

FINDING IRON DEFICIENCY ANEMIA (IDA) AT YOUNG WOMEN WITH OVERWEIGHT OR OBESITY

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Abstract

Background: Young women can suffer from anemia due to monthly menstruation and by having many activities without adequate iron-filled nutrition. Other problems found on them are overweight and obesity. The data show that one with overweight or obesity can lead to iron deficiency anemia (IDA) along with increasing proinflammatory cytokines, which will cause the transcription of hepcidin. The increase of hepcidin transcription will inhibit the absorption of iron from the intestine into the circulation, inhibiting spending iron reserves into circulation, and inhibiting the release of iron recycled from splenic macrophages. This can cause IDA. The purpose of this study was to obtain the proportion of iron deficiency anemia in overweight or obese young women.

Methods: The design of this study was cross sectional using purposive sampling. The subjects of this study were the student from five selected Senior high schools in Boyolali, Central Java, Indonesia. The determination of IDA is done by using hemoglobin and indexes of erythrocytes.

Results: This study was the follow-up of the previous study, which was conducted to 14 obese and/or overweight young women with anemia. From 14 subjects, there was one subject suffered from other anemia and 13 subjects with IDA (using index erythrocytes examination). Their mean of MCV was 72.68 ± 4.29 fl, MCH was 23.08 ± 2.63 pg, and MCHC was 35.21 ± 0.65 %.

Conclusions: From this study, almost all overweight or obese young women with anemia were indicated as IDA (92.8%).

Keywords: *Iron Deficiency Anemia (IDA), young women, overweight and obesity*

Presenting Author's biograph



Amelya Augusthina Ayusari is a lecturer at Faculty of Medicine, SebelasMaret University, Solo, Central Java, Indonesia. As a lecturer and also Medical doctor, her main activities are teaching, conducting research, and performing community services. She follows research group with 'iron deficiency anemia' as its focus study. She always follows medical organization like Indonesian Red Crescent and focusing on social and medical issues.

1. Backgrounds

Health problems faced by adolescents are anemia and malnutrition (underweight, overweight and obesity) (5). The prevalence of anemia, especially in young women (13-18 years) is about 22.7 percent. While the prevalence of obesity in Indonesian adolescents at the age of 16-18 years is about 7.3 percent, which consists of 5.7 percent being fat and 1.6 percent of being obese. This number increased from the year 2007, reaching 1.4 percent (3).

Young women usually suffer from anemia due to menstruation for about 3-7 days in each month, which decreases about 30 ml of blood per day. These conditions can lead to anemia especially for young women who have many activities and are not supported by adequate intake of iron nutrition. In addition, they are in puberty phase that need more iron nutrition for growth and increased blood volume. Iron needs are related to body weight and weight gain will increase the body's need for iron (Arisman, 2010). On the other hand, obesity can increase the risk of iron deficiency anemia, this occurs because obesity can increase proinflammatory cytokines such as interleukin 6 (IL-6), CRP (C-Reactive Protein), and leptin, which will cause transcription of hepcidin. The increase of hepcidin transcription will inhibit the absorption of iron from the intestine into the circulation, inhibit spending iron reserves into circulation, and inhibit the release of iron recycled from splenic macrophages (1,6,8). The purpose of this study was to obtain the proportion of iron deficiency anemia in overweight or obese young women.

2. Methods

The design of this study was observational analytic, "cross-sectional," using purposive sampling. The subjects of this study were the students from five selected Senior high schools in Boyolali, Central Java, Indonesia. They were SMAN 1 Ngemplak, SMAN 1 Banyudono, SMAN 1 Ampel, SMA 3 Boyolali. The determination of IDA is conducted by using hemoglobin and indexes of erythrocytes at clinical laboratory of Banyubening Hospital, Boyolali. The method of hemoglobin harvesting was *cyanmethemoglobin* (cut off 12 mg/dl). Then IDA is measured by looking for microcytic hypochromic anemia using indexes of erythrocytes (Cut off *Mean Corpuscular Volume* (MCV) = 80-100 fl, *Mean Corpuscular Hemoglobin* (MCH) = 26-34 pg, *Mean Corpuscular Hemoglobin Concentration* (MCHC) = 31-37%) (10)

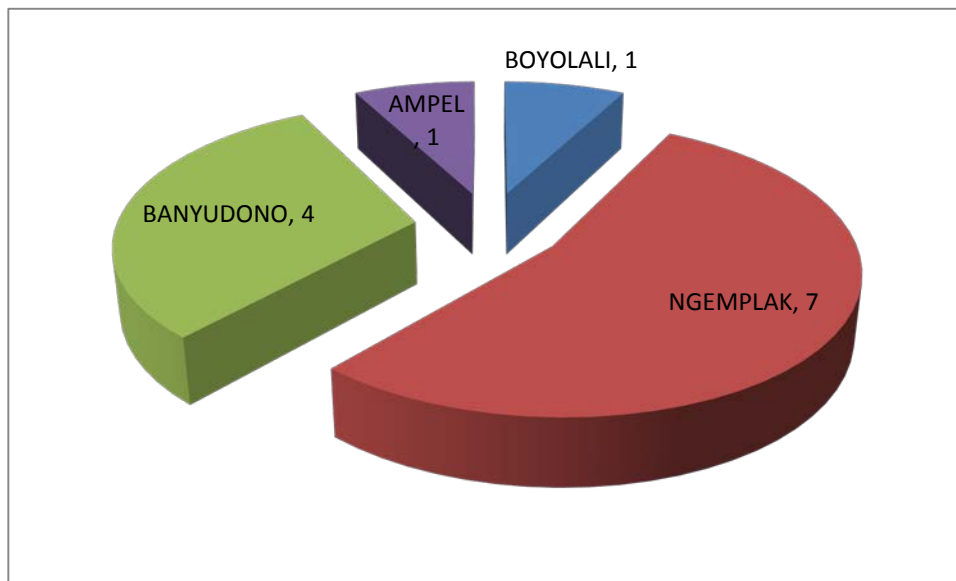
3. Results

This study was done to continue the previous study, which was conducted to 14 young women with anemia from obese and/or overweight 40 girls (12).

From 14 subjects with anemia, we determined them using index erythrocytes examination (MCV < 80 fl, MCH < 26 pg and or MCHC < 31%), there was one subject suffered from other caused anemia and 13 subjects with IDA. There were 13 young women with overweight or obese that had IDA (92.8%). The mean of MCV was 72.68 ± 4.29 fl. The mean of MCH was 23.08 ± 2.63 pg. The mean of MCHC was 35.21 ± 0.65 %. They came from Ampel (1 subject), Boyolali (1 subject), Banyudono (4 subjects), Ngemplak (7 subjects).

Table 1. The characteristics of subjects with IDA

Factor	Mean ± SD	CI 95%	
		Low	Up
Age (th)	16.69 ± 0.75	16	18
MCV (fl)	72.68 ± 4.29	67.0	79.50
MCH (pg)	23.08 ± 2.63	18.36	26.91
MCHC (%)	35.21 ± 0.65	33.90	36.40



Figures 1. The Proportion of 13 subjects with ADB per each school

4. Discussion

Iron is a very important element. It functions to distribute the bound oxygen from the lungs to the tissues, energy production, and cellular growth and proliferation (13). Iron can be found in hemoglobin or myoglobin. Approximately 25% of iron in our body is stored as ferritin, which are found in cells and circulates in the blood. Adult male has about 1000 mg of iron reserves, which would be sufficient to sustain the consumption of iron for three years, and women store approximately 3000 mg that is enough for six months. When one reduces iron intake, iron reserves can be depleted, causing a decrease in hemoglobin levels in the blood, a condition called iron depletion. If iron reserves are no longer available, it would disrupt the system and lead to iron deficiency erythropoiesis (2,14).

Every day, humans consume approximately 10-20 mg of iron and only about 10% can be absorbed (1-2 mg / h). Iron is absorbed in the duodenum and jejunum which will then be used by the bone marrow for erythropoiesis. In addition to absorption, iron is needed when the body loses large amounts of blood, such as in pregnancy, menstruation, and other bleeding (13).

Transport of iron is carried out by the body iron called transferrin. Transferrin is a glycoprotein, which will bind two atoms of iron and carry it from place absorbed into tissues which need the iron. Of the 75 percent absorption of iron, will be bound proteins such as hemoglobin that will serve as the transport of oxygen. About 10-20% is stored as ferritin iron so that a balance will be maintained (13).

Anemia is defined as a condition where a decline in mass amounts of erythrocyte (red cell mass) that it cannot fulfill its function to carry oxygen in sufficient quantities to peripheral tissues (decreased oxygen carrying capacity), anemic condition is indicated by a decrease in hemoglobin (9). Cut-off point anemia differentiates according to age and sex; women of 15-49 years old suffer from anemia when $Hb < 12.0$ g / dL. Anemia is a condition caused by the decreased levels of hemoglobin or red cell count. The most common cause of anemia is due to iron deficiency, but there are also other causes such as nutritional deficiency (folate, vitamin B, and vitamin A), acute and chronic inflammation, parasitic infections, and congenital diseases or acquired that disrupt the formation of hemoglobin, erythrocyte production, and survival of erythrocytes (9,10).

IDA is triggered from an imbalance between the intake of iron, iron reserves, and loss of iron, which causes inadequate amount of iron in the erythrocytes formation. According to Gibson (11), there are three stages of the IDA:

- a. Iron depletion, characterized by a reduction in reserves of iron in the liver, which is characterized by lower levels of serum ferritin. At this stage, hemoglobin levels are within normal limits.
- b. Iron-deficient erythropoiesis, characterized by endless reserves of iron. This stage is often called “iron deficiency without anemia.” At this stage, the supply of iron to erythrocytes is disrupted due to reduced transferrin saturation. At this stage, the hemoglobin begins to show a decline, total iron binding capacity (Total Iron Binding Capacity / TIBC) increases, and increased serum transferrin receptor.
- c. Iron deficiency anemia, characterized by endless fall of reserves of iron and steel in circulation, and the occurrence of hypochromic microcytic anemia. Hemoglobin levels fall due to the unavailability of iron to the bone marrow.

This study was done to continue the previous study, which was conducted to 14 young women with anemia from obese and/or overweight 40 girls (12). There was one subject suffered from other anemia and 13 subjects suffered from IDA (using index erythrocytes examination). The mean of MCV was 72.68 ± 4.29 fl. The mean of MCH was 23.08 ± 2.63 pg. The mean of MCHC was 35.21 ± 0.65 % (shown in Picture 1 and Table 1).

The results are consistent with the research conducted by Aerbeli et al. and Kapil and Sareen (1,7), which showed the relationship between obesity and anemia. This research was also supported by Cepeda-Lopez et al.'s studies conducted in Mexico (4). Children and women of Mexico with obesity is one of the signs of decreasing levels of iron as an early sign of anemia. Therefore, obesity can increase the risk of iron deficiency anemia.

In addition to the fact that obesity can increase proinflammatory cytokines such as interleukin 6 (IL-6), CRP (C-Reactive Protein), leptin will cause the transcription of hepcidin. The increase of hepcidin transcription may cause hepcidin to inhibit the absorption of iron from the intestine into the circulation, inhibit spending iron reserves into circulation, and inhibit the release of iron recycled from splenic macrophages (1,6,8). Hepcidin concentrations in the circulation are controlled by various compounds involved in iron metabolism including through BMP-Smad pathway, transferrin receptor complex or STAT3 signaling (6,15). Special BMP-Smad signaling cell, increased iron stores in the liver and spleen will enable the growth factor interacts with the receptor BMP6 and BMP1 or BMP2 in the membrane of hepatocytes with the presence of co-receptor neogenin and hemojuvelin. Furthermore, ligand binding to its receptor activates Smad 1, 5 and 8 to join the Smad 4, which is then translocated into the nucleus to bind to the hepcidin response element (6)

5. Conclusion

From this study, it can be concluded that almost all young women with overweight or obese that had anemia; and they were indicated as IDA (92.8%)

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