



## A CROSS-SECTIONAL INVESTIGATION ON HEMOGLOBIN LEVELS IN CHILDREN WITH HEART FAILURE

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### Abstract:

**Introduction:** Despite the many challenges linked to pediatric heart failure, little is known about the predictive importance of hemoglobin levels in this group. To improve patient outcomes, our aim was to look into this relationship.

**Objectives:** To assess the relationship between hemoglobin levels and the severity of left ventricular dysfunction in pediatric heart failure, informing personalized therapeutic strategies.

**Study design:** A cross-sectional study.

**Duration and Place of Study:** Department of Community Medicine Khyber Girls Medical College, Peshawar, Between 05-Feb 2021 And 05-Feb 2022.

**Methods:** Our study of paediatric heart failure patients assessed haemoglobin levels as well as the degree of left ventricular dysfunction. at the Tartary Care Hospital in Peshawar.

**Results:** Higher levels of left ventricular dysfunction were linked to decreased haemoglobin levels in 684 people. There were 310 (45.3%) females and 374 (54.7%) males, almost evenly distributed by gender. The average age was 6.8 years. Haemoglobin levels averaged 11.7 g/dL (SD = 1.2) in mild cases, 11.4 g/dL (SD = 1.3) in intermediate cases, and 10.8 g/dL (SD = 1.4) in severe cases.

**Conclusion:** Haemoglobin levels in paediatric heart failure show potential as prognostic indicators, highlighting the need for more studies to create tailored medicines and improve outcomes.

**Keywords:** Heart Failure, Pediatric, Hemoglobin, Prognosis

### Introduction

The inability of the heart to satisfy the body's metabolic needs is the distinguishing feature of juvenile heart failure, a complex and severe clinical condition. Affected children and their families endure high expenditures as a result of this disorder, which is associated with significant morbidity and death.

Despite breakthroughs in diagnostic and therapeutic procedures, heart failure remains the leading cause of child hospitalisations and deaths worldwide [1]. The amount of haemoglobin is one of the primary indicators usually measured in children presenting with heart failure. Haemoglobin, a key component of erythrocytes, is essential for oxygen transport and delivery to tissues. In the setting of heart failure, haemoglobin level changes may indicate underlying pathophysiological causes and give useful prognostic information [2]. Numerous studies have been undertaken on the relationship between haemoglobin levels and heart failure in adult populations, and anaemia has shown to be an independent predictor of poor outcomes in heart failure patients [3]. On the other hand, nothing is known about how haemoglobin levels affect juvenile heart failure. Extrapolating data from adult research may not be appropriate given children's unique physiological and developmental features. There are many reasons why understanding the association between haemoglobin levels and paediatric heart failure is critical. To begin, anaemia has the potential to worsen the overall clinical state and prognosis of heart failure by reducing oxygen flow to vital organs [4]. Furthermore, fluctuations in haemoglobin levels might reflect the severity and duration of a child's heart failure, making them a significant signal for risk assessment and intervention decisions [5]. Thus, the goal of this research is to analyse haemoglobin levels in juvenile heart failure patients in order to determine their potential importance as a prognostic marker and therapeutic target in this vulnerable population. We intend to obtain a better understanding of the pathophysiology of juvenile heart failure and enhance patient outcomes by performing a detailed examination of the relationship between haemoglobin levels and the condition[6].

## Materials and Methods

- The study examined data from hospital records of paediatric children who had clinical signs of heart failure at a specialty care hospital in Peshawar between February 5-2021 and February 5, 2022. Before beginning data collection, the Institutional Review Board (IRB) approved the study. Echocardiographic data revealed impaired left ventricular (LV) function, confirming the diagnosis of heart failure. LV dysfunction was classified as mild, moderate, or severe according to specified criteria:
- **Mild LV Dysfunction:** Ejection fraction (EF) between 40% and 54%.
- **Moderate LV Dysfunction:** Ejection fraction (EF) between 30% and 39%.
- **Severe LV Dysfunction:** Ejection fraction (EF) less than 30%.

All included patients had their haemoglobin (Hb) levels documented at the time of presentation. Standard laboratory methods were used to assess haemoglobin levels, and results were reported in grammes per deciliter, or g/dL. In this investigation, the haemoglobin levels measured during the first presentation were used for analysis.

## Statically analysis

The clinical and demographic characteristics of the study population were compiled using descriptive statistics. SPSS.23.0 was used for statistical analysis. Continuous variables were presented as mean  $\pm$  SD or median with interquartile range (IQR) based on data distribution. Summary frequencies and percentages were utilised for categorical data. Haemoglobin levels and left ventricular dysfunction were examined in subgroup analysis. ANOVA or Kruskal-Wallis tests for continuous variables and chi-square tests for categorical variables were employed for comparison analyses.

## Results

The study included 684 paediatric heart failure patients. The study population had a mean age of  $6.8 \pm 3.2$  years, with 45.5% female and 54.5% male participants. It shows minimal masculine dominance. The findings showed an average Hb level of  $11.2 \pm 1.5$  g/dL at presentation. After echocardiography, patients were categorised by left ventricular (LV) dysfunction. The group included 238 (34.8%) mild LV dysfunction, 309 (45.1%) moderate, and 137 (20.1%) severe LV dysfunction patients. Subgroup analysis was used to assess haemoglobin levels and left ventricular dysfunction. Results indicate

considerable variation in mean haemoglobin levels across patients with varying degrees of left ventricular dysfunction ( $p < 0.001$ ). In particular, severe LV failure patients had lower mean haemoglobin levels than mild or moderate dysfunction patients (Table 1).

**Table 1.** Age distribution and gender breakdown of the research participants

Gender	Number of Patients	Percentage (%)
Male	374	54.7
Female	310	45.3

Mean Age: 6.8 years (Standard Deviation: 3.2 years)

**Table 2:** Mean Hemoglobin Levels Across Severity of LV Dysfunction

LV Dysfunction Severity	Mean Hb Level (g/dL)	Standard Deviation
Mild	11.7	1.2
Moderate	11.4	1.3
Severe	10.8	1.4

Moreover, haemoglobin levels considerably ( $p < 0.001$ ) varied in the distribution of patients among LV dysfunction categories. The distribution of patients by haemoglobin levels and severity of left ventricular failure is shown in Table 2.

**Table 3:** Distribution of Patients by LV Dysfunction Severity and Hemoglobin Levels

LV Dysfunction Severity	Hemoglobin Level (g/dL)	Number of Patients	Percentage (%)
Mild	< 11	72	30.3
	11 - 12	134	56.3
	> 12	32	13.4
Moderate	< 11	98	31.7
	11 - 12	168	54.3
	> 12	43	13.9
Severe	< 11	60	43.8
	11 - 12	62	45.3
	> 12	15	10.9

## Discussion

The characteristic of juvenile heart failure, a complex and multidimensional condition, is the heart's inability to effectively pump blood to satisfy the body's metabolic demands. Numerous aetiologies, such as infections, hypertension, congenital heart defects, cardiomyopathies, and myocarditis, may cause it. Paediatric heart failure is a major source of morbidity and death in children even with advances in diagnosis and treatment [6]. Paediatric heart failure is often caused by congenital heart abnormalities, such as ventricular septal defects (VSDs) and atrial septal defects (ASDs) [7]. Moreover, genetic variables may have an impact on cardiomyopathies such hypertrophic cardiomyopathy (HCM) and dilated cardiomyopathy (DCM), which impair cardiac function and result in infantile heart failure [8]. Comprehending the many causes of paediatric heart failure is crucial for precise diagnosis, risk assessment, and focused treatment approaches. Anaemia is a common comorbidity in people with heart failure and has been linked to worse outcomes and the advancement of the illness. Studies in adult heart failure cohorts that have consistently shown a connection between lower haemoglobin levels and higher death rates have underlined the prognostic importance of anaemia in heart failure [9, 10]. Furthermore, anaemia therapies such as iron supplements or blood transfusions have shown promise in improving clinical outcomes for adult heart failure patients [11, 12]. Our study adds to the growing body of evidence showing haemoglobin levels are a major predictive factor in juvenile heart failure. We found a strong correlation between lower haemoglobin levels and more severe left ventricular (LV) dysfunction in paediatric patients, which is consistent

with data from adult heart failure cohorts. According to these findings, anaemia may be a useful indicator of the prognosis and severity of the illness in both adult and paediatric heart failure populations [13, 14]. Furthermore, our research highlights the need of comprehensive risk stratification techniques in the treatment of juvenile heart failure. Physicians may more accurately identify high-risk patients who can benefit from increased treatment techniques, including iron supplements or transfusion therapy, by integrating haemoglobin testing into clinical assessments. To completely comprehend the possible role of these medicines to improved outcomes, further study in juvenile heart failure cohorts is required [15, 16]. The significance of haemoglobin levels as a potential prognostic marker in kids with heart failure is highlighted in our research's conclusion. Future research should focus on elucidating the basic mechanisms linked to the development of heart failure in children with anaemia and exploring targeted therapies to improve outcomes in this vulnerable population.

**Conclusion:** Haemoglobin levels in juvenile heart failure show promise as prognostic markers, emphasising the need for greater research to develop personalised treatments and better outcomes.

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