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Comparison of Body Mass Index in Beta Thalassemia Major Patients with That of Normal Subjects

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ABSTRACT

Introduction: Beta thalassemia major is a common hereditary haemolytic anemia that has to be treated with repeated blood transfusions. Growth retardation amongst these patients have been reported in previous studies in terms of linear growth. But very few studies are there regarding Body Mass Index (BMI) in the same.

Objective: Present study was undertaken to measure and compare the BMI in thalassemia major patients with that of healthy controls.

Methods : The study involved total 216 individuals who were divided into two groups of 100 normal subjects (control group) and 116 patients of beta thalassemia major (study group) receiving regular blood transfusions between the age group of 5 to 20 yrs involving both, males and females after applying inclusion and exclusion criteria. Height, weight and BMI were measured in all subjects. Statistical analysis of observations was done with the help Chi-square test.

Result: According to CDC classification of BMI, majority of patients were falling into Underweight category as compared to healthy controls.

Conclusion : Thus we can conclude that there is low BMI in thalassemia major patients as compared to controls

Keywords: Beta thalassemia major, Body mass index, Study group, Control group

INTRODUCTION

Beta thalassemia is the commonest single-gene disorder in the Indian population.[1] The incidence of symptomatic individual is estimated at 1 in 1,00,000 throughout the world annually. Whereas average incidence of Beta thalassemia trait in India is 3.3% with 1–2 per 1,000 couples being at risk of having an affected offspring each year. The incidence of Beta thalassemia in different regions of India varies from 3% to 17%, with a mean prevalence of 4%. [2] It is estimated that there are about 45 million carriers of the Beta thalassemia gene in India, while about 15,000 affected infants are born every year, contributing to about 10% of the total thalassemics born all over the world. [3,4]

Thalassemia major manifest as severe anemia in infancy or childhood and in the past was incompatible with life. Now with regular blood transfusions and modern therapeutic interventions they can survive with comparatively prolonged life expectancy.[5] But repeated blood transfusions lead to iron overload as human beings do not have the ability to remove the extra accumulated iron.[6] The iron gets deposited in various organs like liver, heart and endocrine glands which lead to various types of endocrinopathies in thalassemia major patients.[7]

Growth failure in thalassemia major has been recognised for many years, and has persisted despite major therapeutic advances. The pathogenesis of growth failure is multifactorial. The fundamental problem is the free iron and hemosiderosis-induced damage of the endocrine glands. Additional factors may contribute to the etiology of growth delay

including chronic anaemia and hypoxia, chronic liver disease, zinc and folic acid and nutritional deficiencies, intensive use of chelating agents, emotional factors, endocrinopathies (hypogonadism, delayed puberty, hypothyroidism, disturbed calcium homeostasis and bone disease) and dysregulation of the GH-IGF-1 axis.[8]

There are different methods of assessing nutrition e.g. weight for age, height for age , weight for height etc. But body mass index(BMI) is the most frequently used for assessing whether child is obese, overweight, underweight or a healthy weight. Children's BMI (2-20 years of age) is classified using thresholds that take into account the child's age and sex unlike in adults where fixed BMI values are used to classify individuals.[9]

A low BMI is associated with greater mortality risk.[10] Underweight and under-nutrition may lead to loss of energy and susceptibility to injury and infection, under-function of multiple endocrine systems, as well as distorted body image and other psychological problems.[11]

Due to high prevalence of growth disturbances in thalassemia major patients this study was conducted to determine BMI in thalassemia major patients and to compare the same with healthy controls. The information gathered from this study will be of benefit in developing nutritional recommendations to improve nutritional status, growth, quality of life and treatment in the children with thalassemia major.

MATERIALS AND METHODS

The present study was a cross sectional type of study conducted in the Department of Physiology and Department of Pediatric Medicine, Grant Government Medical College, Mumbai and in the Thalassemia unit of St. George Hospital, Mumbai. Before commencement of the project, approval was taken from the Institutional Ethical Committee.

The study design involved total 216 individuals who were divided into two groups of 100 normal subjects (control group) and 116 patients of beta thalassemia major (study group) receiving regular blood transfusions between the age group of 5 to 20 yrs involving both, males and females. Patients with concomitant sickle cell anemia or with associated congenital or acquired heart disease, diabetes mellitus, thyroid disorders or any other endocrine disorder or on long term medications for any other chronic disease were excluded from the study. Written informed consent was taken before the clinical examination of the subject.

Method of data collection

Weight of the subject was measured using digital weighing machine scale whose least count was 0.1kilogram (kg). To ensure that body weight is evenly distributed between both feet over the centre of the scale, the subject was asked to stand still, hold head up and face forward with arms hanging freely by the sides of the body, with palms facing the thighs. Weight was measured in light weight garments without footwear. The height of the subject was measured by making the subject to stand bare feet on a flat floor against a wall on which the measuring scale was inscribed. The subject was asked to keep the feet parallel and the heels, buttocks and occiput touching the wall. The head was held erect and facing straight ahead, then with the help of plastic ruler, the top most point of the vertex compressing the hair was noted on the wall. The height was expressed in centimetres.

BMI was calculated by the formula : weight (kg) /[height (m)]^2. It was plotted on age and sex specific CDC charts available at http://www.cdc.gov/growthcharts/clinical_charts.htm

Classification based on BMI according to CDC growth charts

BMI category	Classification
Less than 5th percentile	Underweight
5th to 84th percentile	Healthy weight
85th to 94th percentile	Overweight
≥ 95th percentile	Obese

Volume 2, Issue 3; May-June 2019; Page No.368-373
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Statistical analysis of the observations was carried out by using Chi-square test. Statistical significance was tested at 5% & expressed in terms of 'p' value with $p<0.05$ as statistically significant.

RESULTS

In the present study mean age of study group was 13.47±4.73 yrs whereas that of control group was 14.72±4.13 yrs.

The height (Table 1) and weight (Table 2) of cases and controls was compared with the standard percentiles in the CDC growth charts.The calculated BMI of the cases and controls were compared according to CDC classification based on BMI. (Table 3 and Figure 1) On statistical analysis the chi-square statistic is 33.2698. The p-value is < 0.00001. The result is significant at $p < 0.05$.

DISCUSSION

The present research was undertaken to determine BMI in thalassemia major patients and compare the same with healthy controls. BMI is one of the most preferred methods to assess underweight and obesity. Both underweight and obesity can results in many health problems including cardiovascular diseases. Thus they should be detected as early as possible to prevent hazardous outcomes.

In the present study we observed that thalassemia major patients presented with reduced height and weight as compared to normal subjects.[Table 1 and 2] This is in accordance with the study done by Mahesh Chand Meena et al and Seyed Hessamedin et al.[12,13] Also similar findings were seen in the study done by Tienboon P et al. who showed linear growth failure along with varying degrees of wasting in thalassemia major patients concluding as these patterns of growth abnormalities indicate general malnutrition as an important cause of growth failure in children with beta thalassemia.[14]

Shazia Ali et al also observed that patients suffering from thalassemia major presented with reduced height and weight which was associated with increased serum ferritin and low haemoglobin levels.[15] In contrast; other investigators reported no significant difference in height and body weight between cases and controls.[16]

In addition we observed that 59.48% thalassemia major patients were underweight, 37.93% were healthy, 1.72% were overweight and 0.86% were obese.[Table 3 and Figure 1] After comparing with normal subjects this was found to be statistically significant. Thus majority of thalassemia major patients (59.48%) were underweight as compared to controls (21%). This is in accordance with the study done by Hammod et al whose BMI result revealed a significant decrease ($p<0.05$) in all groups of thalassemia patients compared with healthy group.[17] Also in work done by Ali and Hamdollah in thalassemic patients, it was revealed that under 10 years of age, BMI was significantly less than 10th percentile in 19% of girls and 7% of boys (total in 12.4% of patients), but above 10 years of age, BMI was less than 10th percentile in 32% of girls and 58% of boys (total in 46.5% of patients).[18]

Study done by Muhammad Amin Sheikh et al showed that 58.69% thalassemia patients were underweight, 35.74% patients were healthy, 3.28% patients were overweight and 2.3% patients were obese.[19] Likewise low BMI amongst thalassemia patients were also recorded by Prakash A et al and Kaur et al. [20, 21] Also Marianna Vlychou et al showed that BMI was lower only in the male patients, compared to controls ($p= 0.015$). The female patient group exhibited non-statistically significant difference compared to healthy age-matched controls. [22] In contrast, normal BMI was noticed in beta thalassemia major patients by Hamed et al and Vogiatzi et al.[16, 23]

Low BMI in thalassemia can be attributed to growth failure which may be because of growth hormone deficiency,[24] abnormal hepatic conversion of steroid hormones to their active metabolites [25] and defective hepatic biosynthesis of insulin like growth factor (IGF-I).[26] It is possible that iron overload is primarily involved in this phenomenon. Chronically transfused, inadequately chelated patients develop hepatocellular injury and late growth failure within the first decade of life.[27] Further various studies have shown improvement in growth in these patients with different treatment modalities such as recombinant human growth hormone supplements [24], zinc supplementation [28] and intensive chelation therapy etc.[29]

CONCLUSION

Our study showed reduced height, weight and BMI in thalassemia major patients as compared to healthy

Volume 2, Issue 3; May-June 2019; Page No.368-373
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controls. Thus apart from routine blood transfusions, regular follow up of thalassemia major patients should be done so as to detect and treat growth retardation as early as possible.

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Volume 2, Issue 3; May-June 2019; Page No.368-373
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TABLES

Table 1: Comparison of height for age from CDC growth charts

Percentiles	Cases	Controls
<5	82.75%	24%
5 to 10	1.72%	16%
10 to 25	8.62%	18%
25 to 50	5.17%	18%
50 to 75	1.72%	20%
75 to 90	0	4%
90 to 95	0	0
>95	0	0

Table 2: Comparison of weight for age from CDC growth charts

Percentiles	Cases	Controls
<5	79.31%	18%
5 to 10	2.58%	18%
10 to 25	7.75%	16%
25 to 50	5.17%	28%
50 to 75	1.72%	8%
75 to 90	3.44%	8%

Volume 2, Issue 3; May-June 2019; Page No.368-373
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90 to 95	0	2%
>95	0	2%

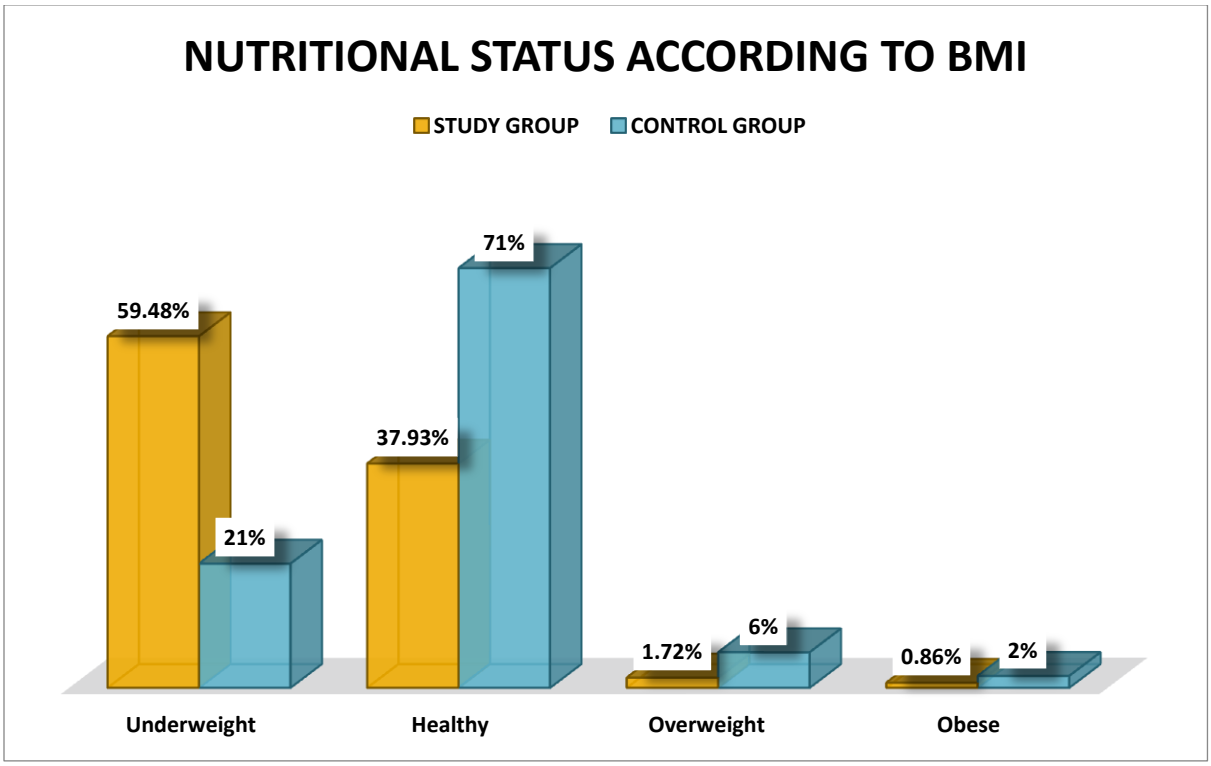
Table 3: Comparison of BMI categories between Study group and Control group

No. Of Subjects	Underweight	Healthy	Overweight	Obese	Total
Study group	69(59.48%)	44(37.93%)	2(1.72%)	1(0.86%)	116
Control group	21(21%)	71(71%)	6(6%)	2(2%)	100

[BMI – Body mass index]

FIGURES

Graph 1: Comparison of BMI categories between Study group and Control group



[BMI – Body mass index]

Volume 2, Issue 3; May-June 2019; Page No.368-373
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