

NUTRITIONAL STATUS OF CHILDREN WITH BETA THALASSEMIA MAJOR USING BODY MASS INDEX

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ABSTRACT

Objective: To assess the nutritional status of children with beta thalassemia major using body mass index

Study design: Cross sectional study

Place of study & Duration of the Study: Thalassemia care center in District Badin from January to July, 2025

Methodology: A total of 101 children (0-18 Years) of either with beta thalassemia major. Weight was measured using a digital weighing machine, while height was measured using a wall-mounted stadiometer. Body Mass Index (BMI) was calculated by dividing weight in kilograms by height in square meters. The BMI Percentile Calculator for children and adolescents" Center for Disease Control and Prevention (CDC)" was utilized to calculate the percentiles of BMI. The calculated BMI values were plotted on age and sex-specific CDC BMI charts, The nutritional status of the participants was categorized based on BMI percentiles as follows: less than 5th percentile (underweight), 5th–84th percentile (healthy weight), 85th-94th percentile (overweight), and equal to or greater than the 95th percentile (obesity). The BMI values were plotted on age- and sex-specific CDC charts. SPSS 26 was used to analyze the data. Mean and standard deviations were computed for quantitative variables and frequency and percentages were computed for qualitative variables. Nutritional status of major beta thalassemia children was also compared with respect of age groups, gender, duration of disease and residential status. The statistically significant level < 0.05 was considered.

Results: 69 (68%) of the children had age more than 10 years. 55 (54.4%) were male and 46 (45.5%) were female. Most the patients had during of disease less than 5 years 70 (69%), 22 (22.2%) had between 5 to 10 years and 9 (8.8%) had > 10 years.

Conclusion: This study highlights the high prevalence of underweight in children with thalassemia.

KEYWORDS: Body mass index, nutritional status, thalassemia, underweight

INTRODUCTION

Beta thalassemia major is one of the most common hereditary disorders worldwide. It is associated with decreased production of hemoglobin beta chains that results in the expression of clinically variable severity of anemia as thalassemia minor (also known as beta-thalassemia trait), thalassemia intermedia and thalassemia major.¹ Thalassemia major typically presents within the first two years of life. The carrier rate of the disease is 1.5%, while 5–7% in Pakistan.^{2,3}

Thalassemia major is one of the main causes of anemia in Mediterranean countries. Thalassemia major is a significant public health issue that is inherited from parents to children. It can be prevented through screening programs and has severe consequences when left untreated.⁴ Thalassemia major also has a negative impact on the quality of life and reduces life expectancy. Thalassemia major manifests clinical symptoms between 6 months and 2 years of age. Chronic anemia and iron overload can lead to damage to the heart, liver, lungs, and endocrine organs. Patients with thalassemia may experience growth retardation, facial and cranial shape changes, as well as dental issues caused by bone deformities.⁵ They may also develop cardiac and hepatic complications, experience delayed puberty, and be at risk for diabetes mellitus, hypothyroidism, and hypoparathyroidism.⁶ The treatment of thalassemia major includes erythrocyte transfusion, iron chelation therapy, surgical interventions like splenectomy, as well as the management of related complications through follow-up care, psychological support, and stem cell transplantation.⁷ Prenatal screening counselling can indeed help identify couples at risk of having a child with thalassemia major. This allows them to make informed decisions about family planning and consider in vitro fertilization or preimplantation genetic diagnosis to prevent the birth of an affected child. In addition to prenatal screening, education and support for affected children and their families are essential.⁸ This includes providing information about proper nutrition and diet plans, as

individuals with thalassemia may be at an increased risk of malnutrition due to factors such as poor appetite and nutrient malabsorption.⁹ Ensuring that children with thalassemia receive adequate nutrition is important for their growth and development. Moreover, complications associated with thalassemia major, such as iron overload and bone deformities, further emphasize the need for regular monitoring and preventive measures. By regularly assessing and managing these complications, healthcare professionals can help improve the quality of life for children with thalassemia major.¹⁰ The aim of the study was to assess the nutritional status of children with beta thalassemia major using body mass index. This study aimed to determine the nutritional status of children with beta thalassemia major.

METHODOLOGY

This cross-sectional study was conducted in conducted at a thalassemia care center in District Badin from January to July, 2025 after obtaining the approval from Ethical Review Committee of the hospital. After obtaining the written informed permission from Parents or guardians, a total of 101 children (0-18 Years) of either gender with beta thalassemia major were included via non-probability consecutive sampling technique. Exclusion criteria included conditions affecting BMI, such as chronic kidney disease, severe malnutrition, history of severe feeding intolerance, and bone disorders. Patients with hemoglobinopathies other than thalassemia major or those whose parents declined to participate in the research were not allowed to participate.

Sample size was calculated using the OpenEpi online calculator using the prevalence of major beta thalassemia i.e. 7%, margin of error =5%, confidence interval=95%, then calculated sample size was 101.

Weight was measured using a digital weighing machine, while height was measured using a wall-mounted stadiometer. Body Mass Index (BMI) was calculated by dividing weight in kilograms by height in square meters. The BMI Percentile Calculator for children and adolescents" Center for Disease Control and Prevention (CDC)" was utilized to calculate the percentiles of BMI. The calculated BMI values were plotted on age and sex-specific CDC BMI charts, which were sourced from [http:// www.cdc.gov/growthcharts/clinical_charts.htm](http://www.cdc.gov/growthcharts/clinical_charts.htm). The nutritional status of the participants was categorized based on BMI percentiles as follows: less than 5th percentile (underweight), 5th–84th percentile (healthy weight), 85th-94th percentile (overweight), and equal to or greater than the 95th percentile (obesity).

SPSS 26 was used to analyze the data. Mean and standard deviations were computed for quantitative variables and frequency and percentages were computed for qualitative variables. Nutritional status of major beta thalassemia children was also compared with respect of age groups, gender, duration of disease and residential status. The statistically significant level < 0.05 was considered.

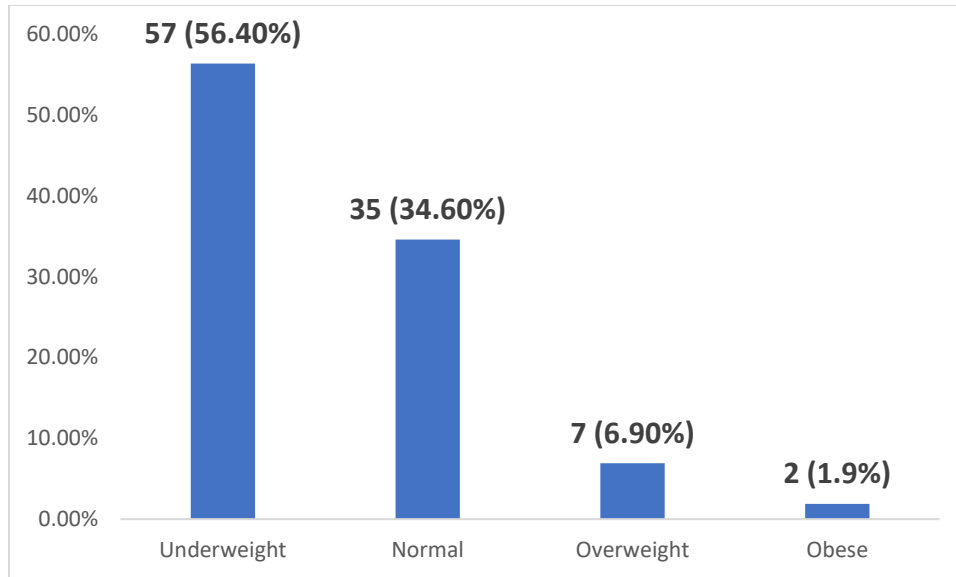
RESULTS

A total of 101 children of major beta thalassemia were included in this study. 69 (68%) of the children had age more than 10 years. 55 (54.4%) were male and 46 (45.5%) were female. Most the patients had a duration of disease less than 5 years 70 (69%), 22 (22.2%) had between 5 to 10 years and 9 (8.8%) had > 10 years. 65 (64.3%) of the children had monthly income Rs. < 20,000, 32 (31.6%) had Rs. >20,000-50,000 and only 4(3.9%) of the patients had Rs. > 50,000, as shown in Table#1.

Table#1 Demographic Data of the Patients

Baseline Data	n(%)
Age	
• 0-10 Years	32 (32%)
• >10-18 years	69 (68%)
Gender	
• Male	55 (54.4%)
• Female	46 (45.5%)
Duration of Disease	
• 0-5 Years	70 (69%)
• >5-10 Years	22 (22.2%)
• >10 years	9 (8.8%)
Monthly Family Income (Rs.)	
• < 20, 000	65 (64.3%)
• >20,000-50,000	32 (31.6%)
• >50,000	04 (3.9%)

All participants were assessed for nutritional status, 57 (56.4%) were underweight, 35 (34.60%) had normal weight, 7 (6.90%) were overweight and 2 (1.9%) were obese, **as shown in (Figure#1)**. Nutritional Status with respect to Demographic Data of the Patients was also compared with respect demographic data, statistically significant difference was observed with respect to age, duration of disease, gender and monthly income, as p-value < 0.05, **as shown in table#2**.



Figure#1: Nutritional Status of Thalassemic Children

Table#2 Comparison of Nutritional Status with respect to Demographic Data of the Patients

Demographic Data	Under weight n(%)	Normal n(%)	Overweight n(%)	Obese n(%)	P-value
Age					
• 0-10 Years	08	22	02	00	0.000
• >10-18 years	49	13	05	02	
Gender					
• Male	45	07	02	01	0.000
• Female	12	28	05	01	
Duration of Disease					
• 0-5 Years	31	31	06	02	0.02
• >5-10 Years	18	03	01	00	
• >10 years	08	01	00	00	
Monthly Family Income (Rs.)					
• < 20, 000	41	17	06	01	0.000
• >20,000-50,000	14	18	00	00	
• >50,000	02	00	01	01	

DISCUSSION

Beta thalassemia major patients have major growth problems/disturbances.^{5,7} BMI i.e. body mass index is one of the methods to assess underweight, healthy, overweight and obese children/patients. As both underweight and obesity are associated with many health problems including coronary risks etc, it is very vital to detect these derangements as early as possible to prevent the consequent impending hazards. There are several studies which show that majority of beta thalassemia patients are underweight. One study showed that around two thirds (60%) of thalassemics are underweight and rest were healthy and overweight.⁸ The toxic effects of deferoxamine, causing excess deposition in tissues and impairing iron dependent enzymes which modify the collagens are thought to be the causes of growth defects. Similarly, low hemoglobin, high ferritin levels and below normal iron chelation are thought to be additional factors.^{9,10}

This cross-sectional study conducted at a healthcare facility aimed to determine the prevalence of malnutrition in children with beta thalassemia major. The results of present research are similar to the results of other studies. These studies have shown that 11.3% - 43% were under weight, while 4.8% were overweight and 6.5% were categorized as obese.¹¹⁻¹⁴ Our study revealed that 57 (56.4%) were underweight, 35 (34.60%) had normal weight, 7 (6.90%) were overweight and 2 (1.9%) were obese. However, the prevalence of malnourished/underweight children in current study was higher than the prevalence reported in the study by Trehan et al; and Pemde et al; respectively 26.7% and 24.2%.^{15,16} The variability in these findings may be attributed to differences in the participants' characteristics. age, ethnicity, and geographical plausibility.

According to this study, the prevalence of underweight was 44.3 % for boys and 19.6 % for girls, as determined by low body mass index. Findings are similar to a study revealed that the prevalence of underweight was 44.3 % for boys and 19.6 % for girls. Furthermore, 44.3 % of boys and 37.7 % of girls were found to be of short stature.¹² Almost similar findings were shown by another study that thalassemia major patients had lower rate of growth and lower BMI which was attributed to low haemoglobin, high ferritin levels and suboptimal iron chelation as already mentioned.¹⁷ However, Tienboon et al has shown 64% and 78% underweight males and females respectively in their work.¹⁹ The studies have explored that decrease in BMI was significantly obvious in those children who had thalassemia for longer duration than those who had recently developed this disease (p=0.000) i.e. longer the duration more were chances of being underweight.^{15,17-19} The current study has also found statistically significant association between the duration of disease and nutritional status in major beta thalassaemic children. Additionally, we found that family monthly income had a significant impact on the level of malnutrition in children.¹⁹

This study provides valuable local data on the nutritional status of children with beta thalassemia major in District Badin, a region where such evidence is limited. The use of standardized anthropometric measurements and CDC BMI percentile charts enhances the reliability of the findings, while the inclusion of key socio-demographic variables allows for a broader understanding of factors associated with malnutrition. However, certain limitations should be acknowledged. As a cross-sectional study, causal relationships cannot be established. The single-center design and use of non-probability sampling may limit the generalizability of the results and introduce selection bias. Furthermore, nutritional assessment was based solely on BMI, which does not reflect micronutrient deficiencies or body composition, and important clinical variables such as dietary intake, serum ferritin levels, and transfusion frequency were not assessed.

CONCLUSION

This study highlights a high prevalence of underweight in children with thalassemia. Preventing these complications and nutritional deficiencies and increasing the life expectancy and quality of patients is necessary. The small sample of our patients may affect this study, which needs to be further investigated in larger groups.

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Recommendations

Moreover, complications associated with thalassemia major, such as iron overload and bone deformities, further emphasise the need for regular monitoring and preventive measures. By regularly assessing and managing these complications, healthcare professionals can help improve the quality of life for children with thalassemia major. Overall, a comprehensive approach that includes prenatal screening, genetic counselling, education, and appropriate medical management is essential in preventing the birth of a baby with thalasse-mia major and providing optimal care for those affected by the condition. The aim of the study was to assess the nutritional status of children with beta thalassemia major using body mass index.