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Erythrocyte Index and Mentzer Index in Fathers of Thalassemia Patients

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ABSTRACT

Background & Objective Thalassemia is a blood disorder caused by genetic factors that cause the globin chain in hemoglobin to not function normally. It is the most common hereditary disease in the world and in Ciamis Regency in 2021 there were 191 patients. Thalassemia prevention is carried out by screening to identify thalassemia carriers. Hematological examination in the form of erythrocyte index (MCV, MCH, MCHC) and mentzer index has been known to determine thalassemia screening. The purpose of this study was to determine the description of erythrocyte index and mentzer index in thalassemia patient's father.
Method The method used in this study is descriptive method. The population in this study were members of POPTI (Parents Association of Thalassemia Patients) Ciamis Regency. The sample in this study were 30 samples.
Result Based on the results of the study obtained the results of erythrocyte index (MCV, MCH) low (MCHC) normal and Mentzer index obtained the results of 20 samples (66%) suspected as thalassemia carrier, 5 samples (17%) suspected iron deficiency anemia and according to the reference value there were 5 samples (17%).
Conclusion The results of a study conducted on 30 fathers of thalassemia patients showed that 83% of fathers of thalassemia patients had MCV and MCH values below the normal threshold and 73% had normal MCHC values. Furthermore, from the results of the Mentzer index examination, it is known that 66% of the fathers of thalassemia patients are suspected of having minor thalassemia, 17% are suspected of having iron deficiency anemia disorders and 17% have a normal Mentzer index.

Keywords Thalassemia; Erythrocyte Index; Mentzer Index

Introduction

Thalassemia is a blood disorder caused by genetic factors that cause the globin chain in hemoglobin to not function normally, causing red blood cells to experience ineffective erythropoesis and shortening the life of red blood cells (Purjanto et al., 2019).

Thalassemia patients are widespread in various countries in the world with the highest prevalence of thalassemia genes in tropical countries. Southeast Asia has 55 million people with minor thalassemia, and the prevalence of congenital or carrier thalassemia in Indonesia is around 3-8%. With a birth rate of 23% in the total population in Indonesia of 240 million people, it is estimated that there will be around 3,000 thalassemia gene carrier babies born in Indonesia every year. This is because if fellow carriers marry, they will potentially give birth to major patients, for this reason thalassemia prevention can be done with a target approach, namely, retrospective, prospective, and education (Maharani & Astuti, 2014).

In 2018, thalassemia cases increased to 8,761. Based on data from union of parents with thalassemia in West Java called POPTI (Persatuan Orang Tua Penderita Thalasemia Indonesia), the most cases are in Greater Bandung with 873 patients and the lowest in Majalengka with 89 patients (Syobri et al., 2020).

At the Ciamis Regency Hospital based on the observation of thalassemia patients who perform routine transfusions in 2018, there were 177 people consisting of children and adults. Every year it always increases, recorded in 2021 thalassemia patients have increased to 191 people, this is due to the lack of education to the public about thalassemia disease and public awareness that ignores the need for screening before marriage. The main types of thalassemia, namely alpha thalassemia, occur due to mutations or deletions in the alpha globin gane, while beta thalassemia occurs due to mutations or deletions in the beta globin gene. Both beta and alpha thalassemia are generally divided into three types, the division is based on the severity of the clinical symptoms experienced, the general division is major, intermediate and minor (Rujito, 2022).

The incidence of thalassemia can be established by conducting education and screening, as an initial parameter for screening thalassemia disease, a simple and easy examination is carried out. Simple hematological examination to see the erythrocyte index and Mentzer index with the calculation of MCV divided by RBC. If the mentzer index value shows low with the result <13 leads to minor thalassemia and if the mentzer index value is high >13 leads to IDA (Iron Deficiency Anemia) (Sensitivity et al., 2018). Meanwhile, erythrocyte index examination or Mean Cospuscular value is an average value that can provide information about the average erythrocyte. MCV is the volume of erythrocytes expressed in units of femtoliters, MCH is the amount of hemoglobin per-erythrocyte expressed in units of picograms, MCHC is the concentration of hemoglobin obtained per-erythrocyte expressed in units of grams of hemoglobin per erythrocyte (Suhartati, 2015).

Based on the description above, the researcher is interested in conducting a study with the title Overview of erythrocyte index and mentzer index in fathers of thalassemia patients in Ciamis district in 2021.

Objective

This study aims to determine the description of erythrocyte index and mentzer index in fathers of thalassemia patients in Ciamis district in 2021.

Method

The type of research used is descriptive research. The population in this study amounted to 191 members of POPTI at Ciamis Regency. The examination was conducted in the laboratory of STIKes Muhammadiyah Ciamis. In this study is to use purposive sampling technique, which is based on certain research criteria, until the number of patients is met as planned by the researcher. The inclusion criteria in this study were the fathers of patients with thalassemia. While the exclusion criteria in this study are not one lineage of thalassemia patients, parents who are not willing to be respondents and lysis samples. The sample size uses the minimum number of samples for research, which is 30 people. Abdurahman (2011) suggests that the larger the sample studied, the better and the more normal the distribution of the sample mean and normal distribution is when the minimum sample size is 30 people. Specimen collection will be carried out at the Ciamis Regional Hospital and the home address of patients who are willing to become respondents, at STIKes Muhammadiyah Ciamis laboratory which in March - April 2021. Data obtained from the results of the description of the erythrocyte index and mentzer index in the father of thalassemia patients by presenting the data in tabular form, then explained in narrative by describing the percentage of these results.

Results

The results can be seen in table 4.1 as follows:

TABLE 1 Erythrocyte Index Examination Results in Fathers of Thalassemia Patients

No.	Name	MCV (fL)	Ket	MCH (pg)	Ket	MCHC (g/dL)	Ket
1	Mr. K	71.5	↓	22.9	↓	22.9	↓
2	Mr. I	71.1	↓	22.2	↓	31.3	N
3	Mr. W	60.7	↓	18.8	↓	31.6	N
4	Mr. AS	89.8	N	29.7	N	31.1	N
5	Mr. NL	69.1	↓	21.5	↓	31.1	N
6	Mr. M	67.8	↓	21.3	↓	31.4	N
7	Mr. A	88.9	N	30.0	N	33.8	N
8	Mr. S	54.8	↓	14.1	↓	25.6	↓
9	Mr. HP	64.4	↓	20.0	↓	31.1	N
10	Mr. AS	80.1	N	26.7	N	33.3	N
11	Mr. R	61.0	↓	14.2	↓	31.4	N
12	Mr. UF	70.8	↓	22.2	↓	31.3	N
13	Mr. N	87.4	N	32.0	N	33.4	N
14	Mr. DS	73.2	↓	21.8	↓	29.8	↓
15	Mr. MK	62.6	↓	18.8	↓	30.0	↓
16	Mr. R	62.2	↓	19.7	↓	31.6	N
17	Mr. EU	74.0	↓	24.7	↓	33.4	N
18	Mr. E	73.5	↓	21.7	↓	29.5	↓
19	Mr. SS	64.0	↓	19.4	↓	30.4	↓
20	Mr. WK	63.8	↓	19.7	↓	31.0	N
21	Mr. TK	63.6	↓	19.9	↓	31.3	N
22	Mr. E	67.1	↓	19.7	↓	29.4	↓

No.	Name	MCV (fL)	Ket	MCH (pg)	Ket	MCHC (g/dL)	Ket
23	Mr. H	66.0	↓	20.9	↓	31.7	N
24	Mr. DS	62.1	↓	19.1	↓	31.7	N
25	Mr. A	65.3	↓	20.9	↓	32.0	N
26	Mr. H	87.1	N	30.0	N	34.5	N
27	Mr. HI	64.2	↓	19.8	↓	30.8	↓
28	Mr. M	73.6	↓	23.7	↓	32.2	N
29	Mr. R	74.9	↓	24.8	↓	33.1	N
30	Mr. E	63.3	↓	20.0	↓	31.6	N
	Average	**70.1**		**22.0**		**31.1**	

Description:
Normal Value
1. MCV : 77-93 fL
2. MCH : 27-32 pg
3. MCHC : 31-35 g/dL
↓ : Low
N : Normal
↑ : High

Based on table 1 the results of the erythrocyte index examination (MCV, MCH, MCHC) in the father of thalassemia patients showed low MCV and MCH, and normal MCHC. With average results on MCV: 70.1 fL MCH: 22.0 pg MCHC: 31.1 g/dL.

TABLE 2 Percentage Distribution of Erythrocyte Index Examination Results in Fathers of Thalassemia Patients.

Erythrocyte index	Total	%
MCV (fL)		
< 77	25	83%
77-93	5	17%
>93	0	0%
Total	**30**	**100%**
MCH (pg)		
< 27	25	83%
27-32	5	17%
>32	0	0%
Total	**30**	**100%**
MCHC (g/dL)		
< 31	8	27%
31-35	22	73%
>35	0	0%
Total	**30**	**100%**

Table 2 shows that the fathers of thalassemia patients with low MCV (<77) were 83%, normal (77-93) 17%, high (>93) 0%. Fathers of thalassemia patients with low MCH (<27) were 83%, normal (27-32) 17%, high (>32) 0%. Fathers of thalassemia patients with low

MCHC (<31) were 27%, normal (31-35) 73%, high (>35) 0%.

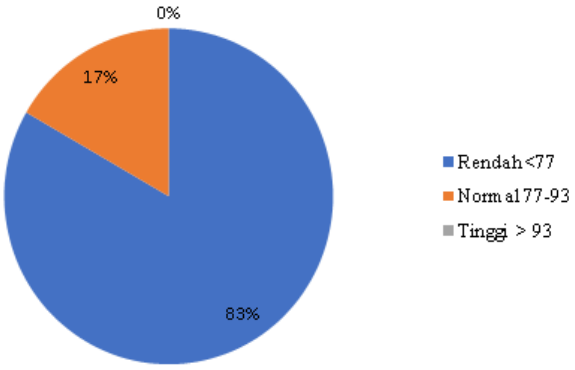

FIGURE 1 Erythrocyte index MCV (fL)

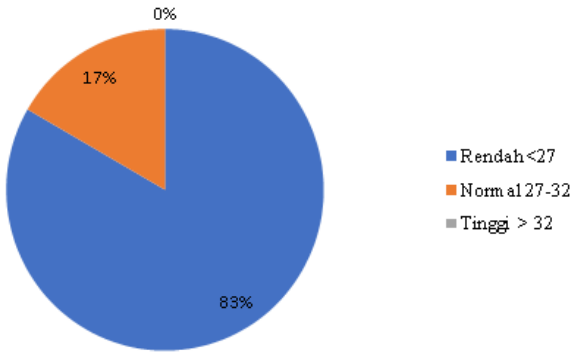

FIGURE 2 MCH Erythrocyte Index (pg)

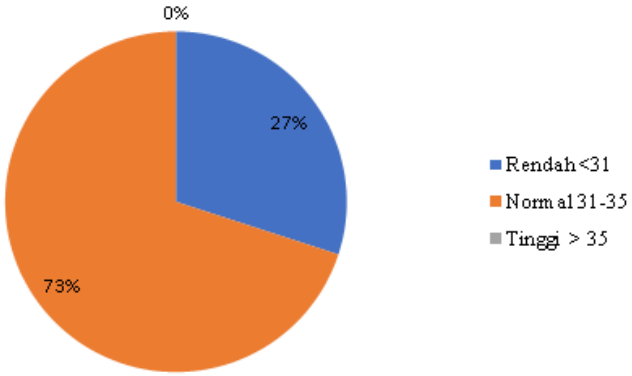

FIGURE 3 Erythrocyte index MCHC (g/dL)

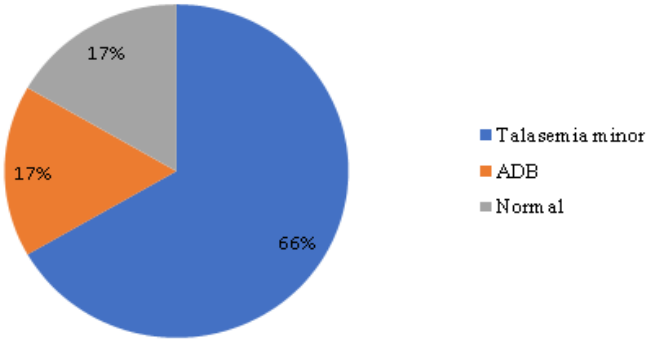

FIGURE 4 Mentzer Index

TABLE 3 Results of Mentzer Index Examination in Fathers of Thalassemia Patients

No.	Name	Hb (g/dL)	MCV (fL)	MCH (pg)	MCHC (g/dL)	Mentzer Index	Presumptive Diagnosis
1	Mr. WK	13.5	71.5	22.9	22.9	12.1	TM
2	Mr. I	12.1	71.1	22.2	31.3	13	TM
3	Mr. W	13.5	60.7	18.8	31.6	8.4	TM
4	Mr. AS	15.7	89.8	29.7	31.1	17	Normal
5	Mr. NL	12.5	69.1	21.5	31.1	11.8	TM
6	Mr. M	12.4	67.8	21.3	31.4	11.6	TM
7	Mr. A	14.6	88.9	30.0	33.8	18.2	Normal
8	Mr. S	7.9	54.8	14.1	25.6	9.7	TM
9	Mr. HP	10.9	64.4	20.0	31.1	11.8	TM
10	Mr. AS	14.8	80.1	26.7	33.3	14.4	Normal
11	Mr. R	12.5	61.0	14.2	31.4	9.3	TM

No.	Name	Hb (g/dL)	MCV (fL)	MCH (pg)	MCHC (g/dL)	Mentzer Index	Presumptive Diagnosis
12	Mr. UF	13.1	70.8	22.2	31.3	12	TM
13	Mr. N	14.8	87.4	32.0	33.4	18.9	Normal
14	Mr. DS	11.4	73.2	21.8	29.8	14	ADB
15	Mr. MK	11.3	62.6	18.8	30.0	10.3	TM
16	Mr. R	9.8	62.2	19.7	31.6	12.4	TM
17	Mr. EU	16.0	74.0	24.7	33.4	11.4	TM
18	Mr. E	11.4	73.5	21.7	29.5	14	ADB
19	Mr. SS	11.7	64.0	19.4	30.4	10.6	TM
20	Mr. WK	12.2	63.8	19.7	31.0	10.3	TM
21	Mr. TK	9.5	63.6	19.9	31.3	13.3	ADB
22	Mr. E	11.7	67.1	19.7	29.4	11.3	TM
23	Mr. H	13.0	66.0	20.9	31.7	10.6	TM
24	Mr. DS	11.6	62.1	19.1	31.7	10.2	TM
25	Mr. A	12.6	65.3	20.9	32.0	10.8	TM
26	Mr. H	16.1	87.1	30.0	34.5	16.2	Normal
27	Mr. HI	13.8	64.2	19.8	30.8	9	TM
28	Mr. M	12.3	73.6	23.7	32.2	14.1	ADB
29	Mr. R	12.9	74.9	24.8	33.1	14.3	ADB
30	Mr. E	14.2	63.3	20.0	31.6	8.9	TM

Description:
TM : Thalassemia Minor
IDA : Iron Deficiency Anemia Normal Values
1. Hb : 14-18 g/dL
2. MCV : 77-93 fL
3. MCH : 27-32 pg
4. MCHC : 31-35 g/dL

Mentzer index
Thalassemia minor : <13 Iron deficiency anemia : >13
Normal : As per reference values

Based on table 3, the results of the Mentzer index examination on the fathers of thalassemia patients showed that there were 20 suspected thalassemia carriers, 5 suspected ADB and 5 normal people.

TABLE 4 Percentage Distribution of Mentzer Index Examination Results in Fathers of Thalassemia Patients

Mentzer Index	Total	%
Calculation result		
Thalassemia minor	20	66%
ADB	5	17%
Normal	5	17%
Total	**30**	**100%**

Table 4 shows that the fathers of thalassemia patients showed 66% suspected thalassemia carriers, 17% suspected ADB and normal, and 17% normal.

Discussion

Based on table 1, the picture of erythrocyte index results in the father of thalassemia patients shows (MCV, MCH) is low with the average results of MCV: 70.1 fL, MCH: 22.0 pg and (MCHC) normal with an average MCHC: 31.1 g/dL. This decrease in erythrocyte index at MCV : 83% MCH: 83% indicates that the erythrocytes have smaller than normal size (microcytic) and less than normal hemoglobin concentration (hypochrome) caused by thalassemia. This genetic disorder makes the synthesis of chains in the body of the thalassemia patient's father to be stopped or reduced. The MCHC value was normal at 73% but there were some low values.

Table 3 shows the Mentzer index of the fathers of thalassemia patients, 20 people were suspected of minor thalassemia seen from a decrease in hemoglobin, erythrocyte index and Mentzer index (<13), 5 people were suspected of ADB seen from a decrease in hemoglobin, erythrocyte index, but Mentzer index (>13), while according to the reference value there were 5 people. These results show that there is a lack of knowledge and public awareness of the status of thalassemia trait carriers, due to the factor of marriage among trait carriers.

Based on the results of the study, thalassemia minor itself only carries the thalassemia gene, the signs do not appear and are not problematic, but if married with thalassemia minor, it will be a problem, the possibility of their children is 25% healthy, 50% minor, 25% major. To prevent the increase of this hereditary disease, pre-marital laboratory examination is necessary (Regar, 2009).

Factors that affect the erythrocyte index examination are factors that affect hemoglobin levels, erythrocyte count and hematocrit concentration, while for the Mentzer index, MCV concentration and erythrocyte count.

Conclusion

Based on the results of research conducted on 30 fathers of thalassemia patients, it is known that 83% of fathers of thalassemia patients have MCV and MCH values below the normal threshold and 73% have normal MCHC values. Furthermore, from the results of the Mentzer index examination, it is known that 66% of the fathers of thalassemia patients are suspected of having minor thalassemia, 17% are suspected of having iron deficiency anemia disorders and 17% have a normal Mentzer index. This study can be continued with a more specific examination, namely with OFT examination, Hb analysis or ferritin examination.

Acknowledgement

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