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Effect of aqueous extract of Moringa leaves on some physiological and biochemical indicators of laboratory rats with anemia

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Abstract

The study was carried out on 25 male albino rats at the age of 7-8 weeks and weighing 165-180±10 gm., The animals were divided into five groups: healthy control, anemic control was experimentally induced in Albino rats using aluminum chloride (AlCl₃) administered orally at 0.5 mg/kg daily for 28 days, and three treatment groups administered different doses of Moringa extract (150, 350, and 650 mg/kg body weight). The aim of this research project/paper/ document. etc. was to know how *Moringa oleifera* extract (from 150 mg/ kg of body weight through 350 mg/ kg of body weight to 650 mg/ kg of body weight affects the blood of rats. It was found that inducing anemia resulted in a marked drop in red cell parameters, eg hemoglobin (Hb) levels, total red blood cell count, and packed cell volume as well as an increased WBC count as compared with the healthy control. Following the administration of *Moringa oleifera* the red cell parameters showed significant improvement. At a dose of 350mg/kg the most benefit was shown to increase the level of Hb, RBC, and PCV suggesting that moringa has an extremely strong stimulation to erythropoiesis. Moringa treatment assisted with returning the WBC levels to normal. Regarding iron, the anemic group was shown to have a significantly reduced serum iron level and ferritin level. On the other hand, the administration of moringa extract resulted in a dose-dependent increase in serum iron and ferritin levels at moderate levels indicating that moringa could assist in increasing the availability and storage of iron. The increase in the ALT and AST levels indicates how the liver has been stressed. The administration of moringa extract resulted in a significant decreased level of both ALT and AST levels (especially at 350 mg/kg and 650 mg/kg). The findings suggest that moringa has a hepatoprotective effect as well.

Keywords: Moringa extract, hemoglobin (Hb), red blood cell count (RBC), packed cell volume (PCV), white blood cell count (WBC)

Introduction

One of the most common worldwide is Anemia due to food deficiency. Anemia can occur in developing or developed countries. The causes of anemic patients range way in terms of their iron (Fe) < his/her hemoglobin concentration, number and amount of red blood cells, significantly reducing the ability of blood to carry oxygen. Iron deficiency is still the predominate cause of anemia. Iron deficiency develops on account of inadequate dietary intake and iron absorption, repeated chronic loss of blood. Anemia has been linked to impaired physical performance, reduced immune functions, and delayed cognitive skills: its extent represents a major public health issue ^[1].

Commonly employed treatments for anemia are conventional therapies, such as supplementation of iron; however, such therapies tend to have complications such as gastrointestinal discomfort and poor compliance ^[2]. Thus, natural options as well as plant-based therapies have been paying more attention, as both have been found to have the potential to be effective and safe in providing anemia therapy. One example of a popular natural/plant-based therapy is *Moringa oleifera* (the drumstick tree); it has become popular due to its high degree of nutritional value and medicinal value ^[3].

Moringa oleifera leaves are packed with all sorts of good stuff like iron, vitamins, and amino acids, plus they have lots of special compounds like flavonoids and phenolic substances that are really good for you ^[4]. These parts are known for helping to stop cells from getting damaged, reducing inflammation, and aiding in the production of blood cells.

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This can help make anemia better and protect important organs, like the liver, from stress caused by oxidation^[5]. Despite the growing body of evidence supporting the health benefits of *Moringa oleifera*, limited studies have investigated its role in improving both hematological and biochemical parameters in anemia models^[6]. Therefore, the present study aims to evaluate the effect of the aqueous extract of *Moringa oleifera* leaves on hematological indices, iron status, and liver enzyme activity in experimentally induced anemic rats^[7].

Materials And Methods

The research took place at the University of Tikrit's College of Veterinary Medicine, in their animal house, over a month, from February 19, 2026, to March 18, 2026. It was carried out in the following way:

Sample collection and preparation

We got some *Moringa oleifera*, a plant used for medicine, from the United States.

Animals used in the study

For this study, we used a type of rat called the white laboratory rat, also known as Albino. These rats were around 7-8 weeks old and weighed about 165-180 grams, give or take 10 grams. We chose 25 male rats from the animal house at the College of Veterinary Medicine, Tikrit University. Before we started the experiment, we kept them under observation for two weeks to make sure they were used to their new surroundings and were in good health. We also had a veterinarian who specializes in this area check them out to ensure they were safe, healthy, and didn't have any diseases that could affect the experiment. This was an important step to take before using them in our study.

The study involved several groups of rats that were given different oral treatments. Each group got a unique mix of substances, along with filtered water, for 28 days. Here's a breakdown of what each group received: This group was made up of five healthy rats, and it acted as a control group for the study. This group had five rats that were given a small amount of aluminum chloride to make them anemic. The aluminum chloride was given to them by mouth at a dose of 0.5 mg/kg^[8].

- **(T₃):** A group of five animals was given a dose of *Moringa oleifera* extract, which was 150 mg/kg for every kilogram of their body weight, and this was done by mouth.
- **(T₄):** A group of five animals was given a dose of *Moringa oleifera* extract, which was 350 mg/kg for every kilogram of their body weight, and this was done by mouth.
- **(T₅):** A group of five animals was given a dose of *Moringa oleifera* extract, which was 650 mg/kg for every kilogram of their body weight, and this was done by mouth.

Collect blood samples: After the end of the 28-day

experiment period, the animals were fasted for 10 hours, and then blood samples were drawn from them by cardiac puncture in an amount of (0.5-5) ml using insulin syringes with a capacity of 1 ml and placed in two sets of test tubes, one with (EDTA) Researchers took blood samples and put them into two different sets of tubes. One set had a special ingredient called EDTA to stop the blood from clotting. The other set didn't have this ingredient. Then, they spun the samples around really fast 3000 times per minute for 15 minutes to separate the liquid part of the blood, called serum. After that, they carefully moved the serum into special tubes with labels and stored them in a very cold freezer at -20 degrees Celsius. They kept the samples there until they were ready to do more tests to see what was going on in the blood^[9].

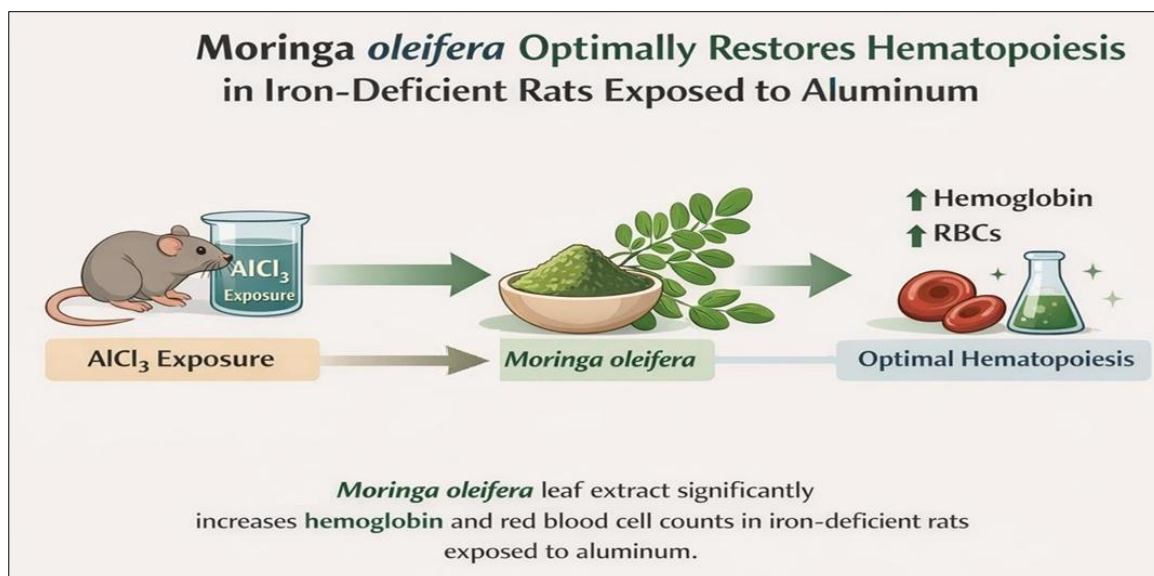
Statistical Analysis

SAS was used to analyze the group differences in this study, through a process known as one-way analysis of variance (ANOVA). ANOVA is a method for determining whether there are significant differences among a number of different groups. The next step of our comparative analysis was to conduct multiple comparisons tests with Duncan's multiple range test. During the final comparison, a p-value threshold of ≤ 0.05 was utilized to determine which group means are statistically different from one another to maintain a more conservative level of uncertainty that statistical associations are due to chance alone.

Results and Discussion

This study has demonstrated that laboratory rat's inducing anemic state resulted in significant alteration in hematological and biochemical parameters of the tested rat. The anemic control group has been shown to have a decrease in hemoglobin (Hb), red blood cell count (RBC), and packed cell volume (PCV) compared to that of the healthy control group and has also been shown to have an increase in white blood cells (WBC) count, indicating that anemic rats are exhibiting the classic signs of anemia due to impaired erythropoiesis and possible inflammation^[7].

The administration of an aqueous extract of *Moringa oleifera* leaves resulted in significant increases in hematological parameters of all treatment groups. The greatest increase in (Hb), (RBC), and (PCV) occurred at the 350 mg/kg dose, making it likely to have the highest stimulating effect on erythropoiesis. The increase in hematological parameters was due to the abundance of iron found in the Moringa leaves and the other nutrients, such as vitamin C and folate, that aid iron absorption and stimulate red blood cell synthesis^[10]. Additionally, the presence of bioactive compounds, such as flavonoids and phenolic compounds, may have contributed to decreased oxidative stress and thus reduced hemolysis of erythrocytes. The increase to normal levels of WBCs in the treated individuals indicates that there may also be a possible immunomodulatory and anti-inflammatory effect of the extract^[11].



Graphical Abstract: Optimal Dose of *Moringa oleifera* Lam for Hematopoietic Recovery in Aluminum-Induced Hematotoxicity ^[13].

Table 1: Effect of the medicinal plant extract (*Moringa oleifera*) on the characteristics of (Hb), white blood cells (WBC 103cells/mm³, red blood cells RBC 103cells/mm³ and PCV stacked blood cell volume%) (means ± standard error) of male rats.

Treatment	Hb	RBC	PCV	WBC
T ₁	13.72±0.13 a	7.32±0.05 A	42.34±0.38 a	7.12±0.14 D
T ₂	8.06±0.18 d	4.08±0.12 D	24.22±0.38 d	9.94±0.17 A
T ₃	10.48±0.13 c	5.28±0.12 C	32.32±0.39 c	8.38±0.05 B
T ₄	12.88±0.13 b	6.50±0.15 B	39.06±0.67 b	7.64±0.13 C
T ₅	13.66±0.09 a	7.12±0.10 A	42.14±0.42 a	7.38±0.10 Cd

* When you see different capital letters in the same column, it means there are big differences between the treatments, and we can be pretty sure these differences aren't just coincidences - they're statistically significant, with a probability of 0.05 or less.

* Similar capital letters within one column indicate that there are no significant differences ($p \geq 0.05$) between treatments.

- (T₁): This group was made up of five healthy rats, and it acted as a control group for the study.
- (T₂): This group had five rats that were given a small amount of aluminum chloride to make them anemic.
- (T₃): A group of five animals was given a dose of *Moringa oleifera* extract, which was 150 mg/kg for every kilogram of their body weight, and this was done by mouth.
- (T₄): A group of five animals was given a dose of *Moringa oleifera* extract, which was 350 mg/kg for every kilogram of their body weight, and this was done by mouth.
- (T₅): A group of five animals was given a dose of *Moringa oleifera* extract, which was 650 mg/kg for every kilogram of their body weight, and this was done by mouth.

Individuals suffering from anemia typically experience much lower serum iron and ferritin levels than those who do not suffer from anemia; in fact, both serum iron and ferritin levels are at risk of being completely depleted ^[1]. However, as the individuals in this study began taking *Moringa oleifera* extract, their serum iron and ferritin levels increased. The results from this study suggest that increased dosages of *Moringa oleifera* extract lead to a greater increase in serum iron and ferritin levels and that increased dosages lead to even greater improvement in those who take 350 mg/kg of *Moringa oleifera* extract. Therefore, it is likely that *Moringa* not only improves the absorption of iron, but it may also help the body to store and utilize iron more effectively. Enhancement of ferritin levels is particularly important in terms of restoring iron status ^[12].

Table 2: Effect of the medicinal plant extract (*Moringa oleifera*) on the characteristics of (Serum Iron), Ferritin (means ± standard error) of male rats.

Treatment	(µg/dL) (Serum Iron)	(ng/ML) (Ferritin)
T ₁	163.20±1.46 A	41.40±0.40 A
T ₂	69.00±1.61 D	13.60±0.40 E
T ₃	96.00±1.70 C	24.40±0.67 D
T ₄	143.00±1.09 B	36.20±0.58 C
T ₅	161.60±0.92 A	39.00±0.44 B

When it comes to how well the liver works, people with anemia had higher levels of certain enzymes, like ALT and AST, which can mean the liver is stressed or damaged. This might be because anemia causes oxidative stress. But when they were given an extract from the *Moringa oleifera* plant, the levels of these enzymes went down, especially when they took 350 or 650 mg/kg of it. This suggests These findings suggest that *Moringa oleifera* confers a protective effect against the liver. It's likely because *Moringa* has antioxidants that help get rid of free radicals and keep cell membranes stable, which prevents liver cells from getting damaged ^[13].

Table 3: Effect of the medicinal plant extract (*Moringa oleifera*) on the characteristics of (ALT), (AST), (means ± standard error) of male rats

Treatment	ALT (U/L)	AST (U/L)
T ₁	35.00±0.31 D	81.20±1.15 D
T ₂	61.80±1.35 A	121.80±1.28 A
T ₃	47.80±1.24 B	98.60±1.07 B
T ₄	40.00±0.54 C	87.60±1.12 C
T ₅	36.40±0.81 D	84.20±1.06 D

These findings demonstrate that *Moringa oleifera* has significant therapeutic potential to manage anemia and related complications. The 350mg/kg dosage provided the best benefits and can be explained to provide optimal results by modestly supplementing patients without requiring higher doses of the agent. The results from the present study support those of previous investigations; thus, reinforcing *Moringa oleifera*'s use as a functional food or as an organic/whole food therapy for the treatment of anemia ^[13].

4. Conclusion

According to research findings conducted using *Moringa oleifera* on blood (hematology) improvements; there is evidence that Moringa olive leaf extract actually helps treat anemia by both improving blood-related parameters and re-establishing iron levels. In fact, all doses tested were effective at treating anemia with the 350mg/kg being the most beneficial overall.

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