ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

Nutritional Status Assessment of Thalassemic Children from Rajasthan

Rakesh Palsaniya[1] and Sumitra Meena[2]

College of Community and Applied Science,

Maharana Pratap University of Agriculture and Technology (MPUAT), Udaipur

Abstract

Nutritional status of children is a prominent factor in making economy and development of any country. Good nutrition is important for achieving normal growth and development. Therefore, to rule out any growth abnormality, nutritional assessment becomes an integral step in every paediatric patient care. Measurement of nutritional status of thalassemic paediatric population is of utmost importance as they are known to have iron overload and multiple nutrient deficiencies due to poor absorption. Present research was planned to assess nutritional status of thalassemic paediatric patients including components of medical history, biochemical and clinical examination, dietary intake and anthropometrics. Total 50 patients were assessed out of whom 10 patients were found severely malnourished, while 30% patients were found mildly malnourished. Therefore, it was recommended to counsel families and children properly to follow a suitable diet so that good nutritional status can be maintained.

Keywords

Thalassemia, children, paediatrics, nutrition status, height, weight, anthropometry, dietary intake, dietary counselling

Introduction

What is paediatric age group?

Paediatric age group covers children <18 yrs of age ranging three life spans - infancy, childhood and adolescence. Nutrition in early childhood is very crucial not only for survival but for proper growth and development and it has an irreversible impact on entire lifespan. Nutritional needs are highest during growth spurt i.e. 0 - 2 years of age and 10 - 12 years of age in girls and 14 - 16 yrs. of age in boys.

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

Global prevalence of malnutrition in paediatric patients

As per data obtained from World Bank (2015), global census of children and adolescents between 5 - 19 years of age is 1.8 billion; out of which approximately 90% children were from lower socio economic group. Black et al. (2013) studied about increased risk of morbidity and mortality due to malnutrition and poor diet in children. As per World Bank (2015) census data, due to scarcity of research work, there is a dire need for more researches on malnutrition in children as they constitute a major segment (27%) of the entire population. Categorization of malnutrition can be done as following –

- Underweight (Low weight-for-age or body mass index),
- Overweight / Obesity (Excess weight-for-age or BMI) with deficiencies of essential fatty acids, vitamins and minerals

What is Thalassemia?

The disorders related to haemoglobin synthesis are known as Thalassemia or hemoglobinopathies or sickle cell disease. Although Thalassemia can be cured by bone marrow transplantation still the rate is very low. According to National Heart, Lung, and Blood Institute (2014), population from Mediterranean, Southern Asia, Africa, and the Middle East is suffered from anaemia with symptoms of microcytic, hypochromic and short-lived RBC's are termed as Thalassemia. As haemoglobin synthesis is not normal, it may lead to improper transportation of oxygen and damaged red blood cells. There are around 266 million carriers with frequency of Thalassemia being 5.1% According to the World Health Organization (WHO) data (Canatan, 2010; 2014). Thalassemia is carried forward by autosomal recessive transition.

Thalassemia is diagnosed using High Performance Liquid Chromatography in patients with suspected BTM by examining Hb F and Hb A2 levels. Nowadays, it may be diagnosed easily by β-Globin Strip test (Karakul 2020). Erythrocytes present an appearance of hypochromic, microcytic and poikilosystosis in peripheral smear. Severity of the disorder ranges from asymptomatic or mild anaemia to more severe symptoms requiring routine blood transfusions. An increase may be seen in plasma volume followed by spleenomegaly and expansion of bone marrow due to improper erythropoiesis. It may lead to facial deformities, osteomalacia, and changes in the structure of bones. Severely thalassemic cases receive continuous blood transfusion with 1.16mg / ml iron per unit of erythrocyte. It resembles to approximately 200-290 mg of iron. Generally 2 or 3 units of

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

blood is transfused per cycle, therefore per day body's iron intake is 1-2 mg (West and Oates 2008). Talasemi Federasyonu Yayınları (2005) also documented annual accumulation of an extra iron upto 6 gram with per year blood transfusion of 30 units. Lynch (2007) also reported similar types of complications associated with iron overload in thalassemic patients. Severely thalassemic patient need recurrent blood transfusion that leads to excess iron overload that gets deposited in many organs like endocrine glands, heart or liver. Different organs can be affected by excessive iron deposition in the following manner -

- Heart: pericarditis, heart failure
- Liver (the main location of the iron storage): cirrhosis, fibrosis
- Pancreas: diabetes mellitus (seen because glucose tolerance is impaired as a result of iron accumulation)
- Thyroid: hypothyroidism
- Kidney: adrenal insufficiency
- Gonads: infertility (as it accumulates in the testicle and ovary), developmental retardation
- Leather pigmenting in bronze color, premature aging
- Bone: osteopenia, osteoporosis, fracture, arthropathy (May be due to imbalance in calcium, vitamin D and phosphorus)

To prevent this condition, chelation therapy should be given on a regular basis.

Clinical symptoms in Thalassemia: Thalassemia is characterized by loss of appetite, paleness of the skin and mucous membranes, tachypnea, tachycardia, weakness, restlessness, lack of attention, hyperactivity syndrome, growth retardation, sleeping disorders, easy breaking on nails and hair, spoon nail, straight and bright tongue, anaemia, nosebleeds in patients, forehead and jaw dislocation, enlargement of spleen and liver can also be noted (Canatan and Aydınok, 2007; Ünal, 2010).

Treatment of Thalassemia major: Treatment includes regular blood transfusion with iron chelation therapies. In case of excess iron deposition in spleen, spleenectomy is also done. These treatments are helpful in prevention of complications associated with Thalassemia and its treatment that may be termed as anaemia, retarded growth, bone

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

deformities etc. Latest invention in this direction is hematopoietic stem cell transplantation (Aydınok, 2010; Canatan, 2010).

Medical nutrition therapy for Thalassemia: Besides iron chelator therapy, nutritional management also have a very important role in Thalassemia. There is a need to reduce iron rich food sources in the diet. Generally iron can be obtained by two types of sources – veg and non veg. Non vegetarian food sources of iron are beef, sheep, red meat, chicken, sea food etc. In children's diet, complete restriction of non vegetarian sources are not recommended otherwise these restrictions may hamper their growth and development. As calcium is known to hinder iron absorption, therefore non veg food items are recommended to be consumed with calcium rich foods e.g. milk.

Vegetarian iron rich food sources include cereals, pulses, vegetables like potato, celery, green leafy vegetable, broccoli; dry fruits, grape syrup, egg etc. Although iron is poorly absorbed from plant sources in comparison to vegetable sources, but it enhances with vitamin C. Therefore consumption of vitamin C rich foods is not recommended in thalassemic patients. Besides vitamin C, iron absorption is also increased with consumption with vinegar, soy sauce, pickles, onions, turnips etc. These types of products need to be avoided. On the other hand, iron absorption is decreased with foods that contain high fiber, phytate, phenolic compounds (tea, coffee) etc. Therefore consumption of these foods is advised to prevent excess iron load.

Some dietary tips for children with Thalassemia

- Patients can have oats and rice without lemon/ amla/ orange juice
- Avoid ready, packaged and sugary foods
- Eat non vegetarian food with calcium rich milk products/ cheese etc.
- Consume milk tea and coffee in meals
- As Vitamin-C is known to have its place in growth and development and in building a strong immune system, therefore it is advisable to consume these types of products two hours prior or after meals
- Avoid multi mineral and vitamin supplements that contain iron and vitamin C in high amounts

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

- Consume vitamin E rich foods like olive oil, sunflower oil, soybean oil and palm oil. (Şenol and Tavşanlı 2015; Karakul and Şenol 2018; Karakul 2019; Anonymous 2005)

The emphasis should be on diet rich in folic acid, vitamins A, vitamin C and minerals, like zinc, copper and selenium. Additionally, adequate intake of calcium and vitamin D is needed to support bone health. Patients not receiving blood transfusions should consume a moderately low-iron diet that limits iron-fortified foods and high red meat intakes.

Aim

- To study nutritional status of thalassemic paediatric patients

Rationale of the study

- Timely assessment of nutritional status can be linked to reduced child mortality rate as it gives us opportunity of taking timely decision

Research Methodology

A baseline survey for assessment of nutritional status was planned. A sample of 50 was taken to study nutritional status of thalassemic children. A purposive sampling method was used. All paediatric thalassemic patients were taken for study until sample size of 50 was completed.

Inclusion criteria for sample selection -

- Patients, who were willing to take part in the study
- Patients between paediatric age group (0 - 18 years)
- Patients suffering from Thalassemia

Exclusion criteria -

- Patients unwilling to participate
- Patients above 18 years of age
- Patients suffering from diseases other than Thalassemia

Data collection was done under following subheadings -

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

Part 1: Collection of general information: General information was collected from a well structured questionnaire. Information was obtained from patient's file or by interviewing the attendant. Following information was collected -

Name:

Age/ Sex:

Place:

Education: Illiterate/Primary/Metric/Graduate/ Post graduate

Economic status : LIG/ MIG/ HIG

Part 2: Assessment of nutritional status

2.1 Anthropometric measurements: In this section of the study, patient's birth weight, present weight, height/ length, mid upper arm circumference (MUAC), circumference of head (upto 1 year) and chest circumference (upto 5 year) were noted. WHO (2006) and IAP (2015) growth charts were used to interpret the data obtained in terms of BMI z score/ percentile. In growth charts, head circumference, weight & height or length have been given on Y axis and age is given on X axis. On this growth chart, 9 centile lines have been given. Normal average growth defined when the child's parameters correspond to 50^{th} centile. Abnormal growth is defined as 2^{nd} and 98^{th} centiles. On the basis of measurements on growth charts, child's nutritional status is categorized as following:

- Undernourished (stunted, wasted, or underweight) - weight measurement < -2 S.D.
- Severely undernourished - Weight measurement below - 3 z score
- Stunted child - z score for height for age is below - 2
- Wasting - Low weight for height as a result of failure to receive adequate nutrition during any acute illness or recent episode of diarrhoea
- Underweight - weight for age 2 SD below the median resulting from either chronic or acute malnutrition or both (Clinical Dietetics Manual)

2.2 Biochemical Profile

Parameters	Result values	References
Hb		

Patient's haemoglobin level was recorded

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

2.3 Clinical Signs and symptoms

Identification of nutritional deficiency can be ruled out by clinical examinations e.g. oedema for protein deficiency, bitot's spot for vitamin A deficiency, pallor for anaemia, cracks at the corner of mouth and sour tongue for vitamin B deficiency.

Therefore patients were examined for following clinical signs and symptoms like Weakness, cough, anorexia, wasting, anaemia, loss of appetite and taste changes, shortness of breath, recurrent bronchitis/pneumonia, fatigue, headache, nausea/ vomiting

2.4 Dietary History

Patient's 24 hours diet recall was noted for 3 consequent days, that have two week days with one holiday. Their nutrient intake was calculated by taking mean nutrient intake of three day's diet. Nutrients intake was calculated by home diet recall by following format -

Time	Meal	Menu	Household measures (g)	Calorie (g)	Protein (g)	Cho (g)	Fat (g)	Iron (mg)	Calcium (mg)

24 Hrs - Home Recall

Food Item	Daily	Weekly	Fortnightly	Monthly	Total Empty Calories Intake
Oil					
Sugar					
Cold drink / Sharbat / Juice					
Pickles / fried foods/ Junk food					
Total					

Empty Calories Intake Through Food Frequency

Part 3: Nutritional diagnosis

In this part of the study, patient's nutritional diagnosis was documented on the basis of above data collected.

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

Statistical Analysis: Student's 't' test was done to check any significant difference between two values. Results have been mentioned after calculating mean values of the data obtained for different parameters.

Results & Discussion

Data collection was done for 50 thalassemic paediatric patients, who were admitted in Mahatma Gandhi Medical College and Hospital, Jaipur between the age group of 0 - 14 years of age.

Results have been described under following sub-headings -

- **Demographic profile of the patients**

Parameter	Variables	N = 50	Percentage
Age (N=50)	0 - 1 yr	8	16.00%
	1 - 3 yr	9	18.00%
	4 - 6 yr	9	18.00%
	7 - 9 yr	7	14.00%
	10 - 14 yr	17	34.00%
Sex (N=50)	Male	38	76.00%
	Female	12	24.00%
Education (4-14 yr) (N= 33)	Literate	21	42.00%
	Illiterate	12	24.00%
Economic status (N=50)	LIG	8	16.00%
	MIG	40	80.00%
	HIG	2	4.00%

Table 1: Demographic profile of thalassemic paediatric patients

Table 1 is depicting the general information or demographic profile of the patients between 0 - 14 years of age. A significantly higher number ($p<0.05$) of children were found between the age group of 10 - 14 years, while other age groups showed similar % ranging from 16 - 18 % each (not significant). More children were male (64%) that was significantly higher ($p<0.05$) than females (24%). Educational level was noted for children above 4 years of age only out of which 42% children were going to school, while 24% children were found illiterate. 80% patients were from middle income group families. There origin place was also noted, out of whom children were found out to be from different areas like Jaipur, Jhunjhunu, Sawai Madhopur, Nagaur and 1 child was from Haryana also.

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

- **Anthropometry data for thalassemic paediatric patients**

	Males		**Females**	
Age	**Mean Height/ Length (cm)**	**Mean weight (Kg)**	**Mean Height (cm)**	**Mean weight (Kg)**
<1 yr	66.5	4.5	98	6
1-3yr	100.5	9.5	100	9.5
4-6yr	106.5	15.13	115.5	13.57
7-9yr	125	26	135	25.5
10-14yr	138.26	29.5	104	29
Mean birth weight	**2.20 kg.**		**2.55 kg.**	
MUAC	(N = 38)	Percentage	(N = 12)	Percentage
Normal	10	26.31%	4	25.00%
Less	23	60.52%	8	66.66%
Severely less	1	3.12	1	8.33%
Obese	4	10.52%	0	0.00%
Head circumference (cm) (N=8) (0 - 1 year)				
Normal	6	75.00%		
Low	2	25 %		
High	0	0		
Chest circumference (N=50)				
Normal	40	80.00%		
Low	10	20.00%		
High	0	0		
BMI (5 - 18 yrs) (N=33)				
Normal	20	60.6		
Low	10	30.3		
High	3	9.09		

Table 2 Anthropometric measurements of thalassemic paediatric patients

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

Table 2 is showing mean height and mean weight for different age groups for both males and females separately. It is clear from the table that mean height and mean weight is quite high for females in comparison to males till growth spurt, where it was found to be declined significantly ($p<0.05$). Males showed an average birth weight of 2.2 kg, on the other hand, it was 2.5 kg for their female counterparts. It is showing that male patients had low birth weight than standard. Besides this, MUAC levels of majority of males and females were seen mild to moderately low. In males, MUAC of 10.52% were found in a higher side showing symptoms of obesity. Children between 0 – 1 years of age showed normal head circumference (75%). Measurement of chest circumference showed normal levels in 80% paediatric patients while 20% kids depicted lower values. Sixty percent children showed normal BMI z score when compared to growth charts but 30.35 children presented BMI z score towards a lower side.

- **Biochemical profile of thalassemic paediatric patients**

Parameter	Interpretation	N=50	Percentage
Haemoglobin level	Normal	24	48.00%
	Low	20	40.00%
	Severely low	6	12.00%

Table 3 Biochemical profile of thalassemic paediatric patients

In this part of nutritional assessment, 48% children showed normal haemoglobin levels while 40% showed lower level although these were not statistically different from each other. Six patients showed haemoglobin levels significantly low. Out of these 6 patients 5 were girls of 10 - 14 years of age group. It may be attributed to the onset of menarche.

- **Medical diagnosis & clinical signs**

Clinical signs & symptoms	Number (N = 50)	Percentage
Weakness	7	14.00%
Fever	2	4.00%
Cough	5	10.00%
Anorexia	2	4.00%
Wasting	2	4.00%

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

Anaemia	20	40.00%
Nausea & Vomiting	5	10.00%
Headache	4	8.00%

Table 4 Clinical Signs and symptoms of thalassemic paediatric patients

Above table is showing that 20 out of 50 patients showed symptoms of anemia, while 7 patients (14%) showed weakness. Symptoms of cough and nausea / vomiting were reported in the study.

- **Nutrient intake**

Nutrient intake as per RDAs		**Total number of patients (N=50)**	**Percentage**
Energy	100.00%	5	10
	80 - 99%	8	16
	70 - 89%	10	20
	60 -79%	15	30
	<60%	12	24
Protein	100.00%	10	20
	80-99%	8	16
	69-79%	20	40
	<60%	12	24
Fat	100.00%	15	30
	80-99%	10	20
	69-79%	12	24
	<60%	13	26
Carbohydrates	100.00%	20	40
	80-99%	10	20
	69-79%	14	28
	<60%	6	12
Iron	100.00%	13	26
	80-99%	7	14

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

	69-79%	10	20
	<60%	20	40
Calcium	100.00%	9	18
	80-99%	15	30
	69-79%	10	20
	<60%	16	32

Table 5 Nutrient intake of thalassemic paediatric patients

Above table 5 is presenting nutrient intake of thalassemic children. Out of 50, only 5 children (10%) showed their energy intake upto the standard levels while 74% children were found to have energy intake below 70% of their requirements. Similar trend was seen for protein also. Fat intake of 50 % was found 80% - 100 % of the requirements. Eighty percent children showed carbohydrate intake near normal requirements. In minerals, intake of iron was found below 60% of the requirements in 40% patients. Similarly intake of calcium was below 79% of requirements in 52% of patients.

- **Nutritional diagnosis**

On the basis of above data, level of nutritional status was derived as following -

Parameters	**Total no. of patients N = 50**	**Percentage (%)**
Malnourished	10	20
Underweight	30	60
Normal	8	16
Overweight	1	2
Obese	1	2

Table 6: Nutritional status of thalassemic paediatric patients

Above data is showing that 60% patients were found to be underweight, while 20% patients were malnourished. Negligible numbers (2% only) of patients were found overweight or obese.

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

Conclusion

On the basis of present research, it can be concluded that Thalassemia was found more in 10 - 14 years old children. In these, boys were 52% more than girls. Birth weight of boys was noted significantly lesser than girls. Besides this, nutritional status of girls was also studies as better in comparison to boys. The only parameter was haemoglobin level and clinical signs of anaemia was documented more in girls between 10 - 12 years in comparison to males of same age group. Majority of younger boys were wasted and underweight in comparison to girls. In total 20% patients were severely malnourished while 30% patients were mildly malnourished.

It can be interpreted from the obtained data that state of nutrition needs more intervention and counselling to maintain a good nutritional status so that thalassemic children can lead a healthy life with lesser side effects of treatment as well as better growth and development.

References

Anonymous (2005). Talasemi Federasyonu Yayınları. Talasemi Hakkında Herşey. (2005). Retma Matbaa,Antalya.http://www.talasemifederasyonu.org.tr/wpcontent/uploads/2015/03/talasemi_hakkinda_h.pdf Erişim Tarihi: 08.05.2020

Aydınok Y. (2010). Talasemide şelasyon tedavisi. Türkiye Klinikleri Journal Hem OncSpecial Topics, 3(1), 76-79

Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, Onis M, Ezzati M, McGregor SG, Katz J, Martorell R, Uauy R (2013). Maternal and child undernutrition and overweight in low income and middle income countries. Lancet, 382(9890): 427 – 451. doi: 10.1016/S0140-6736(13)60937-X

Canatan D. (2010). Talasemi ve hemoglobinopatilerin Dünyada ve Türkiyede durumu.

Canatan D, Aydınok Y. (2007). Talasemi ve hemoglobinopatiler. Tanı ve tedavi. Antalya: Retma Matbaa, 29-34Canatan D. (2014). Türkiye'de hemoglobinopatilerin epidemiyolojisi. Hematolog, 4, 11- 22

Clinical Dietetics Manual (2018). Second edition, Indian Dietetic Association, Elite publishing house, New Delhi - 110002

IAP growth charts (2015). Indian Academy of Paediatrics. https://iapindia.org/iap-growth-charts/

ISSN: 2583-3499 (Online)
Volume 2, Issue 2, Jun 2022

Karakul A, Şenol S. (2018). Beta Talasemi Majör tanılı çocuklarda bakım: Sistematik bir inceleme. Çocuk Sağlığı ve Hastalıklarında Bilimsel Araştırmalar Kitabı (Editör: Şenol S). Akadmisyen Kitabevi, Ankara

Karakul A. (2019). Beta Talasemi Majörlü çocukların güçlendirilmesi. Doktora Tezi. Ege Üniversitesi Sağlık Bilimleri Enstitüsü, İzmir

Karakul A (2020). Nutritional management in children with thalassemia. Advances in Health Sciences Research. (Eds Chernopolski PM, Shapekova NL, Bilal Ak Sancar B) ST. KLIMENT OHRIDSKI UNIVERSITY PRESS SOFIA Chapter 16. 164- 170. ISBN: 978-954-07-5049-1

Lynch (2007). Influence/ inflammation, thalaseemia and nutritional status on iron absorption. International journal for vitamin and nutrition research 77(3). https://doi.org/10.1024/0300-9831.77.3.217

National Heart, Lung, and Blood Institute (2014). Evidence based management of sickle cell disease: Expert Panel Report, 2014.

Şenol S and Tavşanlı NG (2015). Kalıtsal kan hastalıkları: Orak hücre anemisi, Betatalasemi, Hemofili örneğinde pediatrik bakım. Türkiye Klinikleri J Pediatr Nurs- 169 Special Topic, 1(3), 67-73

Unal S (2010). Beta Talasemi kniligi ve tanisi. Turkiye Klinikleri. Journal of Hematology, Special Topics, 3(1), 14 -17.

West AR and Oates PS (2008). Mechanisms of heme iron absorption: Current questions and controversies. World Journal of Gastroenterology. 14(26), 4101 – 4110.

World Bank, India (2015). Undernourished children: A call for reform and action. http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,contentMDK:20916955~pagePK:146736~piPK:146830~theSitePK:223547,00.html .

World Health Organization. Growth Reference 5-19 years-Application tools: Anthroplus Software. World Health Organization; 2016.