



Comparative Study of Physical Growth Parameters in Thalassemia Children with Healthy School Going Children Between the Age Group Of 5-15 Years

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Abstract

Background: Thalassemia (thal) is one of the most frequently genetically transferred diseases and is related to the decreased production of structurally normal hemoglobin.

Objectives: This study aimed to compare the physical growth constraints in thalassemia kid and healthy school-going children between the age group of 5-15 years. **Methodology:** The study was conducted in a multicenter cross-sectional study. A total of 50 thalassemic children were recruited in the study and 50 healthy children as a control group. Thalassemic children and controls were matched for age, sex, height and weight. **Result:** The mean weight of the thalassemic children (23.74 kg) was significantly less as compared to control children (30.66 kg) ($P=0.00198$). The mean body mass index (BMI) of the children was significantly lower than that of the control group children (15.21 kg/m^2 vs 16.65 kg/M^2) ($p=0.00139$).

Conclusion: The study suggested that growth parameters such as height, weight, and BMI were significantly less and most commonly affected in Thalassemia children compared with their healthy counterparts. The results suggested that in 5-10 years age group weight is more affected than height where as in 10-15 years both weight and height are equally affected.

Keywords: Thalassemia, BMI, Growth parameters

Introduction: Worldwide, thalassemia (thal) is one of the most often genetically transferred diseases and is related to the decreased production of structurally normal hemoglobin. It has a range of clinical severity and is connected with unproductive erythropoiesis, bone marrow development, a quick damage of erythrocytes, and regular blood transfusions. A series of inherited haematological illnesses known as beta thalassemia are distinguished by the early

onset of anaemia brought on by the decreased production of one or more beta globin chains, which can be obtained by a variety of globin gene abnormalities. [1]

Thalassemia poses several difficult clinical and psychosocial problems. Thal's impact on physical strength can cause physical abnormality, growth impairment, and postponed adolescence.[2-4] Poor self-image is also a result of how it affects physical appearance, such as bone abnormalities and short height.[3,4]Patients with thal frequently have severe side effects such as "liver diseases", "heart failure", "infections", and problems with their "endocrine system".[5,6] Patients' health-related quality of life (HRQOL) is impacted by the difficulties stated since they do not just influence patients' physical health but also their intellectual, social, and emotional health. [3,4,7-11].[3,4,7-11]

A common consequence of thal is growth failure.[12] Many factors like iron overload, iron chelating agent toxicity, socioeconomic factors, nutritional deficiencies, and hormonal deficiency will lead to growth failure. So early assessment and intervention may help in preventing growth failure in these children.

Anthropometric measurements, specifically BMI has an vital role to evaluate the status of growth.[13] Various factors such as consistent blood transfusion, desferoxamine usage, and other healing services are significant and has role in the progress and advancement of these subjects.[14]Providing these patients with suitable therapy approaches, educating them and their relatives, and emphasising the significance of routinely measuring their physical growth indicators as a measure of the efficacy of the therapeutic intervention.[15]Hence, this study was done to compare the physical growth constraints in thalassemia children and normal healthy children.

Objectives

1. To compare weight, height, and BMI of thalassemia children with healthy school-going children of the same age and sex.
2. To study most affected growth parameters among weight, height, and BMI

Methods

The present comparative observational study was conducted at the Department of Paediatrics at D.Y. Patil medical college hospital and research institute kadamwadi Kolhapur after the institutional ethical committee approval. In this study, children fulfill the inclusion and exclusion criteria were recruited.

Inclusion criteria

- Either sex children of 5-15 years with beta-thalassemia (case group).
- Healthy age and sex matched school children (control group).

Exclusion criteria:

- Double heterozygous thalassemia children.
- Thalassemia children suffering from systemic illness such as tuberculosis, chronic renal disease, and chronic liver disease.

Parents of the patients were informed well in vernacular language about the study protocol and written consent was taken from respective parents on behalf of patients before enrolling into the study. Confidentiality and anonymity were maintained throughout the study process.

The minimum sample size for each group (case and control) is 45. Considering the 10% dropout rate, the sample size for the case group was 50.The sample size for the control group was 50.

Age, sex, height, and weight-matched healthy school-going children were recruited in the study as a control group. Matching of controls was done by randomly selecting 3-4 healthy school-going children of that particular age, and sex, and mean weight and height was

calculated and taken. Detailed history in the form of age, sex, weight, height, were noted and BMI were calculated. Physical growth parameters such as height, weight, and BMI were measured and compared with control group children. Weight in kg was taken by bathroom scale weighing machine, height in cm was taken by stadiometer, and BMI was calculated by formula $wt\ (kg)/ht^2\ (m)$. Weight for age, height for age, and BMI were stated in the form of percentiles relative to WHO 2007 Child Growth Standards reference data.

Statistical analysis

Data were evaluated using SPSS V 1.2.5001 software. Qualitative/Categorical variables are presented in the form of frequency distribution with graphs. Mean and Standard Deviation was computed for quantitative variables. Hypothesis testing is done by Two Sample T-Test. In the present study level of significance is considered to be 5%.

Results

This comparative observational study was conducted at the Department of Paediatrics at D.Y. Patil medical college hospital and research institute kadamwadi Kolhapur.

COMPARISON OF WEIGHT

Table 1: Comparison of weight between groups.

Group	Weight (kg)		Test Statistic	P-value
	Mean	SD		
Control	30.66	12.58	3.1893	0.00198
Thalassemia	23.74	8.76		

The weight of children in the thalassemia group is significantly less than the weight of children in the control group at 5% level of significance ($p < 0.05$).

COMPARISON OF HEIGHT

Table 2: Comparison of height in groups.

Group	Height (cm)		Test Statistic	P-value
	Mean	SD		
Control	131.96	20.38	2.5312	0.01300
Thalassemia	122.44	17.08		

The height of children in the thalassemia group is significantly less than the height of children in the control group at 5% level of significance ($p < 0.05$).

COMPARISON OF BMI

Table 3: Comparison of BMI in groups.

Group	BMI(kg/m^2)		Test Statistic	P-value
	Mean	SD		
Control	16.65	2.25	3.2917	0.00139
Thalassemia	15.21	2.15		

The BMI of children in the thalassemia group is significantly less than the BMI of children in the control group at 5% level of significance ($p < 0.05$).

COMPARISON OF BMI CATEGORIES

Table 4: Distribution of children according to BMI categories

BMI categories	Thalassemia group		Control group		P value
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	
Underweight	46	92	37	74	0.0164
Normal	4	8	11	22	0.016

The proportion of underweight children in thalassemia group is significantly larger than control group at a 5% level of significance ($p < 0.05$).

Since p value is 0.016 ($p < 0.05$) as a proportion of normal children in thalassemia group is significantly less than control group.

COMPARISON OF WEIGHT FOR AGE

Table 5: Comparison of weight for age

Weight for age (percentile)	Thal Group		Control group		P Value
	Frequency(n)	Percentage(%)	Frequency(n)	Percentage(%)	
<3 rd	15	30	0	0	0.00001
3 rd – 50 th	35	70	41	82	0.16
>50 th	0	0	9	18	0.00168

At a 5% level of significance, we can conclude $p < 0.05$ suggesting a significant proportion variance in children belonging to <3rd and >50th percentile weight for age, in the thalassemia group than control group. Whereas, 3rd to 50th percentile showed no significant difference.

COMPARISON OF HEIGHT FOR AGE

Table 6: Comparison of height for age

Height for age (percentile)	Thal Group		Control group		P Value
	Frequency(n)	Percentage(%)	Frequency(n)	Percentage(%)	
<3 rd	25	50	0	0	0.00001
3 rd – 50 th	25	50	44	88	0.00001
>50 th	0	0	6	12	0.01

At a 5% level of significance, we can conclude $p < 0.05$ suggesting a significant proportion difference in children belonging to <3rd, 3rd -50th, and >50th percentile height for age in the thalassemia group compared to the control group.

COMPARISON OF AGE DISTRIBUTION

Table 7: Age-wise distribution of growth parameters

Age Group	Parameter	Thalassemia			Control			P value for		
		Weight(kg)	Height (cm)	BMI (kg/m ²)	Weight(kg)	Height (cm)	BMI (kg/m ²)	Weight	Height	BMI
5 to 10	Mean	16.78	109.15	14.02	20.19	115.22	15.08	0.0020	0.0175	0.0040
	SD	3.34	9.86	1.49	4.85	10.74	1.31			
11 to 15	Mean	31.92	138.04	16.60	42.96	151.61	18.51	0.0000	0.0000	0.0004
	SD	5.34	8.00	1.97	5.69	6.44	1.61			

Above table suggests that there is significantly less weight, height, and BMI in 5 to 10 and 11 to 15 years age group children with thalassemia compared to control group children.

Weight is more affected in 11-15 years age group as compared to 5-10 years age group ($p < 0.05$)

Height is more affected in 11-15 years age group as compared to 5-10 years age group($p<0.05$)

BMI is more affected in 11-15 years age group as compared to 5-10 years age group($p<0.05$)

Table 8: Summative comparison of growth parameters

Growth parameters	Control group (mean±SD)	Thalassemia group (mean±SD)	P value
Weight (Kg)	30.66±12.58	23.74±8.76	0.00198
Height (cm)	131.96±20.38	122.44±17.08	0.01300
BMI (kg/m ²)	16.65±2.25	15.21±2.15	0.00139

Discussion

The comparative observational study was conducted at the department of paediatrics at D.Y. Patil medical college hospital and research institute kadamwadi kolhapur. The study aimed to compare physical growth parameters in thalassemia children with healthy matching school-going children between the age group of 5-15 years. This study determined various physical growth parameters such as height, weight, and BMI of thalassemia children and compared them with normal healthy school-going children and most affected growth parameter was determined.

Age

In this study, we included children of 5-15 years. The mean age of the participants was 9.76 ± 3.79 years which was comparable with the study of Fahim FM et al. and Pemde HK. Et al,[17, 18]. (table A) Johnson, Hertzog, and Malina,[19] suggested that thalassemic children began to show signs of growth retardation at the age of 4. However, Piomelli, Karpatkin, and Arzanian,[20] noticed growth obstruction in all subjects between the ages of four and twelve. The present study shows a corresponding match to the results of Saengar et al [21] who observed that the growth of thalassemic children was approximately normal up to the age of 8 to 10 years old.

Table A: Comparison between studies

Similar studies	Average age (year)
Fahim FM et al [17]	7.35
Pemde HK et al [18]	9.19
Present study	9.76

Weight

In the present study, (table 1) the mean weight of the thalassemia children (23.74 ± 8.76 kg) was significantly less as compared to control children(30.66 ± 12.58 kg)($P=0.00198$). Similarly, Fahim FM et al. [17] reported lower body weight in thalassemia subjects than in the control group. Previous studies reported by Jain M. et al [22], Shamshirsaz AA et al [23], and Hashemi A et al [24] stated a low body weight in the case of the thalassemia group than the control population. Moreover, in this study comparison of weight for age indicated that 30% of thalassemia patients had weight $<3^{\text{rd}}$ percentile. These results are comparable with the study of Mukherjee S. et al. they showed weight $<3^{\text{rd}}$ percentile in 35.57% of thalassemia patients.[25] However, Nabavizadeh SH. et al. showed weight $<5^{\text{th}}$ percentile in 53.7% of the patients.[26] (table B) Fewer incidences in the present study may be due to the various nutritional programs implemented by the government.

Table B: Comparison between studies

Similar studies	Weight/age in percentile	Percentage
Mukherjee S. et al [25]	<3 percentile	35.57%
Nabavizadeh SH. et al [26]	<5 th percentile	53.7%
Present study	<3 rd percentile	30%

Height

In this study, (table 1) we found significantly less height in thalassemic subjects compared to the control group children (122.44±17.08 cm vs 131.96±20.38 cm, P=0.013). These outcomes were compared with the study carried out by Nabavizadeh SH et al.[26] They reported a significant decline in height in thalassemia subjects than control group after examining their physical characteristics. Moreover, when subjects were assessed for height for age, we found that 50% of the subjects in the thalassemia group had height <3rd percentile which indicated short stature. The previous various studies report a significantly higher percentage of short height in thalassemia children. [16, 27-29](table C) Detailed comparison is depicted in table 8. Children that are thalassemia may have short stature due to chronic anaemia, hypersplenism, or a lack of folate. [30]

Table C: Comparison between studies

Similar studies	Short stature (<3 rd percentile)
Rathaur VK et al.[16]	65.71%
Jana A. et al.[27]	65.8%
Fadlyana E. et al.[28]	62%
Das PS, and Majumdar S.[29]	67%
Present study	50%

BMI

In this study, (table 2) nutrition grade was evaluated by BMI depending on age. In thalassemic children mean BMI was significantly less compared to control group children (15.21±2.15 kg/m² vs 16.65±2.25 kg/m², P=0.00139). Moreover, we obtained that 92% of the thalassemia children were underweight which was reported to be 77% and 70% by Rathaur VK et al. and Das PS. et al. [16, 29](table D) Bushra Moiz et al. also noted that 42% of thalassemic children were undernourished and did not have obesity. [1] Yeni et al. discovered stunting in 58.5% of kids and undernutrition in 29.4% of kids. [31] Similar to this, Badiger S et al. have noted stunting and undernutrition in thalassemic children receiving irregular transfusions. Additionally, they noticed pubertal delay in these kids. [32] Growth failure in thalassemia has a complex aetiology. An important contributing component is excess iron. Regular blood transfers can lower haemoglobin levels, but the patient's ability to grow physically can be hampered if serum ferritin levels are too high.

Table D: Comparison between studies

Similar studies	Underweight children percentage
Rathaur VK et al.[16]	77%
Das PS. et al.[29]	70%
Present study	92%

The study suggested that growth parameters such as height, weight, and BMI were significantly less and most commonly affected in thalassemic children compared to their healthy counterparts. The limitation of this study was we did not evaluate the correlation between serum biomarkers of thalassemia and growth parameters. There could be an

association between the frequency of blood transfusion and reduced growth parameters which need to be evaluated further. Moreover, parent education and socioeconomic status could be also risk factors in thalassemia-associated growth retardation.

Conclusion

“The study was conducted to compare physical growth parameters in thalassemia children with healthy school-going children between the age group of 5-15 years”.

- The weight of the thalassemia patient was significantly less as compared to control group children.
- The height of the thalassemia patient was significantly less as compared to control group children.
- The BMI of the thalassemia patient was significantly less as compared to control group children.
- Weight is most affected than height in thalassemia group when compared to control group.
- Growth parameters of thalassemia and control group subjects, when compared according to age categories, suggested that in 5-10 years age group weight is more affected than height where as in 10-15 years both weight and height are equally affected.

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