ORIGINAL ARTICLE

The Assessment of Nutritional Status of Children with Beta Thalassemia Major with Body Mass Index

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ABSTRACT

Aim: To assess the frequency of nutritional status of the children with thalassemia major by BMI at Bahawal Victoria Hospital Bahawalpur.

Methods: This cross sectional study was conducted at Department of Pediatrics, Bahawal Victoria Hospital, Bahawalpur from May 2015 to November 2015. Total 305 patients of thalassemia major having age from 2-16 years either male or female, with 1 year duration of illness were selected for this study. Nutritional status of the patients was assessed.

Results: In this study age range of the patients of thalassemia major was 2 to 16 years with mean age 7.88 ± 3.78 years. Mean height was 118.71 ± 19.25 cm, mean weight was 20.35 ± 7.72 and mean BMI was 14.03 ± 2.71.Total 179 (58.69%) patients were underweight, 109 (35.74%) patients were healthy, 10 (3.28%) patients were overweight and 7 (2.3%) patients were obese. Statistically significant association of nutritional status with age group and duration of illness was noted.

Conclusion: Results of this study showed that most of the thalamic patients were underweight. Statistically significant association of nutritional status with age of thalamic patients and duration of illness was detected. Jobs status of the parents of thalamic patients also affects the nutritional status.

Key words: Beta thalassemia, BMI (body mass index), Underweight, Overweight, Obese

INTRODUCTION

β-thalassemia is caused by abnormalities in the synthesis of the beta chains of hemoglobin that result in variable phenotypes ranging from clinically asymptomatic individuals to severe anemia and autosomal recessive in origin[1].

About 1.5% population of the world are careers of **β** thalassemia[2]. The carrier rate in general population of Pakistan is 5.5%[3] and that may increase up 62.2% in immediate family members of thalassemia patients[4]. Cases of thalassemia major usually present within the first 2 years of life with severe anemia[1]. Growth problems in thalassemia major are a recognized feature. Its pathogenesis is multifactorial. There is ineffective erythropoiesis and accelerated red cell turnover owing to the short life span of red blood cell in thalassemia resulting in increased body demand of energy and nutrients to maintain normal erythropoiesis while they have the average energy intake lower than the recommended daily dietary allowances. Moreover these patients also have multiple deficiencies of vitamins such as vitamin A, vitamin E, folate and vitamin B12 and minerals like calcium and zinc. These factors along with intensive use of chelating agents, emotional factors, endocrinopathies (hypogonadism, delayed puberty, hypothyroidism,) and dysregulation of the GH-IGF-1 axis may lead to abnormalities in growth[5].

Though 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[6].

Thalassemia major is common in this locality and no study had been conducted out to know their nutritional status by BMI as it, unlike other methods of nutritional assessment, assesses all the categories including under and over nutrition. The information gathered from this study will be of utmost benefit in developing nutritional recommendations to improve nutritional status, growth, quality of life and treatment in the children with thalassemia major.

MATERIALS AND METHODS

This cross sectional study was conducted at Department of Paediatrics, Bahawal Victoria Hospital, Bahawalpur from May 2015 to November 2015. Two years to sixteen years an old child of either gender with thalassemia major, have duration of one year and have been registered with this unit for the last six months and is on regular follow up were included in this study. Refusal of parents /guardian to give

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consent, having impaired renal function (serum creatinine elevated more than 1.5 mg/deciliter), thalassemia major patients with other structural hemoglobinopathies like Sickle cell anemia, Hemoglobinopathy D, C and E by hemoglobin electrophoresis, short stature due to other chronic systemic disease or hereditary bone dysplasia diagnosed clinically were excluded from the study.

OPERATIONAL DEFINITIONS

Thalassemia Major: It will be defined as patient with hemoglobin less than 7gm% with hemoglobin F ≥70% and hemoglobin A<30% on hemoglobin electrophoresis at the time of diagnosis.

Assessment of the nutritional status by BMI: The BMI was calculated as "weight in kilogram divided by height in square meter". The value of BMI was plotted on age and sex specific CDC BMI charts available at http://www.cdc.gov/growthcharts/clinical_charts.htm and nutritional status was categorized as:

BMI Category	Nutritional status
Less than 5th percentile	Underweight
5th–84th percentile	Healthy weight
85th–94th percentile	Overweight
≥ 95th percentile	Obesity

Data collection procedure: After taking approval from institutional review committee and written informed consent from parents/guardians of the children total 305 patents with thalassemia major were selected.

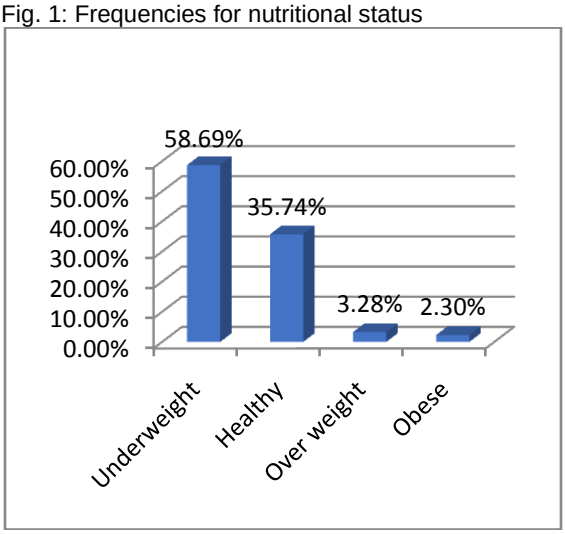
Weight was measured by using digital weighing machine. Height was measured by wall mounted stadiometer. BMI was calculated by the formula: weight (kg) /[height (m)]^2. It was plotted on age and sex specific CDC charts. All the data was entered in predesigned proforma along with demographic profile of the patients.

Data analysis procedure: Data was analyzed in SPSS version 20. Mean and standard deviation were calculated for age, duration of beta thalassemia major, height, weight and BMI at the time of enrollment for the study. Frequency and percentages were calculated for various categories of BMI (obese, overweight, normal, underweight). Effect modifier was controlled through stratification of age at the time of enrollment for the study (age groups 2-6years, 7-11 years, 12-16 years), duration of the disease at the time of enrollment (duration 1-5 years, 6-10 years, 11-15 years), gender, educational status of parents (below primary level, primary level to below metric, metric level and above) and employment status of parents (employed, self-employed, unmployed). Post stratification Chi-square test was applied. P value ≤ 0.05 was taken as significant.

RESULTS

In this study age range of the patients of thalassemia major was 2 to 16 years with mean age 7.88±3.78 years. Mean height was 118.71±19.25 cm, mean weight was 20.35±7.72 and mean BMI was 14.03±2.71. As shown in fig. 1, total 179 (58.69%) patients were underweight, 109(35.74%) patients were healthy, 10(3.28%) patients were overweight and 7(2.3%) patients were obese.

Fig. 1: Frequencies for nutritional status



Patients were divided into three age groups i.e., 2-6 years, 7-11 years, 12-16 years. There were 121 (39.67%), 124(40.66%), 60(19.67%) patients respectively were belonged to age group 2-6 years, 7-11 years and 12-16 years. In age group 2-6 years, underweight patients were 62 (51.24%) followed by healthy 44 (36.36%), overweight were 8(6.61%) and obese were 7(5.79%) patients. In age group 7-11 years, underweight, healthy, overweight and obese were 70(56.45%), 52(41.94%), 2(1.61%) and 0 respectively. In age group 12-16 years, underweight, healthy, overweight and obese were 47(78.33%), 13(21.67%) respectively. Statistically significant (P= 000) association of nutritional status with age group was noted (Table 1).

Patients were divided into 3 groups according to duration of illness i.e. 1-5 years, 6-10 years and 11-15 years. Total 195(63.93%) patients found with 1-5 years of duration of illness followed by 85(27.87%) with 6-10 years and 25(8.2) with 11-15 years duration of illness. In 1-5 years group, total 83 (42.56%), 95(48.72%), 10(5.13%) and 7(3.59%) patients were underweight, healthy, overweight and obese respectively. In 6-10 years group, total 71(83.53%), 14(16.47%), 0 and 0 were underweight, healthy, overweight and obese respectively. In 11-15 years group, 25(29.41%) were underweight. Statistically association (P=000) of nutritional status with duration of illness was noted (Table 2).

Total 158(51.80%) parents of patients were un-employed, of which 105 (66.46%) patients were underweight followed by 47(29.75%) healthy, 4(2.53%) overweight and 2(1.27%) patients were obese. Employed parents of patients were 138(45.25%) of which 71(51.45%) patients were underweight, 56(40.58%) were healthy, 6(4.35%) were overweight and 5(3.62%) patients were obese. Total 9(2.95%) parents of patients were self-employed, of which 3(33.33%) patients were underweight, 6 (66.67%) patients were healthy and no patient was overweight or obese. Statistically insignificant (P=0.06) association between nutritional status and job status of parents was noted (Table 3). Total 141(46.23%) parents of patients were below metric followed by 138 (45.25%) metric and 26 (8.52%) were above metric. Statistically insignificant (P=0.51) association between nutritional status and education status of parents was noted. (Table 4)

Table 1: Association of nutritional status with age group

Age group	Nutritional status (P = 000)				Total
	Underweight	Healthy	Overweight	obese	
2-6	62(51.24%)	44(36.36%)	8(6.61%)	7(5.79%)	121(39.67%)
7-11	70(56.45%)	52(41.94%)	2(1.61%)	0	124(40.66%)
12-16	47(78.33%)	13(21.67%)	0	0	60(19.67%)
Total	179(58.69%)	109(35.74%)	10(3.28%)	7(2.3%)	305

Table 2: Association of nutritional status with duration of illness

Duration of illness	Nutritional status (P = 000)				Total
	Underweight	Healthy	Overweight	obese	
1-5	83(42.56%)	95(48.72%)	10(5.13%)	7(3.59%)	195(63.93%)
6-10	71(83.53%)	14(16.47%)	0	0	85(27.87%)
11-15	25(29.41%)	0	0	0	25(8.2%)
Total	179(58.69%)	109(35.74%)	10(3.28%)	7(2.3%)	305

Table 3: Association of nutritional status with job status of parents

Job status of parents	Nutritional status (P = P=0.06)				Total
	Underweight	Healthy	Overweight	obese	
Un-employed	105(66.46%)	47(29.75%)	4(2.53%)	2(1.27%)	158(51.80%)
Employed	71(51.45%)	56(40.58%)	6(4.35%)	5(3.62%)	138(45.25%)
Self-employed	3(33.33%)	6(66.67%)	0	0	9(2.95%)
Total	179(58.69%)	109(35.74%)	10(3.28%)	7(2.3%)	305

Table 4: Association of nutritional status with education status of parents

Education status of parents	Nutritional status (P = P=0.51)				Total
	Underweight	Healthy	Overweight	obese	
Below metric	88(62.41%)	43(30.5%)	6(4.26%)	4(2.84%)	141(46.23%)
Metric	78(56.52%)	54(39.13%)	4(2.9%)	2(1.45%)	138(45.25%)
Above metric	13(50%)	12(46.15%)	0	1(3.85%)	26(8.52%)
Total	179(58.69%)	109(35.74%)	10(3.28%)	7(2.3%)	305

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 deferrioxamine, 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]. The results of present research are similar to the results of other studies. These studies have shown that 11.3% - 43% were underweightwhile 4.8% were overweight and 6.5% were categorized as obese[10-14]. The results obtained in our study are also almost similar. According to another study, the prevalence of malnutrition was 44.3% for boys and 19.6% for girls, as determined by low body mass index. Furthermore, 44.3% of boys and 37.7% of girls were found to be of

short stature (15). 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[16]. Kumari V et al carried out a study in India which showed that 68.9% of thalassemic children were underweight ie malnourished[17]. Similarly Tanphaichitr et al found 74.5% of thalassemics to be underweight[18]. Tienboon et al has shown 64% and 78% underweight males and females respectively in their work[19]. Growth problems in thalassemia major are a recognized feature. Its pathogenesis is multifactorial. There is ineffective erythropoiesis and accelerated red cell turnover owing to the short life span of red blood cell in thalassemia resulting in increased body demand of energy and nutrients to maintain normal erythropoiesis while they have the average energy intake lower than the recommended daily dietary allowances. Moreover these patients also have multiple deficiencies of vitamins such as vitamin A, vitamin E, folate and vitamin B12 and minerals like calcium and zinc. These factors along with intensive use of chelating agents, emotional factors, endocrinopathies (hypogonadism, delayed puberty, hypothyroidism,) and dysregulation of the GH-IGF-1 axis may lead to abnormalities in growth.

The 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. In our study there was no significant association between status of job (employed, unemployed and self employed) between BMI statuses of the cases of thalassemia. Similar was seen in case of association between education status and BMI categories. There was no significant association between education level of parents and the BMI categorization/status.

Because underweight and obesity expose the patients to greater mortality and morbidity risks, it is important to pay more attention to take this problem in these thalassemic patients into consideration. Growth should be monitored routinely regularly in order to detect any decrease in growth velocity and also any derangement in BMI to formulate an appropriate protocol for investigation and treatment of thalassemia.

CONCLUSION

Results of this study showed that most of the thalamic patients were underweight. Statistically significant association of nutritional status with age of thalamic patients and duration of illness was detected. Jobs status of the parents of thalamic patients also affects the nutritional status.

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