



# Effects of Aqueous Ginger Extract on Some Hematology Parameters, Serum Iron, Ferritin, and Total Iron Binding Capacity in Male Mice (*Mus musculus* L.)

Mustafa Abd Almajeed\*, Nawal Khalil Ibrahim

Department of Physiology, College of Medicine, University of Basrah, Basrah, Iraq

## Abstract

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**\*Correspondence:** Mustafa Abd Almajeed, Department of Physiology, College of Medicine, University of Basrah, Basrah, Iraq. E-mail: mustafa.hussein@uobasrah.edu.iq  
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**BACKGROUND:** Ginger is a common spice with wide range of medicinal properties for benefit in treatment of anemia and also for enhancement the level of iron and other function of blood. Gingerol is considering an active compound that stimulated remedy state of anemia and help in differentiation of red blood cells. Furthermore, the extract has more than wide chemical substances which play important role for many effects in human and animal.

**AIM:** The present study aimed to evaluate the effects of ginger on some hematological parameters as well as on serum iron, ferritin, and total iron binding capacity.

**SUBJECTS AND METHODS:** Thirty adult male mice were randomly divided into three groups, two treated (T1 and T2) and one negative control (NC) groups. The experimental groups were injected intraperitoneally 2 and 4 mg aqueous ginger extract, respectively, every day for 30 days, while the NC group only received the distilled water with the same dose. The estimation of total iron binding capacity and serum iron was measured by an automated analyzer from Rosh, While serum ferritin measurement by the direct immunoenzymatic method.

**RESULTS:** PCV significantly rises in both dose ( $32.67 \pm 5.61$ ) ( $33.12 \pm 6.82$ ), also Hb ( $11.31 \pm 1.40$ ), RBC ( $5.99 \pm 3.52$ ), MCV ( $70.96 \pm 2.41$ ), and MCHC ( $34.92 \pm 4.32$ ) appeared significant increase only in high dose, while MCH clarified not significant affect in two doses. TIBC not reach to significant differences in groups treated with two potion, whereas, rises serum iron ( $23.72 \pm 6.38$ ) and ferritin ( $59.34 \pm 7.41$ ) significantly appeared in high dose only compared with group in control at  $p < 0.01$ .

**CONCLUSIONS:** The ginger safe, benefit for blood component, and help in remedy of anemia and development iron absorption, also it is consider a beneficial as a promising therapy to prevent and treat iron deficiency anemia by rises a percent of hemoglobin and enhancement the iron status parameters.

## Introduction

Ginger (*Zingiber officinale*) is a flowering plant, common spice that belongs to the Zingiberaceae family and its rich in different chemical constituents including vitamins, nutrients, minerals, and antioxidants which consider and have many effects related to health [1]. Therefore, it has a very long history of use in various forms of traditional and alternative medicine [2]. The high content of iron and vitamin C is found in spice ginger which is beneficial for erythropoiesis, more studies have focused that extract of ginger and the supplementation of iron was important to be effect in iron deficiency anemia correcting and consume ginger will be safe in animals and humans with no mortality and side effects [3], [4]. Some of constitute are uses in the inhibition or treatment of different conditions and diseases, such as anemia, vomiting, platelet aggregation, inflammation, hypertension pain, asthma, colds, nausea, and some types of cancers with beneficial effects of an aqueous ginger extract on the immune system cells and antibodies, hematology, and thyroid

hormones in male smokers and non-smokers [5], [6]. Iron is a mineral that our bodies need for several functions, it has an essential role in erythropoiesis (production of RBC<sub>s</sub>), a major part of hemoglobin and is also a part of many other proteins and enzymes [7]. Hence, a lack of iron can lead to iron deficiency anemia, that is, the condition, where the blood lacks enough red blood cells containing hemoglobin to carry oxygen [8]. The body needs iron but cannot synthesis this mineral independently; therefore, a constant supply of iron from food is essential [9]. Recently study belay that ginger is a substance which can helps for improve anemia, production of hemoglobin, and stimulate erythropoiesis [10]. In the present study, we attempt to clarify the ginger role by estimating the effects of different ginger extract doses on the hematological parameters in male mice including: The hemoglobin (Hb), red blood cells count (RBC<sub>s</sub>), packed cell volumes (PCV), mean corpuscular volume (PCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC). As well, in the same experiment we trail the effects of aqueous ginger extract in different doses on the total iron binding capacity, ferritin and

iron in serum. The experimental results may be giving us an idea about the medicinal and therapeutic uses of this herb in the treatment of anemia caused by low iron level.

## Materials and Methods

### Plant extract elaboration

The *Z. officinale* rhizome arid was brought from emporium in market of Basrah. 30 g of crude ginger was lay in inebriant contain 250 ml of water after purification, then to leave for effervescence about (20) min; next disuse, it was let to cool [11]. After this, it will be nominee to prepare dosing score. The primary test was done to preparing different doses and injecting them into mice for different periods of time with observing the dose affecting the animal, which is non-lethal throughout the injection period, after which the selection of the effective dose is taken into account to complete the research and according to this; the potions used include (2 and 4 mg body weight/mice).

### Animals

Thirty adult healthy male mice (*Mus musculus* L. BALB/c) included in this experiment bringing from house animal in the Department of Biology, College of Education. The weight of these mice was (20–22 g). It would be split into three groups, two treated group and one control group (each group contained ten mice). They were retained for 30 days at room temperature (22 ± 3°C) with a 12 h light and 12 h dark cycle with standard water and diet. The diet contains 25.5% protein, 3.4% fat, and 2.8% fiber, while water was obtainable from drinking tubes [12].

### Design of experiment and analysis of blood parameters

The experimental groups were injected by intraperiton (IP) on the morning once time daily with 0.1 ml in every dose, (2 mg and 4 mg/mice) of *Z. officinale* extract also was injected in treated groups, the stander group received the distill water with the same dose and time period. At the end of last dose, animals were sacrifice (the ethical clearance number that was approved by an ethics committee in my city 0304005-006-2022) and blood samples accumulation from the heart to keep it in a two type of a special tube one with EDTA for the differential CBC analysis while anther tube without anticoagulant to form a clot for iron study. The blood clot samples were separated by centrifuge for (20 min at 3000 rpm) to obtain a serum for iron study parameters. The Randox UK kits was used for

estimation the total iron binding capacity and serum iron by an automated analyzer from Rosh [13]. The direct immunoenzymatic determination used to measurement serum ferritin with a kit from Diametra Italy [14]. The measured of a specific hematology parameters is done by auto analyzer that counts a number of cells from a specified dilution during a fixed time, or count the time until a fixed quantity of cells is reached.

### Statistical analysis

Using SPSS version (16), statistical program used to have analytical and descriptive statistics for the data. The mean, standard deviation (±SD), and minimum and maximum values for all parameters were determined. A highly significant difference is  $p < 0.01$ .

## Results

The samples of non-clot blood in Table 1 demonstration that PCV significantly rises in both dose, also Hb, RBC, MCV, and MCHC appeared significant increase only in high dose, while MCH clarified not significant affect in two doses.

**Table 1: Effect of different does of aqueous ginger extract on some blood parameters in male mice**

Parameters	Control Distal water N = 10	Treated 1 (2 mg ginger extract/ mice) N = 10	Treated 2 (4 mg ginger extract/ mice) N = 10	p value
Hemoglobin (Hb)%	10.22 ± 1.22	10.61 ± 4.59	*11.31 ± 1.40	<0.01
Red blood cell (RBC) c/mm	5.17 ± 5.99	5.62 ± 2.43	*5.99 ± 3.52	<0.01
Packed cell volume (PCV)%	31.21 ± 3.44	*32.67 ± 5.61	*33.12 ± 6.82	<0.01
MCV (fl)	69.80 ± 6.91	70.16 ± 3.23	*70.96 ± 2.41	<0.01
MCH (Pg)	23.52 ± 8.25	23.64 ± 7.11	23.89 ± 5.95	<0.01
MCHC%	33.87 ± 2.83	34.33 ± 1.51	*34.92 ± 4.32	<0.01

\*Significant increase.

In Table 2, TIBC not reach to significant differences in groups treated with two potion, whereas, rises serum iron and ferritin significantly appeared in high dose only compared with group in control at ( $p < 0.01$ ).

**Table 2: Effect of aqueous ginger extract with different doses on iron, ferritin, and total iron binding capacity in male mice**

Parameters	Control distal water N = 10	Treated 1 (2 mg ginger extract/mice) N = 10	Treated 2 (4 mg ginger extract/mice) N = 10	p value
Serum iron (µmol/l)	15.47 ± 3.18	18.15 ± 5.94	*23.72 ± 6.38	<0.01
Serum ferritin (ng/mL)	41.82 ± 2.31	46.72 ± 1.88	*59.34 ± 7.41	<0.01
Total iron binding capacity (TIBC) (µg/dl)	363.8 ± 7.65	362.11 ± 2.37	359.65 ± 1.73	<0.01

\*Significant increase.

## Discussion

It was found through the above results that there is a significant increase for both doses in relation to the (PCV) variable, likewise for the variables (Hb, MCV, and

MCHC) that showed an increase only for the high dose, while we did not show a significant changes in relation to (MCH) for both doses. It was also noted in Table 2 the occurrence of significant changes, which included a rise in the serum iron and ferritin percentage, and there was no change that reached the level of significant in (TIBC) for both doses compared with group in control. It has many physiological effects in the body especially on the blood which is a constantly circulating fluid providing the body with nutrition, oxygen, and waste removal [15]. Thus, increased erythrocytes count of ginger extract-treated male mice could due to the lowered level of lipid peroxide in erythrocytes membrane, leading to a decreased erythrocytes susceptibility to hemolysis and help in erythrocyte membrane stabilization by binding to proteins and carbohydrates which are the major constituents of erythrocytes membrane and may prevent the breakdown of erythrocytes membrane that could be useful in improving blood circulation [16]. Blood is mostly liquid (plasma) with numerous cells. About half of blood volume is composed of blood cells including the red blood cells (erythrocytes) containing hemoglobin (Hb) and responsible to carry oxygen from lungs to the tissues, white blood cells (leukocytes) which fight infections and the platelets(thrombocytes) smaller cells that help blood to clot [17].

On the other hand, ginger containing ascorbic acid, amino acids, sugars, and many organic acids, these compounds form a complex with iron to facilitate the iron absorption, so that. Ginger can trigger the erythropoietic system to produce erythrocytes [18]. Furthermore, recent studied demonstrate that ginger extract can potentially activate both the primitive and definitive waves of hematopoiesis through the modulation of Bmp expression and Bmp signaling pathway [19]. The activity of ginger to increase PCV, Hb concentration, and RBC<sub>s</sub> count can be useful in correcting anemia without increase in blood viscosity and thickness and not affect the flow of blood [20], [21]. Furthermore, the extract of ginger may contain some functional substances that impact for initiation of red blood cells and integrated with a mechanism of hemoglobin function in the blood [22]. This may be correlated to ginger platelet inhibition potential, whereas one of ginger constitutes (8-paradol) has a potent effect on cyclooxygenase-1 inhibitor and antiplatelet aggregation [23].

## Conclusions

Ginger can help to rises some of hematology parameters especially (Hb and PCV) and stimulating the production of RBCs, also treat iron deficiency anemia by facilitating iron absorption, and increasing the ferritin concentration. For future studies, we recommend

studying ginger as a medicinal herb to effectiveness on physiological parameters and its role in influencing the immune system of the body.

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## Ethics Approval and Consent to Participate

This research was conducted at Basrah University after obtaining approval from the animal house manager to use experimental animals to complete this research.

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