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سعادة أ. د. رئيس تحرير المجلة المصرية للدراسات المتخصصة المحترم

جامعة عين شمس، كلية التربية النوعية، القاهرة، مصر

تحية طيبة وبعد،،،

يسر **معامل التأثير والاستشهادات المرجعية للمجلات العلمية العربية (ارسيف – ARCIF)**، أحد مبادرات قاعدة بيانات **"معرفة"** للإنتاج والمحتوى العلمي، إعلامكم بأنه قد **أطلق التقرير السنوي التاسع للمجلات للعام 2024**.

ويسرنا تهنئتكم وإعلامكم بأن **المجلة المصرية للدراسات المتخصصة** الصادرة عن **جامعة عين شمس، كلية التربية النوعية، القاهرة، مصر، قد نجحت في تحقيق معايير اعتماد معامل "ارسيف Arcif"** المتوافقة مع المعايير العالمية، والتي يبلغ عددها **(32) معياراً**، وللاطلاع على هذه المعايير يمكنكم الدخول إلى الرابط التالي: http://e-marefa.net/arcif/criteria/

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كما صُنفت مجلتكم في **تخصص العلوم التربوية** من **إجمالي عدد المجلات (127)** على المستوى العربي ضمن الفئة **(Q3)** وهي الفئة الوسطى ، مع العلم أن **متوسط معامل "ارسيف" لهذا التخصص** كان **(0.649)**.

وبإمكانكم الإعلان عن هذه النتيجة سواء على موقعكم الإلكتروني، أو على مواقع التواصل الاجتماعي، وكذلك الإشارة في النسخة الورقية لمجلتكم إلى معامل **"ارسيف Arcif"** الخاص بمجلتكم.

ختاماً، نرجو في حال رغبتكم الحصول على شهادة رسمية إلكترونية خاصة بنجاحكم في معامل " **ارسيف** "، التواصل معنا مشكورين.

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ثانياً : بحوث علمية محكمة باللغة الإنجليزية :

Evaluation of the protective effect of beets and its main component (folic acid) on the symptoms associated with bean anemia in rats.

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Evaluation of the protective effect of beets and its main component (folic acid) on the symptoms associated with bean anemia in rats.

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Abstract

The study aimed to evaluate the impact of red beet root as a rich source of folic acid, antioxidants, and mineral salts on improving the levels of glucose-6-phosphate dehydrogenase (G6PD) enzyme and blood hemoglobin in rats, The study found that red beet roots can improve the immune system, hemoglobin, and enzyme (G6PD) in rats and improve the symptoms associated with favism. These findings may open new horizons for future research on beetroot's positive effects on various health conditions.

Keywords: favism, enzyme hydrogen glucose-6 phosphate, green bean, dehydroepiandrosterone, beetroot

ملخص:

العنوان : تقييم التأثير الوقائي للبنجر ومكونه الرئيسي (حمض الفوليك) على الأعراض المصاحبة لانيميا الفول في الفئران.

المؤلفون : السيدة غندور السحار ، هالة راشد عطايا ، هبة عبد السلام بركات ، مريم سمير شعبان جاد

هدفت الدراسة إلى تقييم تأثير جذر البنجر الأحمر كمصدر غني بحمض الفوليك ومضادات الأكسدة والأملاح المعدنية على تحسين مستويات إنزيم جلوكوز-6-فوسفات ديهيدروجيناز (G6PD) والهيموغلوبين في الدم لدى الفئران، وجدت الدراسة أن جذور البنجر الأحمر يمكن أن تحسن جهاز المناعة، والهيموغلوبين، والإنزيم (G6PD) في الفئران وتحسن الأعراض المرتبطة بالفافيزم. قد تفتح هذه النتائج آفاقًا جديدة للبحوث المستقبلية حول التأثيرات الإيجابية للبنجر على مختلف الحالات الصحية.

الكلمات الدالة : انيميا الفول ، إنزيم الهيدروجين جلوكوز-6 فوسفات، الفول الاخضر، ديهيدروإيباندروستيرون، البنجر

Introduction

Favism is a genetic disorder caused by mutations in the constitutive (Gd)gene, leading to deficiency of an erythrocyte enzyme known as glucose-6-phosphate dehydrogenase (G6PD). (G6PD) is involved in the pentose phosphate metabolic pathway and plays a critical role in maintaining proper redox potential within red blood cells. These mutations lead to different enzyme variants with different levels of activity, resulting in a range of clinical manifestations in individuals with (G6PD) deficiency. It also has diverse biochemical and clinical features. This condition is inherited in a sex-linked manner (**WHO, 2022**).

Favism is a rare cause of methemoglobinemia and hemolysis in individuals with (G6PD) deficiency. The degree of hemolysis in (G6PD)-deficient individuals is proportional to the amount of beans consumed. Identifying and eliminating the precipitating cause of hemolysis is crucial in individuals with (G6PD) impairment. Anemia should be managed accordingly, considering that hemolysis is self-limiting and typically Methylene blue is the first-line treatment for methemoglobinemia. However, its use can increase hemolysis in (G6PD)-deficient patients due to its oxidative effects **(Atta et al., 2021).**

(G6PD) deficiency is a condition that affects a significant number of newborns in Egypt, with a prevalence of 4.3% **(Abo El Ella et al., 2017)**.

Newborns with (G6PD) deficiency often face notable complications, including jaundice and acute hemolytic anemia (**Richardson and O'Malley, 2022)**.

fava beans contain vicine and convicine, which are poisonous glycosides responsible for favism, particularly in young boys with deficient (G6PD) activity **(Zam & Belal, 2020).**

Dehydroepiandrosterone (DHEA) has been shown to reduce levels of falciparum and erythrocyte glutathione while

inhibiting (G6PD) in healthy erythrocytes, suggesting its potential role in malaria treatment **(Zuluaga et al., 2013).**

Red beets are considered a low-fat vegetable with high carbohydrate and starch content, as well as soluble fibers and proteins, providing a moderate calorie value. They are also rich in various vitamins, including vitamins C, A, E, and K. additionally, beet roots are abundant in B-vitamins such as B1 (thiamine), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid), B6 (pyridoxine), B9 (folates), and B12 (cyanocobalamin), along with folic acid and antioxidants **(Ceclu and Nistor, 2020).**

The aim of the study is to explore the effectiveness of incorporating beets into the diet of rats at risk of or who have been diagnosed with hemolytic anemia, by evaluating the effect of beets as a potential source of folic acid**.**

Materials and Methods:

A correlational descriptive design was employed to fulfill the objectives of the present investigation.

Animals:

The current study was conducted on twenty male albino rats, weighing (160±10g) at the beginning of the experiment. They were obtained from the Agricultural Research Center - Institute of Food Technology - animal house unit. They were randomly distributed and placed in cages (5 rats/cage) and kept at a temperature of 22 + 2°C.

They were acclimatized under test conditions for one week before treatment. rats were fed a basal diet with known chemical composition according to **(Reaves et al., 1993).**

Preparation of Vicia faba bean extract after collecting Vicia faba beans from the legumes department, Agriculture Department, Egyptian Ministry of Agriculture. The outer shell of the beans has been separated. Grind the green beans, put them in a glass bowl, put them in the oven, and dry them at a temperature of 45 degrees Celsius. After drying, the beans are ground. The

powder was extracted by maceration method. 250 g of bean powder was extracted with 2500 ml using 70% ethyl alcohol, as it is the most suitable solvent to extract the alcohol and water components from the sample **(El-Shabrawy, 1971).**

Induction of glucose-6-phosphate dehydrogenase (G6PD) Deficiency in rat erythrocyte the (G6PD) deficiency was induced by an intraperitoneal injection dose of Dehydroepiandrosterone (DHEA) at dose 100 mg/kg body weight of (DHEA) dissolved in its solvent, which was made up of 1 vol of 95% ethanol and 9 vols of 16% Tween 80 in 0.9% NaCl for 35 consecutive days (5 weeks). After the last (DHEA) injection, the blood of rats fasting overnight was drawn from their tail artery, and the accuracy of the (G6PD) enzyme deficiency was evaluated by a standard assay kit purchased from Alfa Lab (Doki, Giza). The rats with known (G6PD) enzyme deficiency were selected for the next experiment.

Experimental design:

Twenty of male albino rats, weighing (160±10g) were divided into four groups (5 rats each) As follows:

The first group (1) was used as a negative control [C^-] group and was fed the basal diet. The other group (2) served as a positive control group [C^+] fed a basal diet and induced glucose-6-phosphate dehydrogenase (G6PD) Deficiency in erythrocytes in rats. (G6PD)deficiency was induced by intraperitoneal injection of Dehydroepiandrosterone C19H28O2 (DHEA) at a dose of 100 mg/kg. of body weight of (DHEA) dissolved in its solvent.

Group (3) was provided with 20% beet concentrate and was fed a basic diet and beetroot solution (beet powder + distilled water) through a gastric tube while inducing (G6PD) deficiency in the erythrocytes of rats. The (G6PD) enzyme deficiency was caused by the presence of yeast. Intraperitoneal. (DHEA) injection dose: 100 mg/kg body weight of (DHEA) dissolved in its solvent for 28 days.

Group (4) was provided with 40% beet concentrate and was fed the basic diet and beetroot solution (beet powder + distilled water) through a stomach tube while inducing (G6PD) enzyme deficiency in the red blood cells of rats.

The (G6PD) enzyme deficiency was caused by the presence of yeast inside Peritoneum. (DHEA) injection dose: 100 mg/kg body weight of (DHEA) dissolved in its solvent for 28 days.

At the end of the feeding period (4 weeks), (G6PD) deficiency was induced in the erythrocytes of rats, by intraperitoneally injecting a dose of (DHEA) given Vicia faba bean extract (40 mg/kg body weight) in distilled form. Water (10 ml/kg body weight) was administered orally (by gavage) to all groups except Group 1 because it was a normal control group. One hour after Vicia faba L. bean extract treatment, the animals were anesthetized with petroleum ether. Blood was then removed by cardiac puncture and hematocrit and total hemoglobin values were measured by standard methods for all rats.

Blood samples:

Blood samples were orbital sinus veins by non-heparinized capillary tubes and immediately divided into two Eppendorf tubes (1.5 ml). One containing EDTA (ethylene diamine tetra acetic acid) as anticoagulant (1 mg/ml blood) and used for Haemogram parameters. The second tube (without anticoagulant) was used for t biochemical and immunological parameters. The couple blood was centrifuged at 3500 r. p. m. for 15 min, using cooling centrifuge. Serum samples prepared were divide into aliquots and kept in deep freezer at -18°C the

Liver function test:

Colorimetric determination of alanine aminotransferase (GOT) or aspartate aminotransferase (GPT) was estimated by measuring the amount of pyruvate or oxaloacetate produced by forming 2, 4-dinitrophenylhydrazine, according to the method of **Reitman and Frankel (1957)**

Kidney function test:

Uria, and serum creatinine (Cr) were assayed in serum, using kits provided from Bio diagnostic Co. (Giza, Egypt) according to the methods that were described by **Fossati et al. (1980), Fawcett and Scott (1960) and Szasz et al. (1979).**

Statistical Analysis

By analysis of variance (ANOVA) (Average standard deviation), (stander error Duncan). The significance of various treatments was evaluated by Duncan, s multiple range test ($p>0.05$). All analysis were made using a software package "Costate" a product of cohort software Berkley, California **(Duncan, 1955).**

The Results:

The effect of different doses of beet root on creatinine levels in rats with favism injected intraperitoneally with Dehydroepiandrosterone (DHEA).

Results of biochemical analysis for all tested groups are presented Data in **table (1)** alterations in the kidney functions (Creatinine and Bilirubin) were statistically significant in all tested groups, there were statically increase in the activities of serum Creatinine and Bilirubin in all treatment groups 20% ,40% beet beside (positive control groups) as compared to negative control group. Furthermore, after four weeks of favism and treatment with different concentrations of red beets.

showed that Creatinine level increased in all groups in general compared to the negative control group, there are statistically significant differences between the negative control group G1 (0.94±.02) and the beet group 40% G4 (1.25±.01) in favor of the latter, there are no statistically significant differences between the treatment groups.

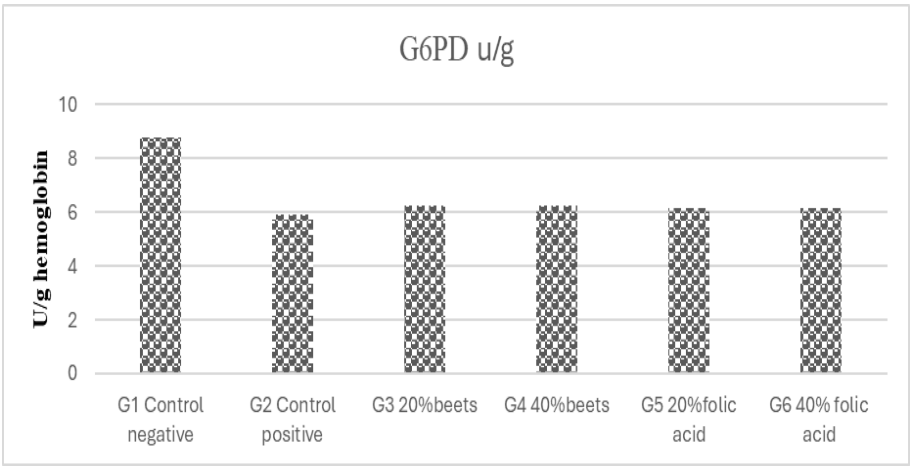
Table 1: Effect on creatinine level in different doses of beet root on rats with favism by injection intraperitoneal (ip) with Dehydroepiandrosterone (DHEA).

Groups / Variables	BIL mg/dl	CREAT mg/dl
Control negative group 1	0.94d±.02	0.85d±.01
Control positive group 2	1.36a±.02	0.95ab±.01
Group 3 (beet 20%)	1.28bc±.01	0.93bc±.01
Group 4 (beet 40%)	1.25c±.01	0.92c±.01

Each value in a Colum followed by the same letter is not significantly different at p≤ (0.05)

The antioxidant protective effect of beetroot and folic acid against the 10% LD50 of ethyl alcoholic extract of faba beans on glucose 6-phosphate dehydrogenase (G6-PD) was investigated.

Figure (1) that in title the antioxidant protective effect of beetroot and folic acid against favism on improve glucose 6-phosphate dehydrogenase (G6-PD) level, it observed that there were significant increased differences between group one and two control negative and positive. While there were none - significant between all treatment groups, moreover the best result was in group (4) that intake 40% beets compared with group (3).



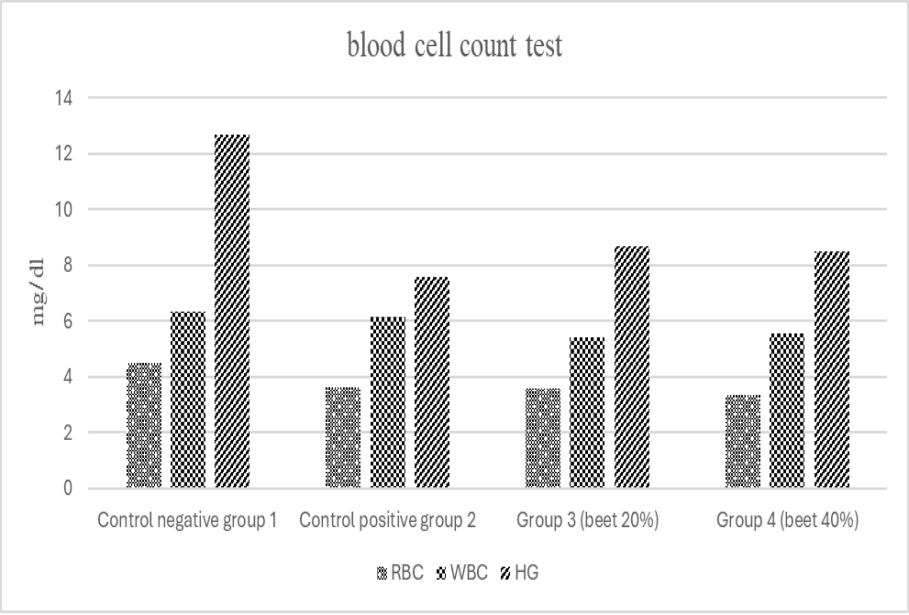
Figer 1: The antioxidant protective effect of beetroot and folic acid against the 10% LD50 of ethyl alcoholic extract of faba

beans on glucose 6-phosphate dehydrogenase (G6-PD) was investigated.

Effect of red beetroot on red blood cells count (RBC), white blood cell (WBC) and Hemoglobin (Hb) levels of rats.

The results in figure (2) indicated that the Hemoglobin (Hb) levels was lower in favism rats Control positive group (2) compared with those of Control negative group (1) The favism groups fed on beetroot all treatments had significantly higher serum hemoglobin (Hb) levels compared with favism group Control positive group (2).

Oral administration of red beetroot improved the suppressive effect of favism in Group 3 (beet 20%) and Group 4 (beet 40%) respectively. The amelioration by red beet root. This means that red beet root has a protective effect.



Figer 2: Effect of red beetroot on red blood cells count (RBC), white blood cell (WBC) and Hemoglobin (Hb) levels of rats.

Effects of folic acid and beetroot on glutathione (GSH), Hydrogen Peroxide (H2O2) and malondialdehyde (MDA) data were presented as mean ± SD. different superscript letters indicate differences (P < 0.05). There was a significant increase in H2O2 in the positive control group (66.33±.88) compared to the negative control group (36.33±.88), followed by a decrease in the treatment groups. Glutathione decreased in the positive control group (11.67±.88) compared to negative control group) 26.67±1.45). The results showed an increase in glutathione in the treatment groups, the highest followed by the beet group 40% (17.33±.88), and the lowest beet group 20% (15.0±.58). The results of the analyzes showed a significant increase in the malondialdehyde (MDA) measurement of fat oxidation for the positive control group (67.00±2.00) compared to the negative control group (95.33±1.45), followed by a significant decrease in the therapeutic groups, the best of which was the beet group 20% (87.33±1.45).

Table 2: effect of beetroot intake supplementation on blood glutathione (GSH) mmol/l, Hydrogen Peroxide (H2O2) mmol/l and malondialdehyde (MDA) mmol/l levels in rats infected with favism.

Variables / Groups	H2O2 mmol/l	GSH mmol/l	MDA mmol/l
Control negative group 1	36.33d±.88	26.67a±1.45	67.00c±2.00
Control positive group 2	66.33a±.88	11.67c±.88	95.33a±1.45
Group 3 (beet 20%)	61.00c±.58	15.0bc±.58	87.33b±1.45
Group 4 (beet 40%)	63.00b±.58	17.33c±.88	87.67b±.88

Each value in a Colum followed by the same letter is not significantly different at p≤ (0.05)

The discussion: -

Effect on creatinine level in different doses of beet root and folic acid on rats with favism by an intraperitoneal injection with Dehydroepiandrosterone

(DHEA) .

Our study agrees with **El Gamal et al. (2014)** which found that the positive control group had significantly higher creatinine

levels than the negative control group, with mean values of 1.01 ± 0.13 and 0.68 ± 0.04 mg/dl, respectively. When compared to the positive control group, all nephrotoxic rats fed varied diets showed significant decreases in mean serum creatinine levels. The results were 0.81±0.081, 0.75±0.10, 0.91±0.03, and 0.97±0.07 mg/dl for groups,

group (3) treated with 5% beet root of diet, group (4) treated with 10% beet root of diet, group (5) treated with 5% beet root leaves of diet and group (6) treated with 10% beet root leaves of diet respectively.

Rats fed in groups of 3, 4, 5, and 6 revealed substantial variations. The best therapy was reported for group (4) that fed on 10% beet root in comparison to the negative control group.

The antioxidant protective effect of beetroot and folic acid against the 10% LD50 of ethyl alcoholic extract of faba beans on glucose 6-phosphate dehydrogenase (G6-PD) was investigated.

In line with our study, **Koriem et al. (2009)** found that favism-induced individuals had significantly lower blood parameters, serum glucose, serum and liver proteins, serum, and liver (AST), serum (ALT), blood, and liver (GSH), serum and liver (G6-PD), liver (ALT), serum Treatment with vitamin E or β-carotene restored all parameters to near-control levels.

Finally, treatment with both antioxidants may provide some protection against the harmful consequences of favism. This suggests that vitamin E or β-carotene can reduce rat's sensitivity to blood poisoning and oxidative stress caused by favism.

Another study by **Azad Bakht et al. (2011)** who discovered that Diospyros lotus L. fruit extract has antioxidant properties that may protect against hemolytic damage caused by Vicia faba bean extracts on both G6PD-deficient humans and rat erythrocytes. and the study provides a scientific basis for the efficacy of the fruit extract currently used in Iran. The fact that this was demonstrated in human erythrocytes in vitro is

significant, and it provides a reason for additional testing in vivo in (G6PD) deficient human populations.

Koriem et al. (2016) who found that anise oil can protect against oxidative stress and genotoxicity caused by favism. And the purpose of this study was to determine the preventive impact of anise oil on favism diseases. Forty-eight male albino rats were divided into six groups: (group 1)received 1 mL distilled water orally, (group 2) received 300 mg/kg anise oil orally, and (group 3)received 100 mg/kg anethole orally over a seven-day period, (group 4) were favism-induced rats, (group 5) received 300 mg/kg anise oil orally, and (group 6) received 100 mg/kg anethole once a day over a seven-day period prior to favism induction.

The results showed that oral administration of anise oil or anethole to normal rats over a seven-day period produced no change.

Hemoglobin, hematocrit, red and white blood cell counts, serum glucose, blood glutathione, glucose-6-phosphate dehydrogenase, total protein, globulin, alanine, and aspartate aminotransferases were all significantly lower after favism induction, whereas serum alkaline phosphatase and bilirubin levels increased significantly. Favism-induced rats were pretreated with anise oil or anethole, which reversed these alterations. Favism also caused deoxyribonucleic acid (DNA) damage, while previous therapy with anise oil preserved liver (DNA) content.

(Al-Garawi et al, 2023) The study found a link between beetroot extract and red blood cells in both sick and healthy samples. The patient's hemoglobin and RBC levels improved throughout the research.

The extract reduced the incidence of anemia due to its nutritional value, which helped build immunity and compensate for blood loss.

Beetroot extract has also been shown to influence(G6PDH) levels. After three weeks, both the patient and the control group

had higher levels of the enzyme inside their hemoglobin and (RBC).

The results corers pond with those found in the study by **Cherepnalkovski et al, (2015)** Detecting (G6PD) activity during a hemolytic crisis can be difficult, and activity within the normal range does not rule out the diagnosis because older (RBCs) with lower enzymatic activity are the first to hemolyze, while younger RBCs with nearly normal enzymatic activity remain in circulation. During the hemolytic crisis, a (G6PD) deficiency was identified, indicating a class II, Mediterranean-type (G6PD) deficiency.

Effect of red beetroot on red blood cells count (RBC), white blood cell (WBC) and Hemoglobin (Hb) levels of rats.

Jaiswal et al. (2014) found that after inducing anemia, the number of erythrocytes and hemoglobin concentration reduced by 62.51% and 69.64%, respectively.

Standard hematinic preparation and extract (200 mg/kg) significantly increased (RBC) count and hemoglobin concentration compared to untreated rats with phenyl hydrazine-induced anemia ($P < 0.001$; $P < 0.01$).

Red beetroot contains an exceptional amount of naturally open cell reinforcements **(Woorton-Beard et al., 2011).**

Many other health-promoting substances include folic acid, iron, magnesium, calcium, potassium, phosphorus, and zinc. Beetroot is also rich in polyphenols **(Pitalua et al., 2010).**

These results were in line with the result reported by **Pushpaanjali et al. (2020)** found that beetroot juice helps treat anemia, boosting Hb levels faster and more efficiently. Beetroot juice can be used as an alternative to hematinic because it has an immediate effect of increasing hemoglobin levels and other hematocrit indicators. Furthermore, they do not generate any unwanted effects even if eaten for months.

addition, **Purba et al. (2021)** revealed that anemic teenage girl's Hb levels increased from 11.47 g/dl to 12.02 g/dl following a two-week beetroot juice intervention. According to the Paired t-test, the rise in Hb levels was statistically significant ($p < 0.05$). Hb levels did, however, rise during the two weeks of red spinach juice intervention, rising from 11.4 g/dl to 12.08 g/dl. There was a statistically significant increase in Hb levels ($p < 0.05$).

According to research by **Jaiswal et al. (2014)**, treating anemic rats with plant root extracts made by hot percolation in a Soxhlet system considerably stopped the declines in (HGB) concentration and (RBC) count.

effect of beetroot intake supplementation on blood glutathione (GSH) mmol/l, Hydrogen Peroxide (H2O2) mmol/l and malondialdehyde (MDA) mmol/l levels in rats infected with favism.

Bustamante et al, (2018) demonstrated that (GSH) is the principal nonenzymatic antioxidant molecule that interacts and neutralizes the oxidizing chemicals, and its decrease has been connected to the advancement of oxidative stress.

Haji Hosseini et al, (2017) found that Group S spent less time in the target quadrant compared to the control group. Administration of B. vulgaris leaf extract (100 and 200 mg/kg) significantly enhanced this time ($p<0.05$). Scopolamine reduced serum antioxidant capacity and elevated serum (MDA) levels insignificantly. B. vulgaris extract (200 mg/kg) significantly improved antioxidant capacity and reduced serum (MDA) levels in scopolamine-treated rats ($p<0.05$).

Jain et al. (2012) observed that treatment with B. vulgaris leaf extract significantly decreased hepatic (MDA) levels and raised (GSH), implying that the antioxidant action of B. vulgaris leaf extract plays a key protective role against ethanol-mediated toxicity.

Conclusion: -

Beetroots play a crucial role in enhancing blood cell quality, protecting against hemolytic anemia, and improving immune system effectiveness. Consuming high-folate foods, such as fresh, steamed vegetables, can increase folate intake. Beetroots also improve blood lipids, hemoglobin, and reduce creatinine urea levels, making them beneficial for patients with iron anemia, gout, kidney function, and liver function.

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