

Original Research Article

Investigating the prolongation of blood transfusion frequency in thalassemic children by omega 3 fatty acid and protein supplementations through milk

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ABSTRACT

Background: Thalassemia is an inherited genetic hemoglobin disorder wherein, afflicted child is born when both parents are carriers for defective alpha or beta hemoglobin gene. The thalassemias are the most common genetic disorder on a worldwide basis. The requirement of frequent blood transfusions in these patients pose a substantial burden on the health care system.

Methods: A prospective observational study was conducted across 6 months (July 2018-December 2018) in a tertiary care hospital, Pune. The present study included 30 registered patient & their past 6 months record of blood transfusion (esp frequency), previous hemoglobin levels, height & weight. All these parameters were compared 6 months after supplementation with Omega 3 fatty Acids & proteins.

Results: Total 16 of 28 patient showed that the average durations between two blood transfusions was increased by minimum 01 day to a maximum of 5 days. The average number of blood bag required was less than required blood bags in the period of pre supplementation. 20 of 28 patients showed a rise in hemoglobin level from a range of 0.5 to 1.2 gm/dl.

Conclusions: In a country like India, with the high frequency of hemoglobinopathies, causing increased burden on the society, it is necessary to control the incidence by effective steps. Low cost and easily administered supplementation by omega 3 fatty acid and proteins may reduce the requirement of repeated blood transfusion along with increase in hemoglobin level. Implementation of carrier screening program offering genetic counseling and prenatal diagnosis followed by selective termination of affected cases would help in preventing the disease.

Keywords: Thalassemia, Blood transfusion, Hemoglobin, Protein, Omega 3 fatty acid

INTRODUCTION

The thalassemias are the most common genetic disorder on a worldwide basis wherein afflicted child is born when both parents are carriers for defective alpha or beta hemoglobin gene. Thalassemias are inherited genetic hemoglobin disorder. The carrier rate varies between 5.5 and >9%; it was estimated that 1000/1.5 million per year live births have beta-thalassemia.

Thalassemia is a dreaded disease which results in several health problems, such as stunted growth, delayed puberty & involvement of heart, liver, bone with life expectancy is about 25 years.¹ Child diagnosed with beta thalassemia major requires blood transfusion every 3-4 weeks. Early and regular blood transfusion decreases the complications of severe anemia and prolongs survival. Yet, transfusion carries the risk of complications. Therefore, knowing different adverse effects of blood transfusion represents a

great issue in managing thalassemic patients. Frequent blood transfusion leads to iron toxicity and blood transfusion related infectious diseases.^{2,3}

Thalassemic children need blood transfusion every 3- 4 weeks. This is a great burden to the family, the blood transfusion services and national economy. The service of blood transfusion to these registered patient's needs to be free of charge and also the complications of regular blood transfusions need to be treated. Therefore, it is hypothesized that if these patients are provided with omega 3 fatty acid and protein supplementation the frequency of transfusion would decrease. Omega 3 fatty acid will help the RBC membrane to become resistant to hemolysis.^{4,5} Protein supplementation would facilitate the wellbeing of the child. The combined omega 3 fatty acid and protein supplementation together is likely to decrease the frequency of transfusion.

METHODS

A prospective observational study was conducted from July 2018 to December 2018 in the department of Pediatrics, Pathology & Bharti Hospital Blood Bank at Bharati Vidyapeeth Medical college and Research Centre, Pune. In this study of the 50 registered thalassemic patients, 30 were included who receive blood transfusion every month regularly. The record of blood transfusion in registered thalassemic patients in past six months was collected from the blood bank. The frequency of blood transfusion, their previous hemoglobin level along with weight, height & other anthropometric measures were observed. After detailed explanation regarding the study & its methodology, a written consent was taken from the parents or guardian of the patient. An emulsion of omega 3 fatty Acids and protein supplement for next 6-8 months was provided. The dose of omega 3 fatty acids & protein supplementations was calculated by a team of paediatrician & experienced dietician as per the age of the patient.

Calculated requirement of omega-3 Fatty Acids

1) 0 - 12 months - 500mg 2) 1 year - 600 mg 3) 2-3 years - 700 mg 4) 4-6 years - 1000mg 5) 7-9 years - Boys: 1200 mg, Girls: 1000mg 6) 10-12 years - Boys: 1400 mg, Girls: 1200 mg 7) 13 - 15 years: Boys: 1500 mg, Girls: 1200 mg

Calculated requirement of Protein Supplementation

1) 0-6 months-1.16 g/kg 2) 6-12 months -1.69 g/kg 3) 1-3 years -1.67 gm/day 4) 4-6 years - 20.1 gm/day 5) 7-9 years - 29.5 gm/day 6) 10-12 years - Boys: 39.9 gm/day, Girls: 40.4 gm/day 7) 13-15 years - Boys: 54.3 gm/day, Girls: 51.9 gm/day 8) 16-17 years - Boys: 61.5 gm/day, Girls: 55.5 gm/day

The compliance was ensured through regular interaction with the parents / guardians and patients. The fatty acid test levels values were done prior to the supplementation of omega 3 fatty acid and at the end of five to six months.

The patient's record of transfusion for next four to six months were taken along with hemoglobin levels. The frequency & duration of blood transfusion after supplementation of Omega 3 Fatty Acids and Protein were studied and analysed.

RESULTS

In this study, 30 patients of thalassemia were studied. Previous six-month data for blood transfusion was taken and next 6 months data (after omega 3 fatty acid with protein supplementation) along with blood transfusion record was studied. There were 17 males and 13 females in this study (Figure 1) and age varied from 02 years to 14 years. Out of 30 patients, 02 female patients did not consume the omega 3 fatty acid with protein supplementation.

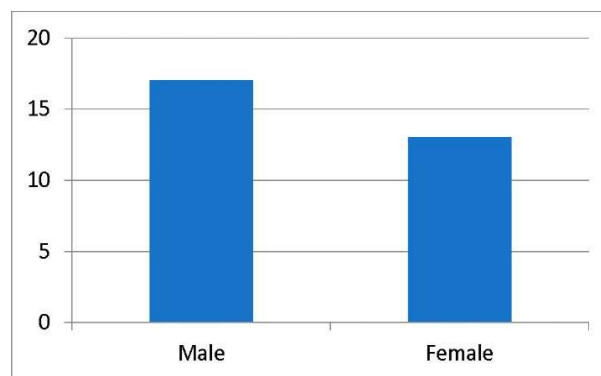


Figure 1: No. of male and female children in the study.

The average height and weight were also observed in 30 patients of thalassemia-pre supplementation and after the course of 6-month supplementation. It was observed that there was not much difference in height of the patients but the weight showed a difference on an average about 0.5 to 1.5 kg.

Figure 2 shows the average number of days between two blood transfusions both pre supplementation and with supplementation, of which 16 patient shows that the average durations was increased by minimum 01 day to a maximum of 5 days and 12 patients shows that the blood transfusion was same or decreased with supplementation.

Figure 3 shows the number of blood transfusion received pre supplementation over a period of six months (January 2018 to June 2018) and six months post supplementation (July 2018 till December 2018). It clearly showed that the average number of blood bag requirement was reduced as compared to pre supplementation period.

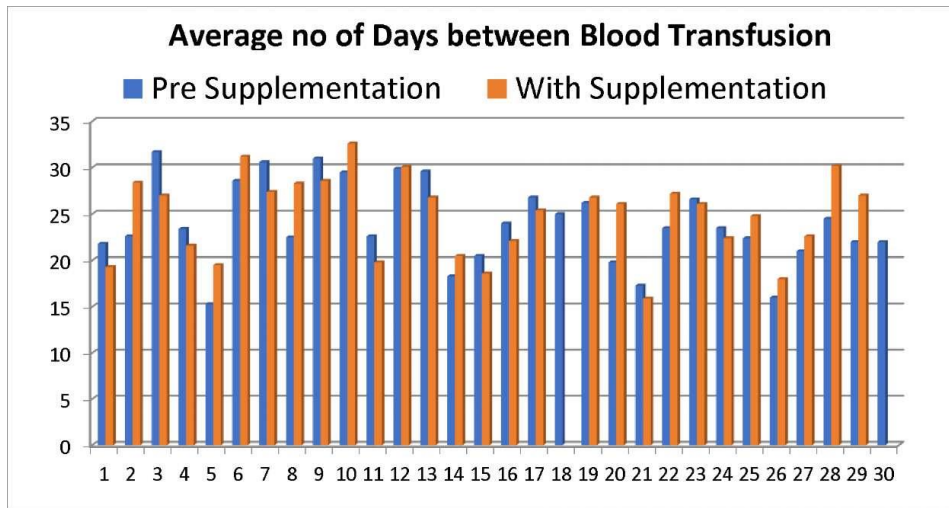


Figure 2: Average no of days between blood transfusion pre supplementation and with supplementation.

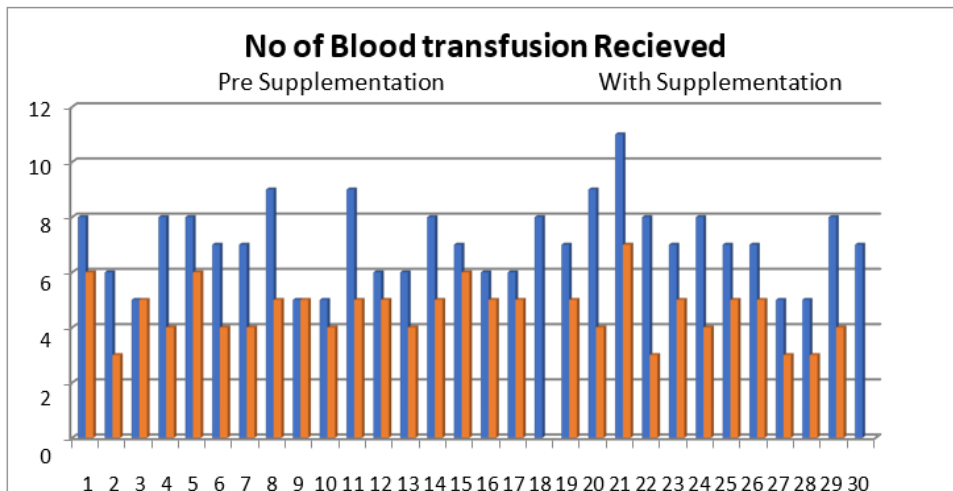


Figure 3: No of blood transfusion received - pre supplementation and with supplementation.

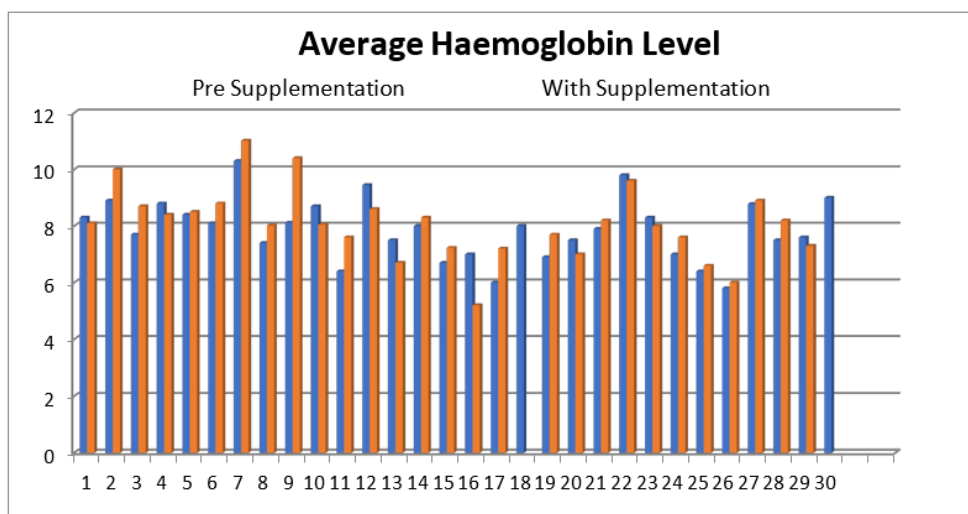


Figure 4: Average hemoglobin level-pre supplementation and with supplementation.

There were more female patients (64%) in the clinical trial group compared to more male patients (57%) in the usual care group ($p < 0.001$). The patients in the clinical trial group were also younger (52 ± 11 years) compared to those in the usual care group (58 ± 11 years) ($p < 0.001$). There were more patients with hypertension (47%) in the clinical trial group compared to those in the usual care group (31%) ($p < 0.001$). The incidence of hyperkalemia was higher among those patients in the clinical trial group (26%) compared to those in the usual care group (16%) ($p < 0.001$). There was no difference in the incidence of IHD and hypercholesterolemia between the 2 groups.

Figure 4 shows the comparison of average hemoglobin level pre supplementation and with supplementation. Out of 30 studied patients 20 patients showed a rise in hemoglobin level from a range of 0.5 to 1.2 gm/dl.

DISCUSSION

The aim of treatment of thalassemia major by blood transfusion was to maintain the hemoglobin level. Blood transfusion therapy and iron chelation are the corner stones in management of thalassemia. Early & regular blood transfusion decreases the complications of severe anemia and prolongs survival.⁶ Yet, transfusion carries the risk of complications. Therefore, knowing different adverse effect of blood transfusion represents a great issue in managing thalassemic patients. Repeated blood transfusions are associated with hazards of iron overload leading to endocrine dysfunction and risk of acquiring transfusion transmitted infection as hepatitis.^{7,8}

Omega 3 Fatty Acids (docosahexenoic acid and eicosapentaenoic acid) have abilities to decrease red blood cell aggregation and their adherence to the endothelium of blood vessels and also interfere with prothrombotic activity, all together help to increase the hemoglobin level.

Both the β thalassemias and sickle cell disorders pose a significant health burden in India. The average prevalence of β thalassemia carriers is 3-4% which translates to 35 to 45 million carriers in our multi-ethnic and culturally and linguistically diverse population of 1.30 billion people which also includes around 8% of tribal groups according to the Census of India 2011. Several ethnic groups have a much higher prevalence (4-17%).⁹ Nutrition supplements, trace elements and the minerals play a vital role in the body to perform its functions properly. They should be present in the body in appropriate amounts and must be available for reacting with other elements to form critical molecules as well as to participate in various important chemical reactions.¹⁰

The study by Sherief et al demonstrated that chronically transfused patients with β thalassemia-major have significant deficiencies of various nutritional markers (vitamins A, C, E, and B12 and trace elements zinc, copper, and selenium) which could be attributed to

inadequate intake in the face of increased demand, consumption and excretion. Dietary supplementation with various vitamins and trace elements along with appropriate diet might represent a promising way to improve the quality of life of thalassemic patients.¹¹ In our study the height difference in pre & post supplementation was not significantly different as majority of the enrolled patients were younger as compared to other studies, on the other hand these patients showed an increase in weight from 0.5 to 1.5 kg most probably due to better nutritional support by Omega 3 fatty acids and proteins (mainly)

The study by Abdulrazzaq et al showed that lower plasma values of essential amino acids and a decrease in urinary amino acids occur in thalassemic patients. Growth impairment both in height and weight also occurs in thalassemic patients compared to a control population.¹² The study by Thongkijprecha et al also showed the similar results of anthropometric measurements compared to present study.¹³

The study by Fuchs et al showed that weight, but not height was significantly increased during the support period and was due to increases in both fat free mass and fat mass. He concluded that nutritional stunting was as the result of reduced nutrient intake which is an important cause of growth failure in young children with thalassemia and is responsive to nutritional support.¹⁴

Similarly, the average no. of days of blood transfusion & the amount of blood unit requirement was less in post supplementation period all because of better nutritional support. An average increase in hemoglobin level ranging from 0.5 to 1.2 gm/dl is also significant over a short time duration of the study.

This is a pilot study of its kind with 30 enrolled patients of the thalassemia however a large cohort study is required to further establish the role of supplementation by omega 3 fatty acids & proteins in decreasing frequency and amount of blood transfusion in patients with thalassemia major.

CONCLUSION

In a country like India, with the high frequency of hemoglobinopathies, causing increased burden on the society, it is necessary to control the incidence by effective steps. The hemoglobinopathies constitute a major public health problem among genetic conditions nationally and internationally, but particularly in the developing world which has the limited resources for coping with the problem. It is apparent that prevention of the disease is of primary importance, not only to reduce the burden on the health services, but also to give better chance of survival to the existing patients. Preventive programs consisting of public education, population screening, genetic counseling and prenatal diagnosis have

been very effective in reducing the birth rate of thalassemia.

Implementation of carrier screening program offering genetic counseling and prenatal diagnosis followed by selective termination of affected cases would help in preventing the disease.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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