

THE EFFECT OF IRON (III)-HYDROXIDE POLYMALTOSE COMPLEX ON ANEMIA: A LITERATURE STUDY

Indah Mutiara Insani¹, Vrili Coirala Rama Uli Br Siregar², Osi Annauli Girsang³

¹ Chemistry Department Faculty of Mathematics and Natural Science, Medan, Indonesia, Universitas Negeri Medan, 20221

² Chemistry Department Faculty of Mathematics and Natural Science, Medan, Indonesia, Universitas Negeri Medan, 20221

³ Chemistry Department Faculty of Mathematics and Natural Science, Medan, Indonesia, Universitas Negeri Medan, 20221

Email: Indahmutiarainsani19@gmail.com¹; vrilicoirala@mhs.unimed.ac.id²; osianagirsang28@gmail.com³

ABSTRACT

Health is an important thing to be maintained in life. In the development of this era, many people, especially teenagers, do not pay attention to the intake of nutrients, iron, and protein that enter the body causing disease. One of the diseases that can be caused is anemia. According to the National Institute of Health (NIH) the cause of anemia can be caused by a lack of iron, vitamins, or chronic disease. In Indonesia, the occurrence of anemia is fairly high. still quite high. To overcome anemia, iron complex compounds can be used because one of the things that causes anemia is a lack of iron in the body. This study aims to describe the application of iron (III)-hydroxide polymaltose complex as an effective compound in overcoming of iron deficiency anemia. This study was compiled from the online literature of local and international journals using secondary data that had been screened based on keywords. The results of the study concluded that iron (III)-Hydroxide Polymaltose Complex Compounds can be used to treat anemia. This literature study covers recently published (year > 2000) reports on iron (III)-Hydroxide Polymaltose Complex Compounds in overcoming the health problem of anemia.

Keywords: iron, complex compound, anemia

1. Introduction

Health is an important thing to be maintained in life. In the development of this era, many people, especially teenagers, do not pay attention to the intake of nutrients, iron, and protein that enter the body causing disease. One of the diseases that can be caused is anemia. Red blood cell mass loss is referred to as anemia. Erythrocyte tagging and in-vivo quantification of the diluted tagged cells in the circulation are required for accurate observations (Conrad, 2011). Recent epidemiologic studies that suggest anemia may be linked to worse outcomes in a number of disorders have generated a great deal of interest in the definition of anemia. Much research follows the WHO expert committee's definition of anemia from over 40 years ago for defining anemia (Beutler, 2006). About 25% of the world's population suffers from anemia, which is defined by low blood hemoglobin levels, with women and children bearing the brunt of the disease's effects (R An, 2021).

The most common causes of anemia are iron deficiency, malaria, and hemoglobin disorders. Decreased

dietary iron intake, blood loss due to chronic blood loss or colonization with intestinal parasites (hookworm infection), and iron malabsorption, which is most common in low- and middle-income countries, are all associated with iron deficiency anemia. can cause in addition, cancer can cause functional iron deficiency due to inflammatory iron sequestration/decreased iron utilization and blood loss at tumor sites, as well as malignant infiltration into normal tissues and bone marrow. In endemic areas, malaria is also a major cause of anemia. Malaria causes anemia in high-prevalence areas, especially in young children. Malaria is associated with maternal anemia during pregnancy and poor birth outcomes at all levels of infection. Hemolysis of red blood cells (RBCs) and severe chronic anemia can result from hereditary hemoglobin disorders such as SCD and thalassemia (R Ann, 2021).

The Institute for Health Metrics and Evaluation found that anemia afflicted 27.0% of the global population, or 1.93 billion people, in the 2013 Global Burden of Disease (GBD) Study (Kassebaum, 2016). Anemia is a recognized global health issue, with young children being particularly at risk. According to World Health Organization (WHO) data, anemia prevalence among children in Indonesia aged 6-59 months was 43.9% in 2000 and 38.4% in 2019. (Sunardi, 2021).

Anemia in women of reproductive age (15-49) is an unsolvable issue of "hidden hunger" in low- and middle-income countries (LMICs), illustrating gender health imbalances and a sad loss of human capital. Anemia is defined by a low hemoglobin level in the blood that develops when tissue iron reserves have been depleted to levels linked to poor function (Christian, 2021).

According to Dr. Fadhil Rizal Makarim, iron deficiency anemia results from a lack of iron in the body, which causes a decrease in the number of healthy red blood cells and their inability to perform their normal functions. Iron is used to make hemoglobin, which is a component of red blood cells. Red blood cells' hemoglobin helps the body bind and carry oxygen from the lungs to all of the body's organs. The removal of carbon dioxide from the body's cells and into the lungs is another function of these red blood cells. The body needs iron to make enough hemoglobin to carry oxygen. Therefore, iron deficiency anemia may cause you to feel exhausted and breathless. Therefore, to enhance the body's blood hemoglobin, an iron complex molecule is needed.

Iron complex compounds can be used because one of the things that causes anemia is a lack of iron in the body, especially the effect of Iron (III) – Hydroxide Polymaltose Complex on anemia. This study aims to describe the application of iron (III) – Hydroxide Polymaltose Complex as an effective compound in overcoming of iron deficiency anemia.

2. Research Method

The technique utilized is a literature research, which involves tracing the origins of previously published writings to find theoretical references that are pertinent to the case or situation. The idea of results is described in the literature review, along with additional research materials that were gleaned from reference sources and will serve as the foundation for further investigation.

The data collection technique used is documentation, which is tracking written sources containing various themes and topics discussed. These sources include books, online

journal articles, internet, seminars, research results, as well as data related to research materials. In searching for data using the keywords Anemia and Iron Complex Compounds. This study was compiled from the online literature of local and international journals using secondary data that had been screened based on keywords. The data analysis technique used is descriptive quantitative which in the form of data on This technique focuses on some relevant literature. This literature study covers recently published (year > 2000) reports on iron (III)-Hydroxide Polymaltose Complex Compounds in overcoming the health problem of anemia. The data is then processed, analyzed, and abstracted into a narrative that explains the results and conclusions focusing on The Effect of Iron (III) – Hydroxide Polymaltose Complex on anemia.

3. Result and Discussion

Table 1 Analysis of the use of iron maltose complex compounds to increase hemoglobin and reduce anemia deficiency

| Name, Year of Research | Research Methods | Research Result |
|------------------------|---|--|
| Praningrum, 2020 | This type of research is a correlation study, the research sample is 40 pregnant women who check their pregnancies at PMB Rahma Pranandita, SST Pajang, Laweyan, Surakarta. Data collection tools and methods used a checklist to find out how to consume Fe tablets and the incidence of anemia and then they used secondary data (indirect sources through literature studies related to research). | The results showed that 19 pregnant women had anemia. Based on the results of the incidence of anemia, 15 respondents experienced mild anemia (78.9%) and 4 respondents experienced moderate anemia (21.1%). From the calculation results, it is known that the significance value (p value) is 0.005 < 0.05, so it can be concluded that there is a relationship between the consumption of Fe tablets and the incidence of anemia in pregnant women at PMB Rahma Pranandita, SST Pajang, Laweyan, Surakarta. |
| Mahmood, 2017 | 170 kids with iron deficiency anemia, hemoglobin 10g/dl, and serum ferritin levels below 6ng/ml were chosen for this randomized control trial. Patients were divided into two groups at random and administered iron sulfate syrup once daily for four weeks at a dose of 6 mg/kg/day elemental iron for Group A and iron complex polymaltose syrup once daily for four weeks at a dose of 6 mg/kg/day elemental iron for Group B. once per day for four weeks. | Age was 24.86 17.85 months on average. For the treatment of iron deficiency anemia, ferrous sulfate was substantially more effective than iron polymaltose complex (p = 0.009). In the treatment of iron-deficiency anemia where a rise in hemoglobin is taken into consideration, ferrous sulfate offers benefits over polymaltose iron complexes. |
| Yasa, 2011 | This is a prospective, randomized, open-label, 4-month trial conducted in children with iron deficiency anemia (IDA). Patients aged 6 months or older, with no known underlying chronic disease, and with at least one symptom of fatigue, syncope, or exhaustion were eligible for inclusion. Patients with subnormal Transferrin saturation levels (TSAT), serum iron, and serum ferritin levels were assessed in Hb levels. Patients were enrolled in the trial and randomly assigned to receive either iron sulfate (twice daily; Ferro Sanol Syrup, Adeka, Turkey) or IPC if any of these iron values were below normal (once daily; Ferrum Hausmann Syrup, Abdi Ibrahim, Turkey). Total iron is 5 mg/kg/day. For newly enrolled patients, treatment allocations were rotated randomly every week. H. Patients recruited for a | Between the two therapy groups, the patients were equally split (IPC, n = 52, 49.5%; ferrous sulfate, n = 51, 50.5%). With the exception of blood ferritin levels, which were considerably higher in individuals randomly assigned to IPC compared to ferrous sulfate, baseline characteristics were comparable between the two groups. Nevertheless, baseline ferritin levels in both groups were below the age-dependent lower limit of normal. According to the study's findings, IPC was just as effective as ferrous sulfate when given orally to young children with iron deficiency anemia. Because IPC is more tolerable than ferrous sulfate, it is more likely that infants and children will take the medication. |

| | | |
|-----------------|--|---|
| | week were split into two treatment groups: one for the initial week of recruitment and the second week of recruitment. | |
| Potgieter, 2007 | The study was conducted as a two-period crossover, single-dose, randomized, open-label, laboratory-blind study. The trial was completed by 22 participants with iron deficient anemia. The trial was divided into two 36-hour treatment phases and a washout interval that lasted between 6 and 14 days. Both treatments were administered orally. Tetracycline (CAS 60-54-8) was used as the test treatment, and iron (III) - hydroxide polymaltose complex (IPC, Maltofer®) was used as the reference treatment (2 x 250 mg capsules). | IPC had no pharmacokinetic effect on the rate of tetracycline absorption. Simultaneous administration of tetracycline and her IPC reaches high enough concentrations of tetracycline to ensure bacteriostasis. We could not observe an inhibitory effect of IPC on tetracycline absorption, as is known for iron(II) salts. |
| Toblli, 2007 | In order to ascertain whether there are any differences in terms of efficacy (primary end-point: hemoglobin after approximately 2 months of treatment) and safety (primary end-point: number of patients with adverse drug reactions (ADRs) after approximately 2 months of treatment), the current analysis will compare IPC with the reference drug(s) most frequently used using recognized methodologies as outlined by the Cochrane group. In order to examine the clinical data, the Cochrane Collaboration Handbook for Reviews' guidelines were employed. | IPC was associated with less adverse medication responses than ferrous sulfate (34.1%; p 0.001), notably upper digestive issues, discolored teeth, and diarrhea. Comparing IPC with ferrous sulfate at identical dosages in investigations on adult patients with iron deficiency anemia revealed that both substances produced comparable hemoglobin levels, indicating similar effectiveness. Adults tolerated IPC much better than ferrous sulfate, and the differences were also noticeable in terms of the specific adverse reactions. This represents a more favorable risk/benefit analysis of IPC in adults. |
| Prashant, 2016 | Iron-polymaltose complex (IPC) is a new complex or compound that binds iron in the form of ferric iron and follows the absorption of iron very similar to the iron salt form. Iron(III) hydroxide-polymaltose complex, also called IPC, is a macromolecular complex in which polynuclear iron oxyhydroxide forms a complex with a polysaccharide group. The molecular weight of IPC is approximately 52,300 Daltons. It is highly soluble in water over a wide pH range, is stable, and does not precipitate in alkaline environments. It also does not react in vitro with food-derived chelating agents (such as phytic acid) or agents containing phenolic groups (eg, phytic acid) at pH 3-8. tetracycline. The reduction potential of IPC is -332 mV. This ensures that it is not reduced in body fluids and does not cause oxidative stress. | Reduced red blood cell formation as a result of inadequate iron storage in the body is known as iron deficiency anemia. It is the most prevalent nutritional disorder in the world and is responsible for about 50% of cases of anemia. Insufficient iron intake and reduced iron absorption can result in iron deficiency anemia. Polynuclear ferric oxyhydroxide is complexed with polysaccharide groups to form the iron (III)-hydroxide polymaltose complex, commonly known as IPC. The current review is based on research that shows iron is significantly bioavailable after oral administration, particularly in patients with iron deficiency. IPC, or iron (III) - hydroxide polymaltose complex, is a stable composite made of non-ionic iron and polymaltose. Over the past decades, numerous research institutions have conducted clinical trials in men, women, children and infants showing that IPC is effective in treating iron deficiency anemia (IDA). The researchers concluded that IPC is best given with food because of its exercise properties, possibly with slightly higher amounts of iron than conventional iron salts. IPCs also have clear advantages over iron salts in terms of acceptability and patient tolerance. Numerous studies and published studies have shown lower treatment discontinuation rates with IPCs than with iron salts. Related. |

Based on the table above, there are results from previous studies that iron maltose complex compounds can reduce anemia deficiency by using several methods, one of which is iron therapy. The research in the table above examines children to parents and pregnant women. One of the therapeutic procedures using ferrous sulfate 200 mg with folic acid 500 mg tablets twice daily, administered for 12 weeks with the results of ferrous sulfate therapy means

to increase hemoglobin in 58% of patients in the group adhered to therapy; 80% the patient has gastrointestinal intolerance; 42% of the study population became non-adherent to drug therapy and showed poor response to therapy.

In this study there are side effects resulting from the use of therapy iron orally, 80% of patients experience

gastrointestinal intolerance. Tobli in his research give iron therapy at a dose of 500 and 1000 mg iron (ferric carboxymaltose) individually proven intravenously for 14-28 days can effectively increase hemoglobin levels. Husayn explained that in both treatment groups gave good results on increasing levels hemoglobin. Iron treatment dose low effective in elderly patients with ADB. It can be taken dose higher is commonly used and can significantly reduce the effect side. Therefore, strategies that encourage oral iron therapy compliance in kids with iron deficient anemia. A kind of anemia called iron deficiency anemia develops when the body does not have enough iron. This condition results in a decrease in the number of healthy red blood cells in the body. So it can be explained why iron maltose complex compounds can reduce anemia deficiency because one of the factors that causes anemia deficiency in the body where the body is iron deficient. Iron deficiency anemia is anemia caused by due to iron deficiency and can be suffered by anyone including infants, children and even adults, both men and women. According to IDAI 2018, Iron Deficiency Anemia (ADB) is anemia caused by reduce body iron stores to form erythrocytes. Iron is a micromineral that plays an important role in the process of forming hemoglobin in red blood cells. Iron including micronutrients that are important for the growth and development of a child because it plays a role in various metabolic processes, including transport oxygen, DNA synthesis, and electron transport. When iron levels in the body decreased, organs and tissues do not receive sufficient oxygen transport resulting in fatigue, decreased performance and decreased immunity. The long-term effects of untreatable iron deficiency cause impaired growth and development. The human body contains about 3-5 grams of iron (45-55 mg/kg body weight in adult women and men). The majority of iron in body (60-70%) in the form of circulating hemoglobin in red blood cells (Andrew, 1999). Other organs rich in iron are the liver and muscles. Hepatic and retinal endothelial macrophages, as well as some ferritin and its breakdown, each contain around 20–30% iron. Myoglobin, cytochromes, and iron-containing enzymes make up the majority of the body's remaining iron. Healthy individuals absorb 1-2 mg of iron from meals each day, which makes up for non-specific iron loss brought on by the desquamation of skin and small

intestinal cells. Additionally, physically, women who lose blood do so. The findings of the study demonstrated iron (III)-hydroxide polymaltose complex compounds boosts Hemoglobin and serum ferritin levels higher than oral ferrous sulfate and creates less adverse effects than ferrous sulfate. The effectiveness of IPC in treating iron deficiency anemia has been demonstrated over the last few decades by various research organizations through the performance of clinical trials in men, women, kids, and newborns (IDA). The researchers concluded that IPC is best given with food because of its exercise properties, possibly with slightly higher amounts of iron than conventional iron salts. IPCs also have clear advantages over iron salts in terms of acceptability and patient tolerance. Numerous studies and published studies have shown lower treatment discontinuation rates with IPCs than with iron salts. Related.

4. Conclusion

Based on literature reviews of six related studies, the findings have similarities. In other words, the iron polymaltose complex (IPC) has the same efficacy as ferrous sulfate, but because of its more stable structure, it is more stable in the absorption of iron in the body. IPC and ferrous sulfate, which have less adverse effects, both increase hemoglobin (Hb) levels in adults and children with iron deficiency anemia.

5. Acknowledgement

This research was supported by our lecturer Dr. Iis Siti Jahro, M.Si., our parents and our friends. We thank our colleagues at the State University of Medan who provided expertise which greatly aided the research, although they may not agree with all the interpretations given in this paper.

We must extend our appreciation to previous researchers for sharing their pearls of wisdom with us during this research. We also express our deepest gratitude to Dr. Iis Siti Jahro, M.Si. for his comments on earlier versions of the manuscript, although any faults are ours alone and should not tarnish the reputation of these esteemed professionals.