



## Mentzer Index for Differential Diagnosis of Iron Deficiency anaemia and Beta Thalassemia Trait

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### Abstract

**Objective:** *Thalassemia trait is commonly seen in Indian population especially in certain communities like sindhis, kachchis, gujratis, Lohana, Prajapati and Bengalis. The individuals having thalassemia trait usually have asymptomatic course and usually have mild microcytic hypochromic anemia. Since the other cause of microcytic anemia is iron deficiency anemia it is important to differentiate between individuals having iron deficiency anemia and thalassemia trait. Though the definitive diagnosis of thalassemia trait is possible only by Hb electrophoresis there are certain blood indices which can differentiate between thalassemia trait and Iron deficiency anemia. Mentzer index is such an index. The aim of our study was to evaluate the reliability of Mentzer index in the differentiation of iron deficiency anemia and Thalassemia trait.*

**Methods:** *This study was a prospective study done on 30 patients each of thalassemia trait and iron deficiency anemia (Total 60 patients). Only those patients who have been found to be having iron deficiency anemia by iron studies and cases of thalassemia trait who have been diagnosed by Hb electrophoresis were included in this study. Those patients who have received blood transfusion within 3 months of study were excluded from the study. Mentzer index of all the patients were calculated and the results were analyzed.*

**Results:** *Mentzer index more than 13 (indicating iron deficiency anemia) and less than 13 (indicating thalassemia) is found to be a reliable screening tool to differentiate in between iron deficiency anemia and thalassemia.*

**Conclusion:** *Iron deficiency anemia and thalassemia have different effects on blood indices. In resource poor and developing countries like that of India it can be used as screening tool. In doubtful cases the diagnosis can be confirmed by Hb Electrophoresis.*

**Keywords:** *Mentzer Index, Beta Thalassemia trait, Iron deficiency anemia.*

### Introduction

Microcytic hypochromic anemia is characterized by decreased hemoglobin, PCV, MCV, MCH, MCHC and normal to increased RDW. Important causes of microcytic hypochromic anemia include thalassemia, iron deficiency anemia, sideroblastic anemia and lead intoxication <sup>[1]</sup>. Iron deficiency anemia and thalassemia are some of common

causes of microcytic hypochromic anemia. Sideroblastic anemia and lead intoxication are relatively uncommon. While the diagnosis of beta thalassemia major is usually becomes obvious within initial years of life because of progressive anemia and need for repeated blood transfusion it is children with beta thalassemia trait who pose a diagnostic dilemma <sup>[2]</sup>. Patients with beta thalass-

emia trait usually are asymptomatic. Nonetheless they have pallor on clinical examination and anemia can be detected clinically when these children attend the pediatrician for some other complaints like Upper respiratory tract infection, Acute gastroenteritis or even during immunization visits. It is of utmost importance to differentiate children having microcytic hypochromic anemia due to thalassemia trait from those due to iron deficiency anemia because of obvious implications such a diagnosis will have on management of these children<sup>[3]</sup>. In thalassemia trait iron needs to be avoided rather than supplemented. Definitive diagnosis of thalassemia trait depends upon Hb Electrophoresis and estimation of Hb A2 and mutation analysis while iron deficiency anemia can be confirmed by iron studies. But these tests are not widely available and many of the patients can't afford them. Moreover they are also not helpful when mass screening of the children is required<sup>[4]</sup>.

Thalassemia trait and iron deficiency anemia both presents as microcytic hypochromic anemias. The differentiation in between these 2 conditions can't be done on the basis of blood picture because both of these conditions presents with decreased PCV, MCV, MCH, MCHC and normal to increased RDW. Inability to differentiate between these 2 conditions on the basis of blood picture and unavailability and non-affordability of the tests like Hb electrophoresis and mutation analysis has led to some investigators utilizing various indices to differentiate between these 2 conditions<sup>[5]</sup>. These indices include Mentzer Index, England and Fraser Index, Srivastava Index, Green and King Index, Shine and Lal Index, red blood cell (RBC) count, red blood cell distribution width and red blood cell blood distribution width index (RDWI)<sup>[6]</sup>.

The aim of this study was to find out the diagnostic value of Mentzer index in differentiating in between beta thalassemia trait and iron deficiency anemia.

Mentzer index is calculated using following formula

Mentzer index = mean corpuscular volume (in fL) / RBC count (in Millions per microLiter).

Mentzer originally described the ratio of MCV and RBC count as Mentzer index. A mentzer index more than 13 is indicative of iron deficiency anemia while a Mentzer index of less than 13 is suggestive of thalassemia.

### Materials and Methods

In this cross-sectional study, we selected 30 children with iron deficiency anemia and 30 children with beta thalassemia trait. The diagnosis of iron deficiency anemia was done on the basis of blood picture and iron studies and the diagnosis of beta thalassemia major was done on the basis of HbA2 (>3.5%) levels estimated by b electrophoresis.

### Inclusion criteria

1. Children already diagnosed with iron deficiency anemia or thalassemia trait on the basis of blood picture, iron studies and Hb Electrophoresis.
2. Age below 12 years of age.

### Exclusion criteria

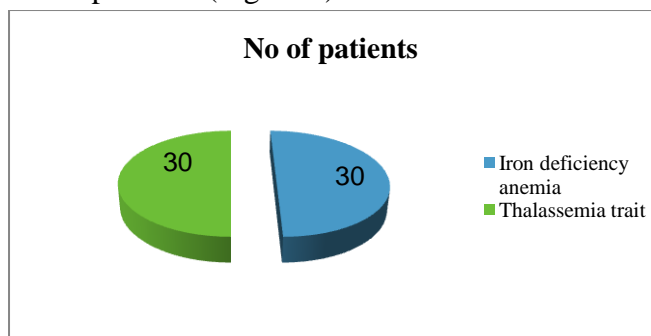
1. Age more than 12 years.
2. Coexistence of other hematological condition like autoimmune hemolytic anemia, aplastic anemia or lead intoxication.
3. History of blood transfusion in near past.

The complete blood count (CBC) was measured by an automated analyzer. In this study we calculated Mentzer index of all the patients belonging to each group ie iron deficiency anemia and beta thalassemia trait and analyzed the results so as to see whether Mentzer index can be used as screening tool to differentiate between beta thalassemia trait and iron deficiency anemia.

### Results

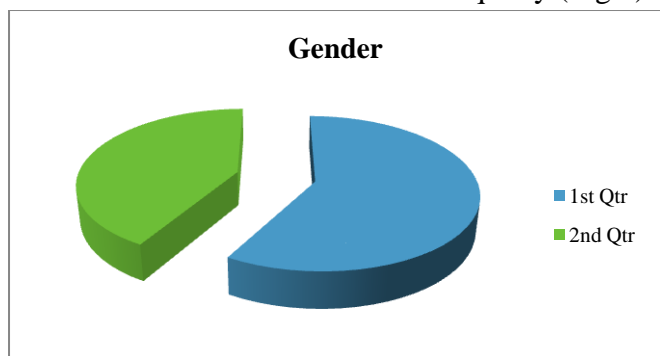
Total 60 children were studied. Out of these iron deficiency anemia or thalassemia trait was the cause of microcytic hypochromic anemia in 30 children each. The diagnosis of microcytic hypochromic anemia was done on the basis of

anemia along with decreased PCV, MCV, MCH, and MCHC. The diagnosis of iron deficiency was based upon iron studies and that of thalassemia trait was based upon increased Hb A2 on Hb electrophoresis (Figure 1).



**Figure 1:** No of studied cases of thalassemia trait and iron deficiency anemia.

Out of these 60 patients 35 were males and 25 were females with a male to female ratio of..... Thalassemia being an autosomal recessive disorder affects males and females equally (Fig 2).



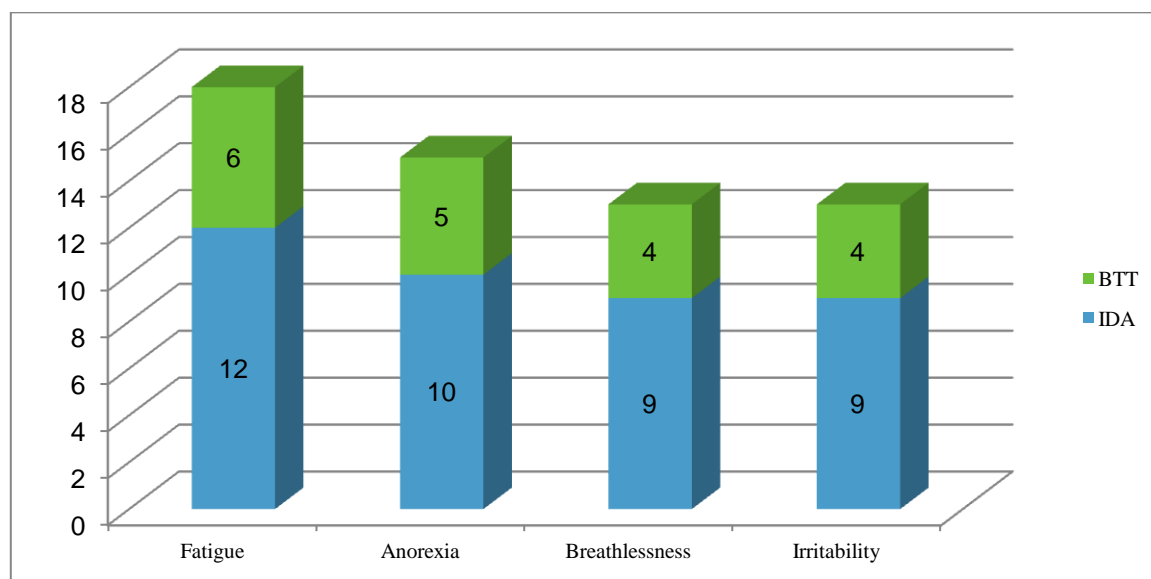
**Figure 2:** Gender distribution of the studied cases.

The study of the age of the patients revealed that the most common age group of patients with anemia in iron deficiency anemia was 2 to 4 years while the most common age group of patients with beta thalassemia trait was 8-10 years [Table 1].

**Table 1:** Age distribution of the patients with iron deficiency anemia and thalassemia trait

Age	Iron Deficiency Anemia	Thalassemia trait	Total
Less than 1 year	6 (10%)	0	6 (10%)
2-4 years	9 (15%)	8 (13.33%)	17 (28.33%)
5-7 years	5 (8.33%)	6 (10%)	11 (18.33%)
8-10 years	4 (6.67%)	10 (16.67%)	14 (23.33%)
>10 years	6 (10%)	6 (10%)	12 (20%)
<b>Total</b>	<b>30 (50%)</b>	<b>30 (50%)</b>	<b>60 (100%)</b>

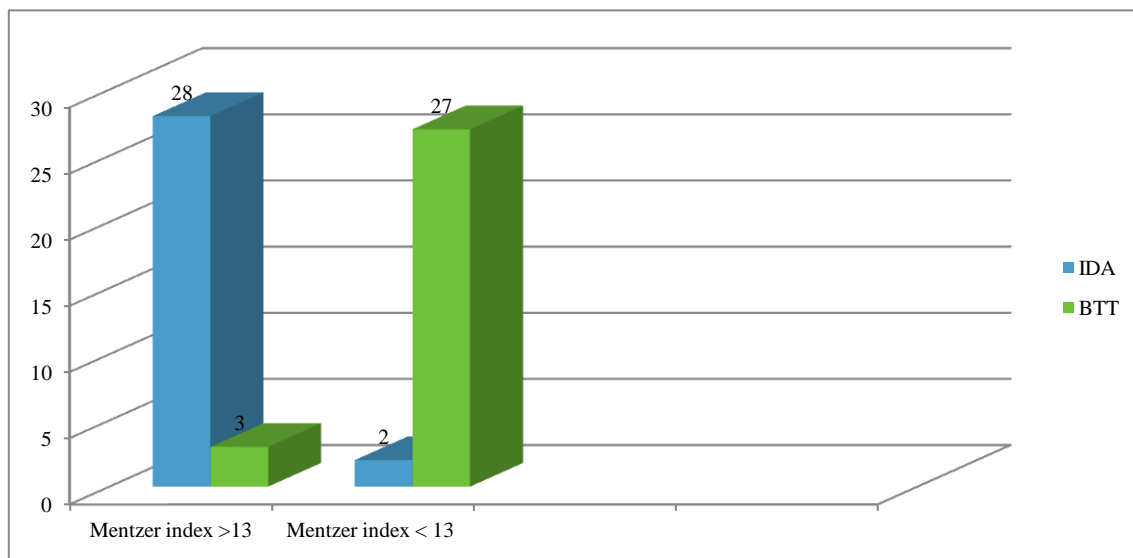
The analysis of signs and symptoms of patients presenting with anemia was studied. The most common clinical features of the patients iron deficiency was found to be fatigue (40%), anorexia (33.33%) breathlessness (30%), and irritability (30%) while the most patients with beta thalassemia trait were asymptomatic some of them presented with fatigue(20%), anorexia (16.66%) breathlessness (13.33%) and and irritability (13.33%).



**Figure 3:** Common Presenting complaints seen in studied cases.

The blood indices of all the cases were studied and Mentzer index was calculated for all the cases of iron deficiency anemia and beta thalassemia trait. Out of 30 patients with iron deficiency 28 (93.33%) patients had Mentzer index more than

13 and 2 (6.66%) had Mentzer index less than 13 while out of 30 patients with thalassemia trait 27 (90%) patients had Mentzer index less than 13 and 3(10%) patients had Mentzer index of more than 13.



**Figure 4:** Mentzer index in Iron deficiency anemia and thalassemia trait.

**Discussion**

Iron deficiency anemia and thalassemia are important causes of microcytic hypochromic anemia in Indian population. Children are predisposed to iron deficiency because of dietary insufficiency, growth and helminthic infestations. On the other hand beta thalassemia trait is usually asymptomatic anemia caused by mutation in one beta globin gene. Majority of the patients with thalassemia syndromes are found in Southeast Asia. They are also seen in Mediterranean region, the Middle East, Southwest Europe, and Africa. In India the communities in whom there is increased risk of thalassemia due to presence of trait in individual members are Sindhis, Gujratis, Punjabis, kachchis, Lohana, Prajapati and Bengalis [7].

The clinical features of iron deficiency anemia and thalassemia trait are usually similar and consist of angular stomatitis, anorexia, irritability, pica, fatigue and breathlessness. The diagnosis of iron deficiency anemia depends upon reduced PCV, MCV, MCH, and MCHC. The iron studies confirm the diagnosis of iron deficiency anemia. The classical findings seen in iron deficiency

anemia are reduced serum ferritin and serum iron along with increased total iron binding capacity. The diagnosis of thalassemia is dependent upon demonstration of increased HbA2 levels in blood (> 3.5%) on Hb electrophoresis and mutation analysis [8].

Though the definitive tests for iron deficiency anemia and thalassemia is iron studies and Hb electrophoresis respectively it is always not possible to do these tests in all patients having microcytic hypochromic anemia. It is for this reason that various indices have been studied to differentiate between iron deficiency anemia and thalassemia trait. The commonly used indices are given below [9].

**Table 2 :** various blood indices to differentiate thalassemia trait from iron deficiency anemia.

Hematological index	Formula
Mentzer index (MI) (1973)	MCV/RBC
RDWI (1987)	MCV × RDW/RBC
Shine and Lal (S and L) (1977)	MCV × MCV × MCH/100
Srivastava (1973)	MCH/RBC
England and Fraser (E and F) (1973)	MCV – (5 × Hb) – RBC – 3.4
MDHL (1999)	(MCH/MCV) × RBC
Sirdah (2007)	MCV – RBC – (3 × Hb)

Originally described by Mentzer in 1973 Mentzer index is useful to differentiate between iron deficiency anemia and thalassemia trait. Mentzer index can be calculated using MCV and RBC count and can be used to differentiate between beta thalassemia trait and iron deficiency anemia. Many studies have found it to be one of the most reliable indices to differentiate between these 2 conditions. Differentiating these conditions is important because of the obvious implications such a differentiation may have on the management of the patients <sup>[10]</sup>.

### Conclusion

Beta thalassemia trait and iron deficiency anemia are conditions causing microcytic hypochromic anemia. Though the definitive diagnosis depends upon iron studies and Hb electrophoresis, in cases where these studies are not possible Mentzer index can be used to screen the patients. In doubtful cases confirmation of diagnosis by iron studies and Hb electrophoresis must be done.

**Conflict Of Interest:** None

### References

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