Effect of Spirulina (*Spirulina platensis*) Powder on Anemic rats:Biological, Biochemical and Technological Studies

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Effect of Spirulina (*Spirulina platensis*) Powder on Anemic rats:Biological, Biochemical and Technological Studies

Abstract

The present study was carried out to investigate the effect of spirulina on rats suffering from iron deficiency anemia. The current study was performed on 30 mature albino rats weighing 200±10g . Rats were divided into two main groups.The first group (6rats) fed on the basal diet as control-ve .The second group (24 rats) were fed on tannic acid by 20 g /kg diet then divided into 4 subgroups each (6 rats).Group2 fed on basal diet as control+ve.Groups 3 ,4 and 5 fed on basal diet supplemented with 2,4 and 6 % spirulina powder , respectively. At the end of the experimental time (28 days), feed intake (FI),Feed efficiency ratio(FER) and body weight gain (BWG) were calculated. Blood Hemoglobin (Hb), Hematocrit (%), White Blood Cells (WBC), Red Blood Cells (RBC),Mean Corpuscular Hemoglobin (MCH), Mean Cell Volume (MCV) , Mean Corpuscular Hemoglobin Concentration (MCHC), serum glcose and platelets of anemic rats were determined.Also, the chemical composition and mineral components of spirulina were determined . Baladi bread was made and fortified with spirulina and the sensory evaluations were applied. Results showed that treatment with spirulina can increase F.I, F.E.R, B.W.G, Hb ,Hematocrit(%),WBC, RBC ,MCH, MCVand MCHC, but decrease serum glucose level and platelets of anemic rats.Sensory evaluation tests indicated greater acceptability of bread fortified with spirulina powder at a concentration of (0.5- 1%) as compared to the control sample. In conclusion, data suggested that spirulina is useful for anemic persons because it is a good source of iron.

Key words: *Spirulina platensis*, Hemoglobin, functional food, red blood cells

Introduction

Anemia is a medical status associated with decreased or increased red blood cells characterized by insufficient oxygen-carrying capacity to fill physiological requirements **(Marks, 2019).** The most famous reason of anemia is deficiency of iron; iron being an integral portion of the bloodprotein, hemoglobin. However, there are other abnormalities also associated with anemia like shortage of vitamin A, vitamin B12, chronic inflammation and parasitic infections **(Premkumar *et al.*, 2018).** Moreover, thalassemia and sickle cell occur because of genetic disorders, either alone or jointly with iron deficiency anemia . These conditions can be treated either by transfusion practices or by chelation therapy that aid in targeting inoperative erythropoiesis and iron dysregulation **(El-Beshlawy and El-Ghamrawy, 2019).**

Iron deficiency anemia (IDA) occurs when the total iron intake from foods or its absorption into the body falls below the recommended requirements. Low iron availability results in the medical condition, hypochromic microcytic anemia due to low haem concentration in the blood **(Marks, 2019)**.

In children, IDA leads to weight loss as well as respiratory infections. The most damaging effect of anemia in children is slow improvement in behavior and psychomotor skills. Iron deficiency weakens the cell-mediated immunologic response of T-lymphocytes. This is due to reduced DNA synthesis that is, in fact, dependent on the function of radionuclide reductase**(Aly *et al.*,2018).**

The production of biomass from microalgae like phytoplankton received much interest recently because it can be considered a good source of alternative protein in foods. Commercialization and production of microalgae rich in carotenoids are mostly conducted on Spirulina, Chlorella and Dunaliella **(lee, 1997).**

These microalgae are mass produced commercially due to its high content of Vitamin A, and also contain a variety of other nutrients such as proteins, minerals, and vitamins. Therefore, Spirulina has been used as food, drug and functional supplements, additives and foods **(Kent, 2015**).Many microalgae have been studied but spirulina is considered the most unique due to its high protein content(65 to 70 %) as it contains a high percentage of amino acids (**Liestianty *et al*., 2019)** . Spirulina is known to be an important source of micro and macronutrients such as minerals , vitamins, gamma-linolenic acid, phycocyanin and sulfated polysaccharides **(Chu *et al*., 2010 and Ljubic *et al*., 2018).**

Spirulina is consumed as a functional food and safe nutritional supplement in the right amount. It is worth noting that the term functional refers to foods that have been shown to help specific functions in the body, leading to enhance health and / or reduce risk of disease (**Rodriguez *et al*., 2018).**Spirulina is also shown that good acceptance as an important food prospect or nutritional supplement and the spirulina has not shown chronic or acute toxicity, it is safely consumed as humans foods **(Salazar *et al*., 1998).**

Several studies have been conducted to find out the effect of spirulina as an antioxidant and an immune booster, as well as to combat hypercholesterolemia, infections, cancer, anemia, viruses, as well as diabetes **(Simon *et al*., 2018)**.

Therefore, this research aimed to investigate the effect of spirulina on anemic rats.

Material and methods

Materials

Casein, vitamins, minerals, cellulose, choline chloride, methionine, and tannic acid were obtained from El-Gomhoriya Company for Trading Drugs, Chemicals and Medical instruments , Cairo, Egypt. Oil and corn starch were obtained from local market in Menoufia, Egypt. The kits were supplied by Bio diagnostics Company, Cairo, Egypt. Spirulina powder was obtained from Agriculture Research Center, Ministry of Agriculture, Cairo, Egypt.

Methods

Basel diet composition was prepared according to **AIN, (1993).** The used vitamins and salts mixture component were that recommended by **Campbell, (1963)** and **Hegsted *et al*., (1941),** respectively.

Induction of anemia

Tannic acid was used to induce iron deficiency anemia in dose of 20 g TA/kg diet for three weeks according to **kaosar *et al.*,(2004).**

Experimental design and animal groups

Thirty white male albino rats, weighing 200 ±10 g were used in the study.Rats were housed in individual stainless steel cages under controlled environmental conditions, in the animal house of the faculty of Home Economics, Menoufia University and fed on basal diet for 7 days before to start feeding on experimental diet for acclimatization . Food and water check and rats weighed weekly. After the period of acclimatization, rats were assigned to 2 main groups:The first group (6rats) fed on the basal diet as control-ve.The second group (24 rats) fed on tannic acid diet (20 g TA\kg diet) for three weeks then divided into four sub groups(each 6 rats). Group2 fed on basal diet as control+ve.Groups 3 ,4 and 5 fed on basal diet supplemented with 2,4 and 6 % spirulina powder , respectively.

Blood sampling collections

At the end of experiment period blood samples were collected after 12 hours fasting from the portal vein; rats were scarified under ether anesthetized. Two blood samples were collected from each rat, the first sample was collected into tube containing EDTA as anticoagulant and used for assessment of erythrocytes indices. The second blood sample collected into a centrifuged tube without EDTA and centrifuged to obtain serum.Serum stored frozen at -20°C for analysis **(Malhotra, 2003**).

Biological evaluation

During the experimental period (28days), the diet consumed was recorded every day and body weight was recorded every week. The body weight gain **(B.W.G.)** and feed efficiency ratio **(F.E.R)** were determined according to **Chapman *et al.*, (1959).** Using the following equations:

B.W.G. = Final weight - Initial weight

$$\text{F.E.R.} = \frac{\textbf{Grams gain in body weight}}{\textbf{Grams feed consumed}}$$

Proximate chemical composition of spirulina

Proteins, fat, ash, fiber and moisture were evaluated according to **(AOAC, 2015).** Carbohydrate contents were estimated by difference.

Biochemical parameters

Hemoglobin (Hb), hematocrit and platelets were estimated according to **Dacie and Lewis, (1998)**, **Jacobs *et al*.,(2001) and Maartina and Daly, (2011)** ,respectively **.**Red blood cells and white blood cells (WBCs) were estimated according to **Lubsandorzhiev, (2006)** and **Koda- Kimble *et al*., (2001)** ,respectively**.**Mean cell volume (MCV)**,** mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were calculated according to **Lee and Nieman, (1996).**

Technological methods

The baladi bread was prepared according to **Saroba *et al*., (2009).**The wheat flour was sub stituted with 0.5 – 1% of spirulina . Samples of bread were subjected to organoleptic tests (by 20 judges) according to **watts *et al*., (1989).**

Results and Discussion

Proximate chemical composition of spirulina powder (per100g)

Data in Table (1) show the proximate chemical composition of spirulina. Proteins were the most abundant compounds, followed by carbohydrates, fat, ash and moisture. The mean values were 58.73, 23.8, 6.66.38 and 2.56 (g/100g) respectively. The most relevance of inorganic micronutrients in spirulina is potassium, magnesium, phosphorous ,sodium and iron.

Table (1): Proximate chemical composition of spirulina powder (per100g)

Component	Value
Total protein (g)	**58.73± 1.41**
Total lipids(g)	**6.6 ±0.3**
Carbohydrates(g)	**23.8 ±1.66**
Water(g)	**2.56±0.40**
Fiber	**1.93±0.15**
Ash(g)	**6.38±0.56**
Iron(mg)	**170±2.5**
Magnesium(mg)	**295 ±5**
Phosphorous (mg)	**896 ±3. 6**
Calcium (mg)	**1473±0.01**
Potassium (mg)	**1500± 0.01**
Sodium (mg)	**246 ±3.21**

The results agreed with the ones reported by **Belay, (2002)** who stated that spirulina is a famous food due to its excellent nutritional quality. These microalgae contain a large amount of protein (60 to 70 percent of dry weight). Also**, Carcea *et al*., (2015**) showed that spirulina contains many minerals and vitamins. The most common minerals that are found in spirulina are calcium, iron, zinc, potassium, magnesium, selenium and many others. Spirulina can be used as a nutritional supplements important to human health because it contains polyunsaturated fats and antioxidant pigments **(Kent *et al*., 2015**) .

Effect of feeding with spirulina powder on Feed intake (FI) , Feed efficiency ratio (FER) and Body weight gain (BWG) of anemic rats

Data listed in Table (2) show the effect of feeding with spirulina powder on FI (g/day), FER and BWG (g/ 28day) of anemic rats . It could be noticed that the mean value of FI for control (-) group was higher than control (+) group being 23.5±1.32 and 15.7±0.79 (g/day) respectively, FI in the negative control group showed significant increase, as compared to the positive control group. All anemic rats fed on spirulina powder showed significant increases in FI as compared to control (+)

group except G3. For FER , finding denote that there were significant increases in FER in all anemic rats fed on spirulaina powder compared to control (+) group.

Concerning BWG, the obtained results showed that the mean value of control (+) group was lower than control (-) group, being 18±2.05 and 85±2.53(g/28day) respectively, showing significant difference compared to control (+) group. All the mean values of groups 3, 4 and 5 had a significant increase in BWG compared to positive control group.

Table (2): Effect of Feeding with spirulina powder on feed intake(FI), feed efficiency ratio (FER) and Body weight gain (BWG) of anemic rats

Groups	FI (g/day) Mean ± SD	FER Mean ± SD	BWG(g) Mean ± SD
(G1):Control negative (-ve)	$23.5^{a}\pm1.32$	$0.123^{a}\pm0.005$	$85^{a}\pm2.53$
(G2):Control positive (+ve)	$15.7^{c}\pm0.79$	$0.036^{d}\pm0.005$	$18^{e}\pm2.05$
(G3):Spirulina(2%)	$17.58^{bc}\pm1.22$	$0.06^{c}\pm0.01$	$32.63^{d}\pm2.77$
(G4):Spirulina(4%)	$19.13^{b}\pm1.3$	$0.096^{b}\pm0.01$	$54.16^{c}\pm1.85$
(G5):Spirulina(6%)	$21.56^{a}\pm1.53$	$0.11^{ab}\pm0.01$	$70^{b}\pm2$
LSD(p≤ 0.05).	2.29	0.01	4.13

Values are expressed as means±SD. Means in the same column with different superscript letters are significantly different at p≤ 0.05.

These result was in harmony with **Azabji *et al.*, (2011**) and **Kumudha and Sarada ,(2015)**they reported that there was an improvement in the weight and height of the malnourished children when they were fed on spirulina, and many of them also appeared to have less anemia because spirulina contains high amount of vitamin B12 which is useful for normal maturation and blood cell development .Also**, Abed *et al.*,(2016)**showed that spirulina has highly effect in treating problems of malnutrition as well as anemia and can be used widely for many purposes because it is cheap compared to other traditional pharmaceutical preparations and formulas. Spirulina can improve hemoglobin level in the blood when used for 12 weeks, it also improves height and weight in malnourished children under the age of five, compared to children who took vitamin supplements. **Kedar *et al.*, (2017)** showed that the consumption of spirulina for nursing mothers, pregnant women and children under the age of six at a dose of 1- 2 grams led to amazing results as it treated malnutrition and anemia.A similar observation also was reported by **Furbeyre *et al,*.(2017)**they tested the effect of spirulina on the development of growth, digestion and absorption of nutrients, as well as intestinal health in weaned pigs, especially its effect on digestive disorders. It was found that spirulina did not cause harmful effects in animals.

Effect of feeding with spirulina powder on Hemoglobin (g/dl) and Hematocrit (%) in anemic rats

Given Hgb and Hct, it is clear in Table 3 that there was significant decrease between group (2) as compared to normal rats (group 1) which were 8.47$\pm$0.748 g/dl and 26.42$\pm$2.24%, respectively for anemic rats as compared to 14.3$\pm$1.126 g/dl and 46.9$\pm$7.39%, respectively for normal rats. In relation to Hgb, there were non significant differences between group 4, 5 and group 1 (normal rats). For HCT, there was no significant difference between Group 3 which treated with (2 % spirulina) and the positive control group. The best result was recorded for group 5.

Table (3): Effect of Feeding with spirulina powder on Hemoglobin (g/dl) and Hematocrit (%) in anemic rats

Groups	Hemoglobin (Hgb) (g/dl) Mean±SD	Hematocrit (HCT) (%) Mean±SD
(G1):Control negative (-ve)	$14.3^{a}\pm1.126$	$46.9^{a}\pm7.39$
(G2):Control positive (+ve)	$8.47^{d}\pm0.748$	$26.42^{c}\pm2.24$
(G3):Spirulina(2%)	$11.03^{b}\pm0.907$	$34.1^{bc}\pm2.72$
(G4):Spirulina(4 %)	$13.23^{a}\pm0.680$	$40.7^{ab}\pm2.04$
(G5):Spirulina (6 %)	$14.03^{a}\pm1.767$	$41.35^{ab}\pm6.14$
LSD(p≤ 0.05)	2.032	8.26

Values are expressed as means±SD. Means in the same column with different superscript letters are significantly different at p≤ 0.05.

These results are supported by the results published by **Kauser *et al.*,(2001)** and **Sachdeva *et al.*, (2004)** they observed a significant increase in hemoglobin and intellectual levels when used spirulina powder for just five weeks in the study.Also, **Pugazhendy *et al.*, (2012)** reported that spirulina can improve Hb, MCH and MCHC in anemic children .The nutritional benefits of the spirulina over the vitamins and mineral supplementations might refer to the functional activities of it. Levels of anemia decreased in children when spirulina was added to their diet **Branger *et al.*, (2003).Rajachar *et al.*, (2016)** showed in their randomized study of 1000 children that consuming spirulina in doses (1 and 2 grams) led to an increase in hemoglobin level as well as a significant improvement in their mental abilities and their academic level.

Effect of feeding with spirulina powder on MCV (fl), MCH (pg) and MCHC (g/dl) in anemic rats

As regards to MCV, MCH and MCHC, the results showed that there were significant decreases in anemic rats without treatment compared to normal rats. Which were 50.30+2.06 (fl), 12.53+1.33 (pg) and 19.83+2.12 (g/dl), respectively for anemic rats.for MCV, there were non significant differences between group 4, 5 and group 1. The best treatments and high values were recorded for group 4 and group 5.Looking for MCH, there were significant increases in all treatment compared to anemic rats without treatment (group 2). Also there was no significant difference between group 5 and group 1. Group (5) showed the best treatment when compared to control (-ve) group. In MCHC, it could be noticed that, there were significant increases between all anemic groups treated with spirulina and control (+ve) group.

Table (4): Effect of feeding with spirulina powder on MCV (fl), MCH (pg) and MCHC (g/dl) in anemic rats

Groups	MCV (fl) Mean + SD	MCH (pg) Mean + SD	MCHC (g/dl) Mean + SD
(G1):Control negative (-ve)	62.63^{a}+2.55	33.83^{a}+1.48	38.33^{a}+0.757
(G2):Control positive(+ve)	50.30^{c}+2.06	12.53^{d}+1.33	19.83^{d}+2.12
(G3):Spirulina(2 %)	53.93^{b}+1.32	20.30^{c}+2.05	25.03^{c}+1.70
(G4):Spirulina(4 %)	58.56^{a}+1.53	26.33^{b}+1.52	30.5^{b}+1.50
(G5):Spirulina (6 %)	60.63^{a}+	30.96^{a}+2.10	36.06^{a}+1.85
LSD(p≤ 0.05)	3.321	3.147	3.008

Values are expressed as means±SD. Means in the same column with different superscript letters are significantly different at p≤ 0.05.

These results are completely in agreement with **Seyidoglu *et al*., (2019)** they showed that spirulina could improve haematological and morphological parameters when they studied its effect on morphological and haematological factors resulting from social stress in male rats.

Effect of feeding with spirulina powder on WBC (k/ul), RBC (k/ul) and Platelets (k/ul) in anemic rats.

Reading WBC and RBC, Data showed that there were significant increases in WBC and RBC between normal rats compared to anemic rats which were 14.2$\pm$1.13 (k/ul) and 6.5$\pm$0.5 (k/ul), respectively for normal rats as compared to 10.5$\pm$1.37 (k/ul) and 2.5$\pm$0.3 (k/ul), respectively for anemic rats. All rats fed by tannic acid and fed on spirulina powder had a significant increase in WBC and RBC compared to control (+ve) group. The best result was recorded to Group (5) for WBC and RBC. According to platelets, results denote that there were asignificant decreases in platelets in normal rats compared to control (+ve) group .Rats given tannic acid then fed on spirulina (6 g/kg basel diet) showed the highest significant decrease in platelets which was 281.36$\pm$3.066 (k/ul).

Table (5): Effect of feeding with spirulina powder on WBC (k/ul), RBC (k/ul), and platelet (k/ul) in anemic rats

Groups	WBC (k/ul) Mean ± SD	RBC (k/ul) Mean ± SD	Platelets (k/ul) Mean ± SD
(G1):Control negative (-ve)	14.2^{a}±1.135	6.5^{a}±0.5	285.6^{d}±4.55
(G2):Control positive(+ve)	10.5^{b}±1.37	2.5^{d}±0.3	574.33^{a}±4.041
(G3):Spirulina(2 %)	12.13^{ab}±1.10	3.56^{c}±0.602	417.66^{b}±3.785
(G4):Spirulina(4 %)	13.06^{ab}±0.901	5.23^{b}±0.251	315^{c}±5
(G5):Spirulina (6 %)	14.06^{a}±1.46	6.2^{a}±0.360	281.36^{d}±3.066
LSD(p≤ 0.05)	2.205	0.770	7.538

Values are expressed as means ± SD ; means in the same column with different letter are significantly different (p≤ 0.05).

These results are in agreement with those found by **Watanuki *et al.*, (2006)** they observed that spirulina has positive effective on interleukin and tumor necrosis factor which are responsible to cellular response in carps, and also helps to produce red and white blood cell and interferons in rats . Also, **Simsek *et al.*, (2009)** reported that spirulina has an inhibitory effect on development of leucopenia and anemia induced by cadmium and lead in rats . Treating animals with spirulina led to an increase in the levels of MCH, red blood cells and hemoglobin, and its consumption may increase the production and function of red blood cells, and there was a steady increase in the level of hemoglobin with the increase in the consumption of spirulina **(Bléyéré*et al.*, 2013)**. Older women benefited faster from spirulina supplements **(Mohan *et al.*, 2014)**. Spirulina is a rich source of iron with levels equivalent to that contained in beef. The iron content in the spirulina has the ability to replete the serum iron as well as the ferritin stores **(Kauser and Parveen, 2001)** .Also, **Kambou *et al.*, (2015)** studied anti anaemic effect of spirulina in rabbits and showed that spirulina is a rich source of nutrients.

Roberto , (2015) and **Balasubramani *et al* . , (2016)** showed that spirulina contains minerals such as iron, magnesium, calcium , and phosphorus. Spirulina is a splendid source of iron which contains20 times more iron than wheat gram so spirulina is a good treatment for anemia .

These results are supported by the results published by **Visnegarwala and Mahesh, (2017)** showed the effects of spirulina, blue green algae, as an alternative to iron supplements, to not only alleviate the anemia of pregnancy but also have impact on the fetal and maternal outcomes, through its impact on the gut microbiome. Also, **Radha and Chandra, (2018)** showed thatspirulina is useful for anemic persons because it is a good source of iron, meaning it is excellent for women during pregnancy.

Table (6): Effect of feeding with spirulina powder on serum glucose level of anemic rats

Groups	Serum glucose level (mg/dl) Mean $\pm$ SD
(G1):Control negative (-ve)	$74.5^{e}\pm2.78$
(G2):Control positive (+ve)	$197^{a}\pm2.64$
(G3):Spirulina(2 %)	$155.66^{b}\pm2.51$
(G4):Spirulina(4 %)	$142.86^{c}\pm2.80$
(G5):Spirulina (6 %)	$94.76^{d}\pm2.54$
LSD(p≤ 0.05)	4.84

Values are expressed as means±SD. Means in the same column with different superscript letters are significantly different at p≤ 0.05.

The data in Table 6 illustrate a significant increase in blood glucose level in positive control group compared to that of normal control rats. Treatment with all doses of spirulina caused a significant decreases in blood glucose levels in anemic rats.

These results are completely in agreement with **Simon *et al*., (2018)** they reported that feeding diabetic rats on spirulina reduced blood glucose levels, serum lipid profile, and serum renal markers as well as increase the antioxidant status and minimize the extent of tissue damage. Also**, Oriquat *et al*.,(2019**) reported that spirulina(250‑750 mg/kg of Spirulina for 30 days) successfully ameliorated the induced elevation of fasting blood glucose, insulin and hepatic enzymes. These results are supported by the results published by **Wan *et al*.,(2019)** who reported that there was an improvement in glucose tolerance as well as altered gut microbiota composition after consuming high-fat high-sucrose diet supplemented with spirulina extracts .

Table (7): Sensory properties of bread supplemented with spirulina powder

Variable	Control	0.5% spirulina	1% spirulina
Appearance	8.51 ^{a} ± 0.08	8.5^{a}± 0.50	9.16^{a} ± 0.28
Flavor	8.33^{a} ± 0.28	8.66^{a} ± 0.28	8.83^{a} ± 0.57
Taste	8.16^{b} ±0.28	8.5^{b} ± 0.0	9.33^{a} ± 0.28
Texture	8.66^{a} ± 0.28	8.83^{a} ± 0.57	8.83^{a} ± 0.28
Crispness	8.83^{a} ± 0.57	8.5^{a} ± 0.86	9^{a} ± 0.5
Colure	8.16^{b} ± 0.28	8.83^{a}± 0.28	9.16^{a} ± 0.28
Over all acceptapility	8.66^{a} ± 0.28	8.83^{a} ± 0.28	9.33^{a} ± 0.57

Values are mean ± SD. Values in the same raw sharing the same superscript letters are not statistically significantly different.

Sensory properties of bread supplemented with spirulina (0.5–1%) are presented in Table (7) .There were non significant differences in appearance, flavor ,texture ,crispness and overall acceptapility between control and bread supplemented with spirulina (0.5–1%) .However taste and color of bread prepared with 1% spirulina were significantly better than control and bread supplemented with % 0.5 spirulina.

Barkallah *et al.*, (2017) developed a yoghurt containing spirulina at concentrations within the range 0.25–1. 0% which showed higher protein and fibre content together with better water holding capacity and lower whey syneresis during storage .In addition , **Lucas, *et al.*, (2018)** manufactured extruded snacks containing spirulina at a concentration of 2.6% and reported high sensorial acceptance .Spirulina was also effectively incorporated into other dairy products such as cheese**(Golmakani *et al.*, 2019).**

Moreover, **Marti-Quijal *et al.*, (2019)** recently assessed the potential of spirulina on the physicochemical properties of fresh pork sausages and concluded that although colour and texture were significantly affected, the nutritionally favourable amino acid content and composition could lead to their use as alternatives to soy protein. **Mostolizadeh *et al.*, (2020**) studied the effects of incorporation spirulina powder in wheat flour on chemical, microbial and sensory properties of pasta**.** spirulina powder can improve sensory properties of pasta**.**

In conclusion

Spirulina can be considered a super food due to its high content of nutrients such as protein, minerals, vitamins, phyto nutrients, essential fatty acids and amino acids so it can be used effectively as nutritional supplements to enhance human health.

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تأثير مسحوق الاسبرولينا على الفئران المصابة بالانيميا

دراسات بيولوجية وكيموحيوية وتكنولوجية

أجريت الدراسة الحالية لمعرفة تأثير مادة الاسبرولينا على الفئران التى تعانى من فقر الدم بسبب نقص الحديد وقد أجريت الدراسة الحالية على ثلاثون فأروتم تقسيمهم الى مجموعتين رئيسيتين : المجموعة الأولى (ست فئران) تتغذى على الوجبة الرئيسية الاساسية كمجموعة ضابطة سالبة اما المجموعة الثانية (اربعة وعشرون فأر) تم حقنها بحمض التانيك (عشرون جم لكل كجم من الوجبة)لمدة ثلاث اسابيع ثم تم تقسيمها الى اربع مجموعات وقد تركت المجموعة الثانية كمجموعة ضابطة موجبة وتغذت المجموعة الثالثة والرابعة والخامسة على الوجبة الاساسية مدعمة بالاسبرولينا بجرعة 2 و4 و6% على التوالى.وفى نهاية التجربة والتى استمرت 28 يوم تم تقدير مأخوذ الطعام ووزن الجسم ومعدل كفاءة الغذاء والهيموجلوبين والهيماتوكريت وكذلك خلايا الدم البيضاء والحمراء ومتوسط الهيموجلوبين العضلى ومتوسط حجم الخلية ومتوسط تركيز الهيموجلوبين العضلى و مستوى السكر فى الدم والصفائح الدموية كما تم تقدير التركيب الكيماوى والمحتوى من العناصر المعدنية للاسبرولينا وتم عمل خبزبلدى مدعم بالاسبرولينا وتم تقييمه حسيا لمعرفة مدى قابليته وخواصه الحسيه. وقد أظهرت النتائج حدوث زيادة فى مأخوذ الطعام ووزن الجسم ومعدل كفاءة الغذاء والهيموجلوبين والهيماتوكريت وكذلك خلايا الدم البيضاء والحمراء ومتوسط الهيموجلوبين العضلى ومتوسط حجم الخلية ومتوسط تركيز الهيموجلوبين العضلى بينما حدث انخفاض فى مستوى السكر فى الدم والصفائح الدموية.وقدأظهر اختبار التقييم الحسي قبولاً أكبر للخبز المدعم بمسحوق الاسبيرولينا بتركيز (0.5-1 ٪) مقارنة بعينة التحكموتوصى الدراسة باستخدام الاسبيرولينا للأشخاص المصابين بفقر الدم لأنه مصدر جيد للحديد

الكلمات المفتاحية : الاسبرولينا، الهيموجلوبين، الأغذية الوظيفية، خلايا الدم الحمراء