
# Prevalence of Iron Deficiency and Iron Supplementation Practices Among Uncorrected Cyanotic Congenital Heart Disease Patients and its associated factors at the Pediatrics Cardiac Clinic of Tikur Anbessa Specialized Hospital; Hospital based Cross-Sectional Study

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**I, the undersigned Pediatric and Child Health Resident, declare that I have submitted my original work titled "Prevalence of Iron Deficiency and Iron Supplementation Practices Among Uncorrected Cyanotic CHD Patients and Its Associated Factors at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia : A Hospital-Based Cross-Sectional Study".**

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## Acronym

ACHD……..Acyanotic congenital heart disease

CBC…….. Complete blood count

CCHD……Cyanotic congenital heart disease

CHD …….Congenital heart disease

DORV……Double outlet right ventricle

ECHO…….Echocardiography

ID……..Iron deficient

IDA …….Iron deficiency anemia

MCH…….Mean corpuscular hemoglobin

MCV……Mean corpuscular volume

MUAC……..Mid upper arm circumference

RDW……Red cell distribution width

TASH……..TikurAnbessa specialized hospital

TGA……Transposition of great arteries

TOF…….Tetralogy of fallot

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## Executive summary

**Background:** Congenital heart disease (CHD) refers to a significant structural defect in the heart or major blood vessels within the chest that affects how the heart functions. According to EUROCAT registries, CHD affected approximately 8 out of every 1,000 births in Europe between 2000 and 2005, with cyanotic congenital heart disease (CCHD) making up 25% of cases. CCHD is characterized by the right-to-left shunting of desaturated blood, leading to decreased oxygen saturation in the systemic circulation. A common but often overlooked complication in children with CCHD is iron deficiency (ID), which can go undetected due to misleading high hemoglobin levels that mask the condition.

**Methods**: A Hospital based cross-sectional study was carried out at the pediatric cardiac clinic of Tikur Anbessa Specialized Hospital in Addis Ababa. Children attending follow-up visits was randomly selected using a simple random sampling method. Data was gathered through structured questionnaires. The collected data was analyzed using Statistical Package for Social Sciences (SPSS) version 25, focusing on descriptive and analytical statistics. Associations between variables was considered statistically significant when the p-value is less than 0.05

**Result:** Among the 206 patients included in the study, the prevalence of iron deficiency, as determined by MCV and RDW, was 58.7%. Additionally, the prevalence of anemia among uncorrected CCHD patients, defined by a hemoglobin level of less than 15 g/dl, was 35%.The presence of polycythemia was identified as a statistically significant association with iron deficiency.Regarding iron supplementation, 38.8% of CCHD patients did not receive any iron therapy. Among those diagnosed with iron deficiency, 28.1% were not given iron treatment, 33% received therapy at a sub-optimal dose (<3 mg/kg/day), and 47 38% were administered a therapeutic dose(3-6mg/kg/day).

**Consclusion:** This study identified a high prevalence of iron deficiency (58.7%) among uncorrected CCHD patients attending follow-up visits at the pediatric cardiac clinic at TASH. The presence of polycythemia was identified as a stastically significant associated factor with iron deficiency . Additionally, iron supplementation practices for those patients were found to be inadequate and sub-optimal

# 1. Introduction

## 1.1 Background

Congenital heart disease is a gross structural abnormality of the heart or intrathoracic great vessels that has actual or potential functional significance.
Congenital heart disease(CHD) is defined as a gross structural defect of the heart or intrathoracic great vessels that has potential functional significance(1). According to EUROCAT registries, between 2000 and 2005 CHD affected approximately 8 out of every 1,000 births in Europe, with cyanotic congenital heart disease (CCHD) making up 25% of cases(2). In Africa, There are Approximately 500,000 children born with CHD per year with a majority of this in sub-Saharan Africa which most of these receive sub-optimal or no care at all(3). Congenital cardiac defects can be classified into two major categories based on the presence or absence of cyanosis as: cyanotic and Acyanotic congenital heart defects(4). in developed countries, With increase in availability of both corrective and palliative surgery, the number of children with CHD surviving to adulthood has increased dramatically. However, CHD is still the leading cause of death among children with congenital malformation.

Cyanotic congenital heart defect (CCHD) is a type of congenital heart disease with right to left shunting of deoxygenated blood which leads to reduced oxygen saturation in the systemic circulation(5)..Twenty-five percent of congenital heart defects (CHD) are considered as cyanotic congenital heart defects (CCHD) and it can be classified into three main types;such as right side obstructive lesions, left side obstructive lesions and mixing lesions(6). Tetralogy of Fallot (TOF) is the most prevalent CCHD, comprising about 5% of all CCHD cases, while transposition of the great arteries (TGA) is the second most common, accounting for roughly 2% of all CCHD cases, and it is the most frequent CCHD presenting within the first week after birth. Cyanotic congenital heart diseases results in decreased oxygen saturation in the systemic circulation which triggers for increase production of erythropoietin that promotes secondary erythropoiesis in an effort to maintain tissue oxygenation. The resultant polycythemia and hyper viscosity can present clinically as thromboembolic events in the children with CCHD.

Cyanosis is characterized by a bluish discoloration of the skin and mucous membranes resulting from an increased concentration of reduced hemoglobin to about 5 g/100 mL in the cutaneous veins which resulted from either decreased arterial blood saturation or increased extraction of oxygen by peripheral tissue in the presence of normal arterial saturation(7). Cyanosis is recognized at a lower level of oxygen saturation in patients with anemia but at a higher level of oxygen saturation in patients with polycythemia (7)

Iron deficiency(ID) is frequently observed in children with uncorrected cyanotic congenital heart disease (CCHD), affecting over a third of these patients but it is usually overlooked due to the misleadingly high hemoglobin level.(5). Cyanosis increases erythropitin production which increase red cell mass and raises iron demands without sufficient iron which leads to iron deficiency. The presence of iron deficiency leads to hypochromic, microcytic red cells that are less flexible and have reduced oxygen-carrying capacity which exacerbates hyper viscosity and increase the risk of cerebrovascular events and cyanotic spells.

## 1.2 statement of the problem

In resource-limited countries, the prevalence of uncorrected cyanotic congenital heart disease (CCHD) is not well-documented but is believed to be high due to limited access to surgical interventions and specialized care. Iron deficiency is the common complication and mostly under-diagnosed due to the presence of high hemoglobin . Diagnosing iron deficiency in these children is challenging because their hemoglobin levels can seem normal or elevated, masking the deficiency. While accurate tests like bone marrow aspiration and ferritin levels exist, they are often expensive, invasive, and not available in many public hospitals. In contrast, a complete blood count (CBC), which is more widely available, can be a useful tool. Specifically, mean corpuscular volume (MCV) and red cell distribution width (RDW) are highly sensitive(98%) markers for detecting iron deficiency among CCHD patients

At Tikur Anbessa Specialized Hospital (TASH), the prevalence of iron deficiency among patients with uncorrected cyanotic CCHD is significant, yet the extent of the problem and its impact on patient outcomes are not well understood. While iron supplementation is a common treatment for IDA, the effectiveness and practices related to its use in this patient group remain unclear. There is a pressing need for more research to better understand the relationship between iron deficiency and cyanotic CHD and to improve management strategies for these patients.

### 1.3 Rationale of the study

At Tikur Anbessa Specialized Hospital (TASH), iron deficiency has been observed among patients with uncorrected Cyanotic congenital heart disease, but there is a lack of research on its prevalence and iron supplementation practices. This study aims to assess the prevalence of ID and the use of iron supplementation with its associated factors at TASH. The findings will offer crucial insights for healthcare providers at pediatric cardiac clinics, inform iron supplementation practices, aid in developing evidence-based guidelines, and serve as a benchmark for future research in this area.

## 2. Literature review

According to European Surveillance of Congenital Anomalies (EUROCAT) registries between 2000 and 2005 the total prevalence of CHD in Europe was approx. 8.0 per 1000 live births(2). There is an approx. 500,000 children born in Africa with CHD each year with a majority of this in sub-Saharan Africa. The majority of these children receive sub-optimal or no care at all(3).

A study conducted in tertiary hospitals in India to see the prevalence of iron deficiency anemia (IDA) among children with cyanotic congenital heart disease (CCHD). The study included 51 children and used diagnostic parameters such as RBC indices( mean corpuscular volume (MCV), red cell distribution width (RDW)) and iron studies like serum ferritin, serum iron, total iron binding capacity (TIBC), and transferrin saturation (TS). The results revealed that 47% of the patients had iron deficiency .(5)

In contrast, a 2013 observational study in India assessed iron deficiency anemia (IDA) in 30 children with cyanotic congenital heart disease using ferritin levels and mean corpuscular volume (MCV) for diagnosis. The study found that IDA was present in 56.6% of the cases based on MCV measurements.(8)

A case-control study was conducted in Egypt in 2021 which compared the prevalence of iron deficiency anemia (IDA) among children with cyanotic and non-cyanotic congenital heart disease (CHD). The study included 30 children, with 15 having cyanotic CHD and 15 having non-cyanotic CHD. The study used Serum ferritin levels as the diagnostic tool, revealing that IDA was present in approximately 53% of the cyanotic patients and around 13% of the non-cyanotic patients.(9)

A cross-sectional case-control study conducted in Nigeria to see the serum iron level of children with cyanotic congenital heart disease (CHD), using ferritin levels as a diagnostic tool. The study included 75 cyanotic CHD patients, with Tetralogy of Fallot(TOF) being the most common cardiac lesion(52%), followed by double-outlet right ventricle (DORV) at 12%. The prevalence of iron deficiency was found to be 9.3%. The most common types of CCHD associated with iron deficiency were TGA, DORV, and TOF, accounting for 33.3%, 11.1%, and 7.7% of cases, respectively. Iron deficiency was significantly associated with children older than 5 years.(10)

In 2016, a cross-sectional study was conducted in Ghana to see the prevalence of iron deficiency anemia among patients with congenital heart disease (CHD) and examined iron supplementation practices, using erythrocyte index as a diagnostic tool. Among the 80 cases selected, approximately 48% had Tetralogy of Fallot (TOF), followed by 10% with persistent truncus arteriosus, and 8.8% with TGA. The study found that around 72.2% of participants had relative iron deficiency anemia, and about 62.5% was not given iron supplementation. (11)

A cross-sectional study conducted in Tanzania examined iron deficiency and iron deficiency anemia among patients with CHD, using serum ferritin levels as a diagnostic tool. Among the 238 participants, the prevalence of iron deficiency was found to be 26.9%, while iron deficiency anemia was found in 20.2% of the patients . Both conditions were significantly associated with being under 5 years old, having cyanotic congenital heart disease, a recent history of illness, and lower read meat consumption.(12)

A hospital-based cross-sectional study was conducted in Nairobi, Kenya to see the prevalence of iron deficiency among children with CCHD. The study included 112 children, with TOF being the most common cardiac lesion, present in 54% of cases. Using serum ferritin levels to diagnose iron deficiency, it was found in 16.9% of children with CCHD. It was significantly associated with children under 5 years old and those with severe stunting.(13)

In 2021, an institutional-based cross-sectional study was conducted to examine anemia among congenital heart disease (CHD) patients in selected governmental hospitals in Addis Ababa. The study included 373 children, ranging from newborns to 15 years old, with 298 non-cyanotic and 75 cyanotic cases. Hemoglobin levels were used to diagnose anemia. The most common type of cyanotic congenital heart disease (CCHD) was Tetralogy of Fallot. The study found that the overall prevalence of anemia among CCHD patients was 72%, and anemia was significantly associated with the presence of pulmonary hypertension.(14)

A single-center prospective cross-sectional study was conducted at the Pediatric Cardiac Clinic of Tikur Anbessa Specialized Hospital to investigate hematologic derangements among children with un-operated cyanotic congenital heart disease in Ethiopia. Among the 70 children recruited, the overall prevalence of polycythemia was 63%, and 84% of these patients received iron supplementation.(15)

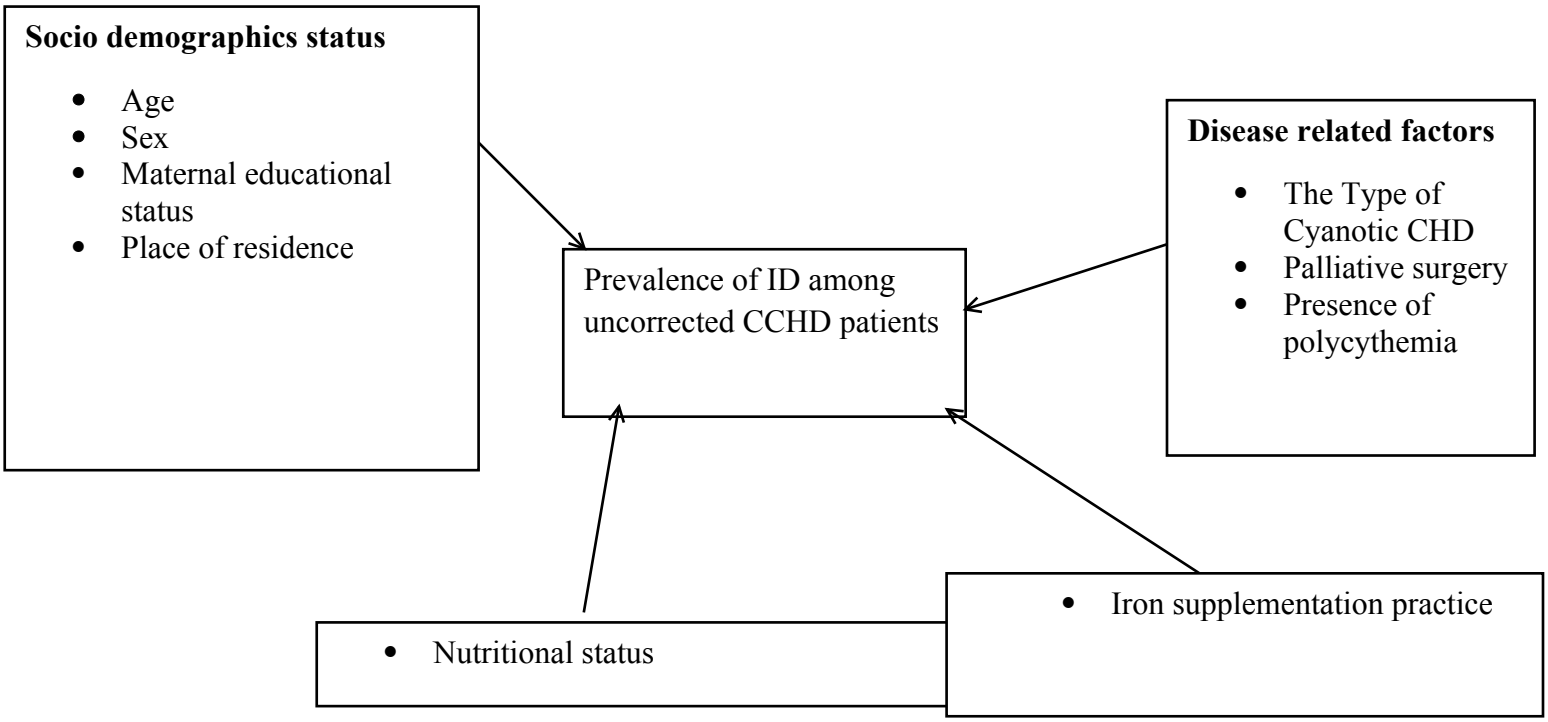


Figure 1: conceptual framework

## 3. Objectives

### 3.1 General objectives

- To see the prevalence of iron deficiency and iron supplementation practice among uncorrected cyanotic CHD patients at TASH and factors associated with it.

### 3.2 Specific objectives

- To see the prevalence of iron deficiency among uncorrected cyanotic CHD patient
- To identify associated factor of ID among uncorrected cyanotic CHD patient
- To assess iron supplementation practice among uncorrected cyanotic CHD patient

# 4.methods and materials

## 4.1 Study area

The study was conducted at TASH, department of pediatrics and child health. The department has emergency, outpatient, follow up clinic, wards and intensive care units. TASH is the largest referral teaching hospital located at the capital city of the country, Ethiopia. Pediatric cardiac patients are referred from all corners of the country. TASH is the only government owned hospital where pediatric cardiac surgery is done. Pediatric cardiology unit is staffed with consultant pediatric cardiologists and fellows. Pediatric residents and medical interns are assigned on rotation bases. The unit offers inpatient and outpatient care, diagnostic tests and mission based cardiac surgeries.

## 4.2 Study design and Study period

- Hospital based Cross-sectional study was done between September 1 and December 30, 2024.

## 4.3 Source populations

- All children less than 15years of age, with uncorrected CCHD patient on follow up at pediatrics cardiac clinic, TASH

## 4.4 Study population

- All children less than 15 years of age, with uncorrected CCHD patient who came for follow up at pediatrics cardiac clinic, TASH during the study period

## 4.5 Inclusion criteria:

- ✓ Children under the age of 15 years with cyanotic congenital heart disease whose parents or caretakers provided consent to participate were included in the study.

## 4.6 Exclusion criteria:

- ✓ Children who have acute illness requiring urgent medical attention at the time of data collection
- ✓ Children who underwent corrective surgical procedures
- ✓ Patients with previously diagnosed hematologic disorders, including malignancies, Macrocytic and normochromic anemia, thalassemia, and other causes of anemia not fulfilling operational definition

### 4.7 Sample size determination

The sample size was calculated using the formula

$$n = \frac{(Z\ \alpha/2)^2\ P\ (1-P)}{d^2}$$

Where:

n is size without considering source,

z is the probability of the error going to estimate(1.96),

d is precision required (5%), and

p is 16% overall prevalence of IDA among uncorrected CCHD patients which was from the previous study

Sample size n =206

### 4.8 Sampling methods: Simple random sampling method

### 4.9 Study variables

#### 4.9.1 Dependent variables

- ✓ Prevalence of Iron deficiency among uncorrected CCHD patients

#### 4.9.2 Independent variables

- ✓ Socio-demographics factors(Age, sex, socioeconomic status of the family)
- ✓ Disease related factors (The Type of Cyanotic CHD, palliative surgery)
- ✓ Iron supplementation
- ✓ Polycythemia
- ✓ Nutritional status

## 5. Data collection procedures and Data quality assurance:

A standardized, structured questionnaire was developed in English, and data was collected by trained personnel under the supervision of the principal investigator. CBC parameters were

obtained from the hospital's electronic medical recording(EMR) and patient charts. Data accuracy, completeness, and consistency was checked by the primary investigator before performing statistical analysis.

## 6. Data analysis

After the data was cleaned and checked for its completeness, data was entered into the statistical package for Social Science ver.25 (SPSS) for subsequent descriptive analysis and multi variable logistic regression analysis. Statistical significance was considered when p-value is $< 0.05$.

### 7. Ethical clearance

Ethical clearance was received from the Pediatrics Departments of Tikur Anbessa specialized hospital with the permission of the Institutional Review Board (IRB). Written Informed consent was taken from the patients caregiver/parents. Privacy and confidentiality was maintained by avoiding the use of identifiers and restriction of data access. Unique codes that cannot be traced back was created.

### 8. Dissemination of findings

The output of this study was displayed both in tabular and graphical presentations. The finding was presented on the research defense day and it will be submitted to the Department of Pediatrics and Child Health with both soft and hard copies with formal report. The research output will be published in local or international scientific journals.

## 9. Operational definition

- **Anemia** in CCHD patient can be defined as hemoglobin level less than 15 g/dl
- **Iron deficiency(ID)** is typically defined using iron studies, but in this setting, it is identified based on low MCV and high RDW values**.(8)**
- **Iron deficiency anemia (IDA)**: can be defined as hemoglobin level less than 15g/dl and low MCV and high RDW (16)
- **Low MCV**: defined as MCV value less than the lower cut point of the age specific reference range.
- **High RDW** defined as RDW value higher than the upper cut point of the age specific reference range.
- **Cyanotic congenital heart disease (CCHD)** is characterized by right to left shunting of desaturated blood which results in decreased oxygen saturation in the systemic circulation confirmed by echocardiography

- **Palliative surgery** is surgical intervention targeted to make a patient's symptoms less severe, thus make the patient's quality of life better despite negligible impact on the patient's survival

- **Polycythemia** requiring phlebotomy can be defined as HCT level >=65%.(17)

## 10. Result

### 1. Sociodemographic characterstics

Two hundred six(206) patients participated in the study. Among them, 129 (62.9%) were children under five years old, and 109 (52.9%) were male. Additionally, 106 (51.5%) of the mothers were from Addis Ababa. In terms of education, 79 (38.3%) held a diploma, degree, or higher qualification. (see table 1)

| Variables | | Frequency( n=206) | Percentage (%) |
|---|---|---|---|
| Age of the child | Under Five years (<60 months) | 129 | 62.6 |
| | Five and above years (>=60 months) | 77 | 37.4 |
| Sex | Female | 97 | 47.1 |
| | Male | 109 | 52.9 |
| Maternal educational Status | Cannot read and write | 21 | 10.2 |
| | Diploma/degree and above | 79 | 38.3 |
| | Primary school | 46 | 22.3 |
| | Secondary school | 60 | 29.1 |
| Place of Residence | Addis Ababa | 106 | 51.5 |
| | Amhara | 25 | 12.1 |
| | Gambella | 1 | 0.5 |
| | Oromia | 56 | 27.2 |
| | Sidama | 7 | 3.4 |
| | SNNP | 6 | 2.9 |
| | South west | 1 | 0.5 |
| | Tigray | 4 | 1.9 |

Table 1: Socio-demographic characteristics of patients with uncorrected CCHD

### 2. Nutritional status

With regarding to anthropometric parameters, 74.8% of children have under-nutrition in which 48 (23.3%) patients had moderate underweight, while 46 (22.3%) were severely underweight. Additionally, 21 (10.2%) exhibited moderate stunting, and 13 (6.3%) had severe stunting. Furthermore, 36 (17.5%) experienced moderate wasting, whereas 78 (37.8%) had severe wasting.(table 2)

| Anthropometrics parameters | | Frequency(n=206) | Percentage(%) |
|---|---|---|---|
| Weight for age | Normal | 112 | 54.4% |
| | Moderate Underweight(W/A B/N -2 and -3 z score ) | 48 | 23.3% |
| | Severe Underweight W/A less than -3 z score | 46 | 22.3% |
| Height for age | Normal | 172 | 83.5% |
| | Moderate stunting (H/A B/N -2 and -3 z score ) | 21 | 10.2% |
| | Severe stunting H/A less than -3 z score | 13 | 6.3% |
| Weight for height or BMI/A | Normal | 92 | 44.7% |
| | Moderate Wasting (W/H or BMI/A B/N -2 and -3 z score ) | 36 | 17.5% |
| | Severe-wasting W/H or BMI/A less than -3 z score | 78 | 37.8% |

Table 2: Anthropometric assessment

**3. Disease related factors**

The study also found that 108 (52.4%) of patients with CCHD were diagnosed with TOF. Other conditions included transposition of the great arteries (26 patients, 12.6%), tricuspid atresia (25 patients, 12.2%), DORV with the Taussig-Bing variant (19 patients, 9.2%), and DORV with the TOF variant (12 patients, 5.8%). Additionally, palliative surgery was performed in 19 (9.2%) of cases. Phlebotomy was done in 42 (20.4%) of patients, with the majority (31 patients, 73.8%) undergoing the procedure 1–5 times per year, 9 (4.4%) receiving it 5–10 times per year, and 2 (1%) requiring it more than 10 times annually.

| Variables | | Frequency( n=206) | Percentage (%) |
|---|---|---|---|
| Type of CCHD | TOF | 108 | 52.4 |
| | TGA | 26 | 12.6 |
| | Tricuspid atresia | 25 | 12.2 |
| | DORV with Taussig-Bing variant | 19 | 9.2 |
| | DORV with TOF variant | 12 | 5.8 |
| | Ebstein anomaly | 7 | 3.4 |
| | Pulmonary atresia with intact septum | 1 | 0.5 |
| | TAPVR | 2 | 1 |
| | Truncus arteriosus | 6 | 2.9 |
| Was Palliative surgery Done? | No | 197 | 95.6 |
| | Yes | 9 | 4.5 |

Table 3: Disease related factors

**4. Hematologic parameters**

**4.1 Prevalence of polycythemia**

Among children's who had uncorrected CCHD patients(n=206) 42.7 % of children had polycythemia

| Polycythemia | Frequency (n=206) | Percentage (%) |
|---|---|---|
| Yes | 88 | 42.7% |
| No | 118 | 57.3% |

Table 4: Presence of polycythemia

### 4.2 Prevalence of Iron deficiency based on MCV and RDW

The prevalence of iron deficiency (ID) was diagnosed using RBC indices (Low MCV and high RDW level). Based on these criteria, the prevalence of iron deficiency among the uncorrected CCHD patients was found to be 58.7% (95% CI: 52.94–65). (See figure 1).

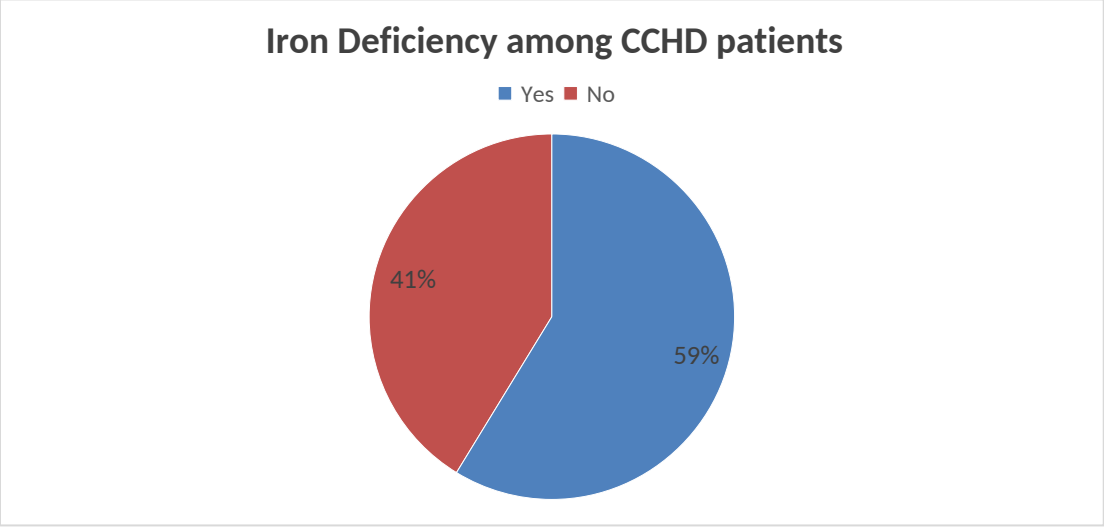


Figure 2: Prevalence of iron deficiency

### 4.3 Prevalence of anemia based on Hemoglobin level

The prevalence of anemia using hemoglobin level among uncorrected CCHD patients is 73( 35.4%)

| | | Frequency | Percent |
|---|---|---|---|
| Anemia (Hgb<15g/dl) | Anemia | 73 | 35.4 |
| | No Anemia | 133 | 64.6 |
| | Total | 206 | 100.0 |

Table 5: The prevalence of anemia

### 4.4 Prevalence of Iron deficiency anemia (IDA)

Among patients with iron deficiency, 32.2% have iron deficiency anemia (IDA), as indicated by low hemoglobin levels (below 15g/dl), low MCV, and high RDW.

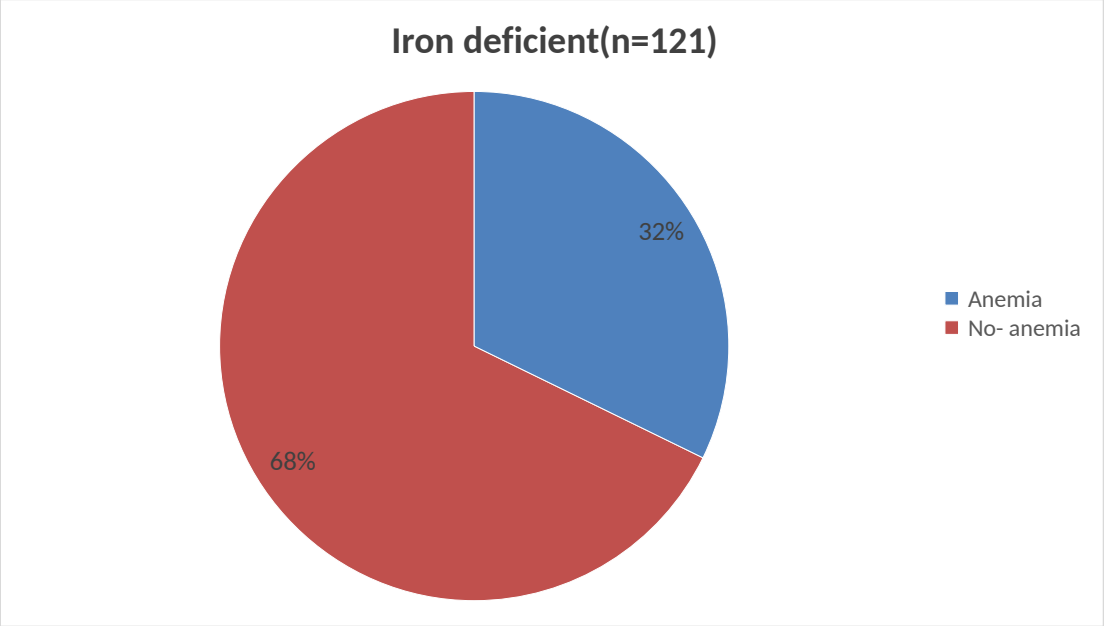


**Figure 3: Prevalence of iron deficiency anemia**

## 5. Iron supplemetation practice

In this study, 80 (38.8%) of CCHD patients did not receive iron supplementation. Among those with iron deficiency, 34 (28.1%) were not given iron therapy, 40 (33%) received supplementation at a sub-optimal dose (less than 3 mg/kg/day), and 47 (38%) were administered a therapeutic dose. (See the table 5)

| | | Iron Deficiency Status | | |
|---|---|---|---|---|
| | | no IDA | IDA | Total |
| Iron supplemented ? | between 3mg/kg/day and 6mg/kg/day | 11 | 47 | 58 |
| | less than 3mg/kg/day | 28 | 40 | 68 |
| | not supplemented | 46 | 34 | 80 |
| Total | | 85 | 121 | 206 |

Table 6: Iron supplementation practice

**6. Associated factors with iron deficiency**

associated factors with iron deficiency among patients with uncorrected CCHD was determined using both bi-variable and multi-variable logistic regression analyses. Variables with a p-value less than 0.05 were considered statistically significant (refer to Table 7).

Polycythemia showed a statistically significant association with iron deficiency, with a p-value of 0.010. Patients with polycythemia were approximately twice as likely to develop iron deficiency compared to those without it. (AOR: 2.145; 95% CI: 1.196–3.849).

In contrast, no significant associations were observed between iron deficiency and other factors such as age, sex, nutritional status, history of palliative surgery, or the type of congenital cyanotic heart disease (CCHD).

| Variables | | Iron deficient | | COR(95%CI) | sig | AOR(95%CI) |
|---|---|---|---|---|---|---|
| | | Yes | No | | | |
| Age | Less than 5 years | 73 | 56 | 1.270(0.713-2.263) | 0.418 | |
| | 5 years or | 48 | 29 | 1 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | above | | | | | |
| Sex | Male | 61 | 48 | 1 | | |
| | Female | 60 | 37 | 1.276(0.731-2.228) | 0.392 | |
| Nutritional status | Undernutrition | 77 | 54 | 0.995(0.559-1.771) | 0.987 | |
| | Normal | 44 | 31 | 1 | | |
| Types of CCHD | Inc pulm blood flow | 42 | 22 | 1 | 0.179 | |
| | Dec pulm blood flow | 79 | 63 | 1.522(0.825-2.810) | | |
| Palliative surgery | Yes | 7 | 2 | 2.548(0.516-12.580) | 0.251 | |
| | No | 114 | 83 | 1 | | |
| Polycythemia | Yes | 61 | 27 | 2.184(1.224-3.898) | **0.010** | **2.145(1.196-3.849)** |
| | No | 60 | 58 | 1 | | 1 |

Table 7: analysis of factors associated with iron deficiency

## 11. Discussion

In this study the prevalence of anemia, iron deficiency(ID) and iron deficiency anemia(IDA) found to be 35.4%, 58.7% and 32.2 % respectively. The presence of polycythemia was having a

statistically significant association with iron deficiency among uncorrected CCHD patients . patients with polycythemia had the odd ratio of two times more likely to develop iron deficiency compared to those without it (AOR: 2.145; 95% CI: 1.196–3.849)

In this study the prevalence of IDA found to be lower (32.2%) compared to an observational study conducted in tertiary hospitals in India(47%).(5)

Another observational study conducted in India assessed iron deficiency anemia (IDA) in 30 children with cyanotic congenital heart disease (CCHD) using ferritin levels and mean corpuscular volume (MCV) as diagnostic criteria. The study found that IDA was present in 56.6% of cases based on MCV measurements, which is higher than the prevalence observed in the current study.(8)

A case-control study conducted in Egypt in 2021 compared the prevalence of iron deficiency anemia (IDA) in children with cyanotic and non-cyanotic congenital heart disease (CHD).Using serum ferritin levels as the diagnostic tool, the study found that IDA was present in approximately 53% of cyanotic patients which is higher than the prevalence observed in the current study(32.2%).(9)

Similarly,Another study conducted in Nigeria which assessed the serum iron status of children with cyanotic congenital heart disease (CHD) using serum ferritin levels as a diagnostic marker. . The prevalence of iron deficiency was found to be 9.3% which is lower than the prevalence observed in the current study(58.7%).(10)

When we compare the current study with previous study which was done in Tanzania using serum ferritin levels as a diagnostic tool, the prevalence of iron deficiency and iron deficiency and iron deficiency anemia is higher in the current study (58.7% vs 26.9%) and (32.2% vs 20.2%) respectively.(12)

When we Compare the current study with the study conducted in Ghana in 2016, the prevalence of iron deficiency in this study is lower (58.7% vs. 72.2%). However, regarding iron supplementation practices, this study shows a higher supplementation rate. In this study, 38.8% of patients did not receive iron supplementation, which is lower than the 62.5% reported in the Ghana study.(11)

Additionally, another cross-sectional study was conducted at Nairobi, Kenya using serum ferritin levels to diagnose iron deficiency anemia, the prevalence was found to be 16.9% which is much lower than the current study(58.7%).(13)

In 2021, an institutional-based cross-sectional study was carried out to examine anemia among congenital heart disease (CHD) patients in selected governmental hospitals in Addis Ababa. The study included 373 children, ranging from newborns to 15 years old, with 298 non-cyanotic and 75 cyanotic cases. Hemoglobin levels were used to diagnose anemia. The most common type of cyanotic congenital heart disease (CCHD) was Tetralogy of Fallot. The study found that the

overall prevalence of anemia among CCHD patients was 72% which is higher than the findings in the current study(35.4%).(14).

## 12. Conclusion

This study found a high prevalence of iron deficiency (58.7%) among uncorrected CCHD patients attending follow-up visits at the pediatric cardiac clinic at TASH. The presence of polycythemia was identified as a stastically significant association with iron deficiency . Additionally, iron supplementation practices for those patients were found to be inadequate and sub-optimal

## 13. Limitation of the study

Iron sudies were not used for the diagnosis which makes it dificult to rule out other causes of microcytic anemia

## 14. Recommendation

Patients with uncorrected cyanotic CHD, especially those with polycythemia, should be carefully assessed for iron deficiency and managed accordingly. Iron supplementation practices should follow standard dosing. Further research is needed to evaluate the diagnosis of iron deficiency (ID) using iron studies and to conduct studies with a prospective study design.

## 15. Acknowledgment

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