Journal of Medical Research and Health Sciences
Received 20 July 2024| Revised 21 Aug 2024 | Accepted 25 Sept 2024 | Published Online 15 Oct 2024

DOI: https://doi.org/10.52845/JMRHS/2024-7-10-3

JMRHS 7 (10), 3214–3223 (2024)

ISSN (O) 2589-9031 | (P) 2589-9023

Original Article **Open Access Journal**

Prevalence of Thalasemia in Mirwais Regional Hospital (MRH) Pediatric Ward

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Abstract **Background**: Thalassemia is a common, monogenetic, inherited blood disease. It is prevalent in the Kandahar province in Afghanistan due to consanguineous marriage. In the present study, we would like to determine the prevalence of thalassemia among the children admitted to the Mirwais Regional Hospital pediatric ward with severe anemia.

Objective: To determine the prevalence of thalassemia in the Mirwais Regional Hospital pediatric ward.

Method: This cross-sectional study was conducted in Mirwais Regional Hospital Pediatric Ward Kandahar, Afghanistan, from January 2019 to July 2019. Blood samples were collected from suspected severe anemic patients in a 5ml vacutainer and sent for a complete blood count examination and confirmation with hemoglobin electrophoresis. A questionnaire collected detailed information on diagnosed patients with thalassemia.

Results: The total number of patients admitted to the pediatric ward during six months (Jan 2019 to July 2019) was 29642. One hundred thirty-one were diagnosed with thalassemia, and the prevalence rate of thalassemia in the pediatric ward was 0.44%. Of 131 patients, 55.73% were male, and 44.2% were female. The mean age of thalassemic children was 33.82(SD±37.682) months. Out of 131 patients, 83.97%were within the range of 4 months to 5 years. Hemoglobin levels varied from 1.8 mg/dl to 10.6mg/dl with an average of (5.491SD±1.97) mg/dl.

Regarding the severity of anemia, 78.6% had severe, 16% had moderate, and 5.3% had mild anemia. The rate of Consanguineous marriage between parents of thalassemic children was 57.3%.

Conclusion: The prevalence of thalassemia is 0.44% in the pediatric ward. This means that out of ten thousand patients who attended the pediatric ward, 44 were newly diagnosed with thalassemia. Since thalassemia is the most common monogenetic inheritor disease and leads to fatal complications, the data obtained from this study can be used by public health authorities to prepare policies for reducing the burden of the disease and providing treatment and support to people already suffering from it.

Keywords: **Prevalence, Thalassemia, Kandahar, Consanguineous, Anemia**

Introduction:

Thalassemia is an inherited autosomal recessive disorder caused by mutation in alpha-globin or beta-globin gene clusters (Ebrahimi et al., 2021). Although β-thalassemia has >200 mutations, most are rare (Galanello & Origa, 2010). Approximately 20 common alleles constitute 80% of the known thalassemia worldwide, 3% of the world's population carries genes for β-thalassemia, and in Southeast Asia, 5–10% of the population carries genes for α-thalassemia (Fathi et al., 2019). Thalassemia is an inherited hemoglobin-related disorders, which include the structural variants (hemoglobin S, C, and E) and the alpha (α)- and beta (β)-thalassemia, affects more than 300,000 children annually, mainly in malaria-endemic regions extending from sub-Saharan Africa and the Mediterranean to Southeast Asia (Williams & Weatherall, 2012).

Each year, about 300,000 infants worldwide are born with thalassemia syndromes or sickle-cell anemia globally (World Health Organization, 2024). The World Health Organization report on b-thalassemia in India indicated a carrier frequency of 3–4%, which gave the recent national population between 35.6 and 47.5 million carriers of the disorder nationwide (Basu, 2015). The total annual incidence of symptomatic individuals is projected at 1 in 100,000 worldwide and 1 in 10,000 in the European Union(Galanello & Origa, 2010). Sickle-cell disease and β-thalassemia affect as much as 5% of the world's population, constituting a significant public health problem in certain parts of the world, including the Mediterranean and Middle East.

Saudi Arabia is well-known for its high prevalence of hereditary blood disorders. In a study conducted in Saudi Arabia and published in June 2007, 4.20% of the participants had sickle cell trait, 0.26% had sickle cell disease, 3.22% had b-thalassemia trait, and 0.07% had β-thalassemia disease (Memish et al., 2011). The increasing number of Thalassemia patients has led to a significant rise in the cost of supportive treatment, such as blood transfusion, iron chelation for a lifetime, and treatment when complications occur. This financial burden, coupled with the psychological challenges faced by patients and their families, underscores the urgent need for prevention programs in countries with a high prevalence of hemoglobinopathies. A premarital screening program can be instrumental in identifying and preventing high-risk marriages, thereby reducing the incidence of thalassemia.

Detecting carrier couples with a premarital screening program effectively controls thalassemia major(Hashemizadeh & Noori, 2013). Koren et al. (2014), in a Cost-Benefit Analysis on the Prevention of β Thalassemia in Northern Israel study, indicated that each new β Thalassemia patient born incurred an excessive budget of about $2 million for a life expectancy of 50 years. Such a budget could fund a prevention program for 4.6 years and prevent at least 31 affected patients. It had benefits to society as well, in addition to the direct financial savings of millions of dollars, the saving of hundreds of blood units, work power, compensation fees, treatment of endocrinological and cardiac complications, and treatment of intercurrent complications and expenses, and prevent at least 31 affected patients(Koren et al., 2014).

Parental awareness regarding various aspects of beta thalassemia is of great importance not only for the proper management and improved quality of life of the patient with thalassemia but also for the prevention of further children with thalassemia major in the family (Yousuf et al., 2022). This study aims to determine the prevalence of thalassemia, demographic data, socioeconomic status, lab exams, and complications of thalassemia children admitted to Mirwais Regional Hospital pediatric ward, Kandahar, Afghanistan. Therefore, we selected this study in Kandahar, and until now, there has not been any study on thalassemia. Moreover, the number of cases is increasing day by day. Also, many thalassemia children come to the pediatric intensive care unit with life-threatening complications. Their parents do not have enough

information about this genetic disease, its mode of transmission, prevention, and treatment.

Method

This study is a prospective cross-sectional (descriptive) study. Data was collected from the records of thalassemia patients in the Hospital of Mirwais Regional pediatric ward that fulfilled the eligible criteria. Data collection sheets were prepared to ensure the collection of all essential data related to patients.

The collected data was processed using computer programs, such as Microsoft Office, for graphic and descriptive demonstrations. Information from the patient chart was meticulously coded and entered into computer software. The data was then subjected to rigorous analysis using SPSS version 22.0, a powerful and widely used statistical software package, underlining the study's reliance on robust tools for data analysis.

Study Population

The cross-sectional study, a crucial step in our research, included children inpatients with **thalassemia** above four months and less than or equal to 15 years old who were admitted to Mirwais Regional pediatric ward between March 2019 and July 2019. The study included children regardless of gender and race, underlining the significance of their diverse representation in our research. We included the patient population aged four months up to 15 years old children who had a diagnosis of thalassemia by clinical evaluation, blood smear, and hemoglobin electrophoresis and were on regular transfusion. We excluded patient

less than 4month and over 15 years old and patients whose parents were unwilling to participate in this study.

Ethical committee approval

Ethical approval for the study was obtained from the Research Committee of the Kandahar medical faculty.

Demographics

Of 29,642 children seen in the pediatric ward of Mirwais Regional Hospital, 131 children were diagnosed with thalassemia, which shows that the prevalence of thalassemia during this study period was 0.44%. The demographic and socioeconomic characteristics are given in **Table 1**. The mean age of thalassemic children was 33.82(SD±37.682), ranging from 4 months to 5 years. Of 131 cases, 55.7% were male, and 44.3% were female (male and female ratio 1.25:1). Around 56.49% of patients were residents of rural areas, and the remaining 43.51% were from urban residences.

Regarding family income, many families had 108 (82.4%) had income less than 10000 thousand Afghani per month, and 22(16.8%)families had an income of 10000 to 19000 thousand Afghani per month.

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Table 1

Characteristics	No of Cases	Percentage
Age group		
1.4months –5years	110	83.97%
2. 5-10years	15	11.45%
3. 10-15years	6	4.58%
Type of residence		
1.Urban	57	43.51%
2.Rural	74	56.49%
Gender		
1.Male	73	55.7%
2.Female	58	44.3%
Education level participants		
1. Preschool age	110	83.97%
2. School age	10	47.6%
Education level of the father		
1.Non	85	64.9%
2.Elementary	24	18.3%
3.Intermediate	3	2.3%
4.High school	2	1.5%
5.Higher education	1	0.8%
6.Religious education	16	12.2%
Education level of the mother		
1.Uneducated	119	90.8%
2.Elementary	7	5.3%
3.Vocational	1	0.8%
4.Religious education	4	3.1%
Household income (Afghani)		
1. 10000	108	82.4%
2. 10000-19000	22	16.8
3. Don't want to answer	1	0.8

Consanguineous Marriage and Relationship of the Parents

In this study, the rate of consanguineous marriages was 57.3%, and 42.7% had no consanguineous marriages. We found that 67.2% of families had no

sibling history of thalassemia, and the remaining 32.8% had a sibling history. The rate of families with positive family history was 56.5% had positive family history, and 43.5% did not have a positive history of thalassemia in their own family.

Laboratory Characteristics of the Patient

The patients' laboratory results showed that 35.9% had blood group A, 24.4% group B, 6.9% group AB, 32.8% group O, and 89.31% were RH positive. Also, based on the electrophoresis of Hb result, has uncovered significant insights. We found that 3.8% of participants had thalassemia minor,42% had thalassemia intermediate, and 54.2% had thalassemia major.

Regarding the severity of anemia, 103(78.6%) patients had severe anemia, 21 (16%) had moderate anemia, and 7(5.3%) mild anemia. A one-sample T-test was conducted to determine if a statistically significant difference exists between the Hb level of 131 patients with thalassemia and the standard value 11gr/dl. The result indicated a significant difference between the Hb level of the sample (M=5.491 SD=1.97) and the standard value p= 0.001. The average Hb level was less than the standard value.

We conducted an independent sample T-test to compare the average mean Hb level in male and female thalassemic children. There was no significant difference in male Hb level (M=5.653, SD=1.96) and female Hb (M=5.286, SD=1.98) and P=0.291. The results suggest that there is no significant difference between male and female Hb levels. See Table 2

Table 2

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
hemoglobine(g/dl)	Equal variances assumed	.007	.935	1.060	129	.291	.3672	.3464	-.3182	1.0527
	Equal variances not assumed			1.058	121.67	.292	.3672	.3470	-.3197	1.0541

Frequency of Blood Requirement, Vaccination, and Medical Characteristics of the Participant

We found that 93.1% of the patients needed blood transfusion once a month, and 6.9% needed blood transfusion more than once a month. We found that 91.6% of participants had partially completed their vaccines, 6.9% had completed them, and 1.5% had not taken any. The age at which they were diagnosed and had their first blood transfusion is discussed below.

Our study's results underscore the importance of early diagnosis, with 90.8% of participants being diagnosed in the first five years of their lives. Only 7.6% and 1.5% were diagnosed in 5-10 years and above ten years of age, respectively. Most participants had their first blood transfusion in the first year of life, highlighting the need for early intervention. This study also showed that only 2.3% had surgically removed their spleen, and the remaining 97.7% of participants were with the spleen.

Our study revealed a concerning trend, with 51.9% of participants experiencing complications. This high percentage underscores the importance of addressing these issues to improve patient care and reduce the burden on healthcare systems. The remaining 63 (48.1%) had no complications. Regarding complication types, most participants

had 60(88.2%) infections, and the remaining had CCF, coagulation disorder, and shock. See Table 3.

Table 3

Characteristics	No of cases	Percentage
Vaccination		
Partially completed Completed Not taken	120 9 2	91.6% 6.9% 1.5%
Age diagnosis of thalassemia		
0-5 years 5-10 years Above 10years	119 10 2	90.8% 7.6% 1.5%
Age in which first BT done		
0-1 years 1-5 years Above 5 years	85 38 8	64.9% 29% 6.1%
Splenectomy		
Yes No	3 128	2.3% 97.7%
Complication of thalassemia		
Yes No	68 63	51.9% 48.1%
Types of complication		
Infection Bleeding disorder Chronic heart failure Shock	60 4 3 1	88.23% 5.88% 4.41% 0.8%
Household income (Afghani)		
10000 10000-19000 Don't want to answer	108 22 1	82.4% 16.8%. 0.8%

Nutrition Status Characteristics

For our nutritional assessment, we utilized the height/weight ratio and the World Health Organization (2017) guideline, a trusted tool in nutritional assessment, to thoroughly analyze the nutritional status of the participants. We classified the participants into two categories: 84.73% were under five years old, and the remaining 15.26% were above five. Our assessment revealed that 32.43% of those under five years old had SAM (severe acute malnutrition), 3.6% had MAM (moderate acute malnutrition), and the remaining 63.95% had a normal nutritional status.

We assessed the nutritional status of participants older than five years using their body mass index (BMI), a widely accepted measure of body fat (Khanna et al., 2022). We found that 55% of participants had a healthy weight, 40% were underweight, and 5% were overweight, based on their BMI values.

Furthermore, we recorded and analyzed the participants' breastfeeding duration, a critical factor in early childhood nutrition. We found that 41.2% of participants breastfed for 7-12 months, 32.1% breastfed for 1-6 months, 20.6% breastfed for 3-24 months, 4.6% did not breastfeed at all, and 1.5% breastfed for more than two years. See Table 4

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Table 4

Characteristics	No of cases	Percentage
<5 years old nutrition status	111	84.73%
<-3SD(SAM) -3SD(MAM). -2SD -1SD(Normal)	36 4 18 53	32.43% 3.6% 16.21% 47.74%
>5 years old nutrition status (BMI)	20	15.26%
Healthy weight Underweight Overweight	11 8 1	55% 40% 5%
Breast feeding duration(months)		
1-6 7-12 13-24 >24 Zero	42 54 27 2 6	32.1% 41.2% 20.6% 1.5% 4.6%

Discussion

Thalassemia is one of the most common genetic disorders resulting from abnormalities in the synthesis of the hemoglobin molecule in red blood cells due to mutation of globin chains (Khan et al., 2005). Each year, 300,000 infants are born with significant hemoglobinopathies all over the world, from which 60,000 to 70,000 are beta thalassemia major cases from different parts of the world, especially in the Mediterranean area, Middle East, Far East, and East Asia (Khan & Shaikh, 2023; Warghade et al., 2018). Severe beta thalassemia accounts for 50,000 to 100,000 deaths per year or 0.5% to 0.9% of all deaths of children under 5 in low or middle-income countries. (Li et al., 2019).

In this study, the prevalence of thalassemia was 0.44% during the study period, which is supported by evidence from other studies in Iran. Khodaei et al. (2013) indicated that the prevalence of thalassemia in Iran is 3.6%, with a prevalence of 0.6% among the provinces of Khorasan Razavi. Alternatively, the prevalence of Beta thalassemia in the general population of Quetta City, Pakistan, was calculated at 6.5% in 2012, which included mild, primary, and carrier (Aziz & Anwar, 2012)—in another study conducted in Adil Abad, India, inpatient pediatric wards reported that the prevalence rate of thalassemia was 2.53% which is different in number from our study (Rao, 2018).

In the current study, among the 131 study participants, the number of thalassemia was higher in males, 55.7%, than in females, 44.3% in the affected families. This finding is of significant importance as it aligns with other studies from Zahidan, southeast Iran, and India Ahmad Abad, which also reported a higher number of males, 54.3% and 67%, respectively (Miri-Moghaddam et al., 2016; Talsania et al., 2011). Our study revealed that a significant percentage of participants, 83.97%, fell within the age group of 4 months to 5 years. This finding is consistent with other studies, such as those from Sheikh Zayed Medical College Lahore, Pakistan, where Ghafoor et al. (2016) found that 55% of cases were in patients five years old and younger, and in India, where Miri-Moghaddam et al. (2016) found that 69.5% were in patients younger than five years old.

Consanguineous marriage, a significant factor in the prevalence of genetic disorders, refers to marriage between close relatives. This type of marriage is frequent in developing countries, but its frequency has declined in developed countries. Inherited disorders are more common in consanguineous marriages than in non-consanguineous marriages (Hamamy, 2012). Our research found that 57.3% of

couples had consanguineous marriages, with 45% of parents being close relatives, 10.7% being distant relatives, and 44.3% being unrelated, which was further supported by the Thalassemia Centre at Sir Ganga Ram Hospital, Lahore, Pakistan, where consanguinity was positive in 82.5% of the parents with an extended family history of thalassemia, indicating that the disorder was present in multiple generations and positive in 40.8% (Arif et al., 2008).

Moreover, our findings, consistent with a study in the Hazara region of Khaibar Pashton Khawa, Pakistan, and a study in southeast Iran, underscore the need for more research and understanding of consanguineous marriages and their impact on genetic disorders. In the Hazara region, half of the parents of affected children were in consanguineous marriages (Burki et al., 1998). The study in southeast Iran showed similar results: 57.8% of parents were close relatives, 19.7% were distant relatives, and 22.5% were unrelated (Miri-Moghaddam et al., 2016).

Our research, based on the electrophoresis of Hb result, has uncovered significant insights. We found that 3.8% of participants had thalassemia minor,42% had thalassemia intermediate, and 54.2% had thalassemia major. When compared with a study from Shiekh Zayed Medical College Pakistan and a Gujart Ahmad Abad hospital-based study in India, these findings provide a comprehensive understanding of thalassemia prevalence. The Pakistan study, for instance, reported that out of 283 cases, 91% were suffering from thalassemia major, and 9% had thalassemia intermediate (Iqbal et al., .2012). The India study conducted by Talsania et al. (2011) found that 80.3% had thalassemia major, 16.1% had thalassemia intermediate, and 3.6% had thalassemia minor.

We found that 32.1% of participants were only breastfed for the first six months, 41.2% for 12 months, 20.6% for years, 1.5% for more than two years, and 4.6% were not breastfed. A study which was conducted at the outpatient clinic of thalassemia at Zagazig University Hospital in Egypt between 2007 and 2014 showed that breastfed infants with beta-thalassemia major might accumulate less iron than infants fed iron-fortified formula, potentially delaying the onset of iron overload in the breastfed infants. These findings have the potential to change current practices in the care of infants with beta-thalassemia major, emphasizing the importance of breastfeeding in managing their condition (El Safy et al., 2017).

Conclusion

The prevalence of thalassemia is 0.44% in the pediatric ward, a figure that underscores the need for immediate action. Public health authorities can use this data to prepare a suitable action plan, which can significantly reduce the burden of the disease and provide treatment and support to those already suffering from it.

Our study concluded that a significant number of consanguineous marriages were present in the studied population. It is crucial to create awareness about the potential health risks associated with consanguineous marriages, particularly the increased risk of adverse health outcomes for infants.

To control thalassemia's major complications, mortality, and economic burden on the health sector, an awareness and health education program for preventing this disease should be improved, and a screening program for thalassemia carriers should be initiated.

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How to Cite : Mehrabi, M. Z., Hayat, M. S., Nazari, Q., & Khan, A. . (2024). Prevalence of Thalasemia in Mirwais Regional Hospital (MRH) Pediatric Ward. Jour Med Resh and Health Sci, 7(10), 3214–3223. https://doi.org/10.52845/JMRHS/2024-7-10-3