCV and MCH, along with reduced hemoglobin and hematocrit levels, confirming IDA based on WHO criteria [32].

Despite these abnormal red cell indices, more specific confirmatory tests such as serum iron, total iron-binding capacity (TIBC), transferrin saturation, and stool for occult blood were not conducted in any of the cases. Reticulocyte count was also missing in 99.4% of cases. These gaps in diagnostic evaluation point to limitations in healthcare resources or practices in the settings where the study was conducted. This limitation is consistent with findings, who highlighted the reliance on cost-effective indices like the Mentzer Index in resource-limited settings, especially where confirmatory tests like serum ferritin or transferrin saturation are not routinely accessible. The absence of peripheral blood smear examination in all cases further underscores the need for improved diagnostic protocols [33]. In terms of anemia severity, 43.1% of children had moderate anemia, followed by 33.1% with mild anemia and 23.8% with severe anemia. These severity levels reflected a substantial public health concern and are comparable to the distribution found in the study, where moderate-to-severe cases made up the majority of their sample [34]. Likewise, the study conducted in Bangladesh reported that 65% of children had mild anemia, but a significant number also progressed to more severe stages due to lack of early intervention. These similarities further validated the severity profile observed in the current research. Overall, while basic hematological testing (such as CBC) was conducted applied in this study, whereas the lack of comprehensive iron studies and confirmatory diagnostics indicated a gap between identification and definitive diagnosis of IDA. This emphasized the need for capacity-building in laboratory infrastructure and clinician training to ensure thorough assessment and classification of iron deficiency anemia [35].

In the present study, 76.3% of children were currently receiving oral iron therapy, with ferrous fumarate being the most commonly used formulation (25.6%). However, a large number of caregivers (98.8%) were unaware of the correct dosage, and only 0.6% reported administration within recommended dosage ranges. These findings indicated a significant gap in treatment literacy among caregivers. Similar findings are reported in a study which reported that poor parental awareness and irregular supplementation as contributing factors to ongoing iron deficiency in Bangladeshi children. Furthermore, another study emphasized that although oral iron remains the first-line therapy, its effectiveness depends heavily on proper dosing and adherence, which are often lacking in real-world settings [36]. According to present study findings side effects of oral iron therapy were reported in 11.9% of the children, with constipation, stomach upset, and dark stools being the most common. These adverse effects may contribute to poor compliance, especially in younger age groups. This is consistent with the meta-analysis, which found that despite the superior efficacy of daily dosing, gastrointestinal side effects frequently limit adherence, particularly when not properly managed with dietary counseling or alternate formulations. Intravenous (IV) iron therapy had been administered to 31.9% of the children. Iron sucrose was the predominant IV formulation used (56.3%), and most caregivers were unaware of the number of sessions administered. Regarding response, 11.9% showed significant improvement, while 20% had moderate improvement. The remaining

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majority either had no known outcome or were not treated. These trends reflected both the increasing role of parenteral iron in moderate-to-severe cases and a lack of follow-up or understanding among caregivers. Similar findings are reported in hospital-based studies, which emphasized that while IV iron is effective, it is often used without adequate monitoring or education on response assessment [37]. Only 23.1% of children in the current study had received a blood transfusion, typically reserved for severe anemia cases or when oral and IV iron were ineffective or not tolerated. These findings are aligned with clinical protocols and is supported by the retrospective analysis, which that noted transfusions were most commonly indicated for hemoglobin levels under 6 g/dL or in symptomatic children unresponsive to iron therapy [38]. Vitamin C supplementation alongside iron was used in 91.3% of cases, primarily in liquid form (56.3%). However, only 2.5% of caregivers knew the correct dosage, again highlighting knowledge gaps. The use of Vitamin C is pharmacologically justified, as it enhances non-heme iron absorption in the gastrointestinal tract. This practice has been emphasized in the review, which recommended Vitamin C co-administration as a standard part of therapy, particularly in vegetarian or low-meat diets where non-heme iron predominates. In terms of response to iron and Vitamin C therapy, 48.1% of children showed significant improvement, while 43.1% reported moderate improvement. This favorable response is consistent with pilot exploratory study, which support the role of combined nutritional interventions in promoting hemoglobin recovery and reducing the duration of iron deficiency. However, 8.8% showed no improvement, likely due to underlying malabsorption or non-compliance. Furthermore, the present study reported side effects from iron and Vitamin C combination therapy being relatively low (16.3%), with constipation, stomach upset, and nausea being the most common. Although being mild but these symptoms can still impact adherence. which have been supported by Meta analyses emphasized the proactive education on expected side effects and strategies for minimizing discomfort (e.g., dosing with food, alternating formulations) as key to improve adherence.

5.0. CONCLUSION

Based on the results of the study, it is concluded that iron deficiency anemia (IDA) is highly prevalent among children, with 94.4% of participants diagnosed with the condition. Most affected children were from urban areas and had a normal birth weight. The common age group was between 6–59 months, and males were slightly more affected than females. The majority of children experienced symptoms like fatigue, shortness of breath, dizziness, and poor appetite, indicating a wide range of general, cardiovascular, respiratory, gastrointestinal, and neurological manifestations. Poor diet and malabsorption were identified as the leading causes of IDA, while common risk factors included poor nutrition, low birth weight, and frequent infections.

Diagnostic evaluation mostly relied on complete blood count and serum ferritin, with nearly all children showing low levels. However, many other important diagnostic tests such as peripheral smear, TIBC, and transferrin saturation were not performed, indicating a gap in proper diagnostic practices. In terms of treatment, most children were on oral iron supplements, with ferrous fumarate being the most commonly used. A significant number also received IV iron, especially iron sucrose, though caregivers had limited knowledge about the treatment dosage and schedule. A majority of children also took iron with Vitamin C, mainly in liquid form. While most children showed moderate to significant improvement, some experienced mild side effects like constipation and stomach upset. Overall, the study highlighted that although IDA is being treated in many children, there is a lack of comprehensive diagnostic evaluation and caregiver awareness regarding dosage and treatment follow-up. Improved education, diagnosis, and

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management strategies are needed to enhance outcomes in children with IDA.

Conflict of Interest:

The authors declare no conflict of interest.

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