# The Effects of Moringa Leaves and Chia Seeds on Some Blood Parameters and Histopathology of Liver and Kidney to Boost Immunity of Diabetic Rats

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**Abstract:**

This investigation aimed to evaluate the effect of moringa leaves, chia seeds and mixture of both on supporting immunity of male diabetic rats. Thirty (30) adult male Sprague Dawley rats were divided into five groups. Group (1): Normal rats fed on basal diet as control negative (C-), Group (2): Control positive (C+) (untreated group). Group (3): Diabetic rats fed on basal diet and moringa leaves (5%). Group (4): Diabetic rats fed on basal diet and chia seeds (5%). Group (5): Diabetic rats fed on basal diet and mixture of both (moringa leaves & chia seeds) (5%). At the end of experiment, after 28 days of feeding, all serum samples were analyzed for different parameters. Injection with alloxan caused a significant decrease in the level of Hb, Ht, RBC, WBC, Neutrophils, Lymphocytes, Monocytes, Eosinphils and Basophils while a significant increase was recorded in Plt and organs weight. Diabetic rats treated with various experimental diets, showed the improvement in all previous parameters, indicating enhancement of immunity. Immunity was enforced better by chia seeds, then moringa leaves, both the mix diet was the best, indicating a synergistic action.

**Key words:** Diabetes – Moringa leaves - Chia seeds.

## Introduction:

Patients with uncontrolled diabetes are considered immunosuppressed due to the negative effects of elevated blood sugars on the immune system. Hyperglycemia impairs overall immunity through different mechanisms. Chronic hyperglycemia in diabetes patients can lead to acidosis, which limits the activity of the immune system. The effects of these changes are reversible upon treatment of acidosis and hyperglycemia **(Clement *et al*., 2004).**

Although the most common infections in diabetes patients involve the skin and urinary tract, more severe infections may arise if blood sugars are not controlled. High glucose levels limit and deregulate neutrophil synthesis, which is essential in the immune system to attack a foreign object. Cytosolic calcium in polymorphonuclear leukocytes (PMNs) increases in the presence of hyperglycemia and is inversely proportional to the occurrence of phagocytosis in patients with type II diabetes. High levels of cytosolic calcium inhibit the synthesis of adenosine triphosphate (ATP), which is essential for phagocytosis. The ability of PMN leukocytes to mobilize to the site of infection and stimulate of apoptosis is negatively impacted as well **(Clement *et al*., 2004).**

The *Moringa oleifera* is a significant medicinal plant belonging to the family Moringa ceae. The *M. oleifera* is recognized for its vast therapeutic properties since ancient times. It is also known as drumstick tree or horseradish tree; the leaves are very beneficial and offer important source of beta-carotene, vitamin C, protein, iron, and potassium **(Verma *et al*., 2009)**. T *M. oleifera* tree can grow well in the humid tropic or hot dry land and it can survive in harsh climatic condition including destitute soil. The root, bark, gum, leaf, pods, flowers, seed, and seed oil are used in traditional medicine for treatment of various ailments. The leaves, flowers, roots, gums, fruits, and seeds of *M. oleifera* are extensively used in the treatment of inflammation, cardiovascular dysfunction, liver disease, and hematological and renal malfunction **(Adeyemi and Elebiyo, 2014).**

The leaves of *M. oleifera* (g/g) have the calcium four times that of milk, vitamin C seven times that of oranges, and potassium three times that of bananas, three times the iron of spinach, four times the vitamin A in carrots, and two times the protein in milk **(Asante *et al*., 2014).** Studies have attributed the medicinal benefits of *M. oleifera* to its anti-inflammatory, antioxidant, and antipathogenic constituents. Also, the strong antioxidant and scavenging ability of *M. oleifera* has been linked to chemoprevention of diseases like cancer **(Atawodi *et al.,* 2010).**

Chia (*Salvia hispanica*) is native from southern Mexico and northern Guatemala. Along with corn, beans and amaranth, chia was a core component in the diet of many pre-Colombian civilizations in America, including the Mayan and Aztec populations; its seeds were valued as oil source for medicinal use. Nowadays, chia is commercially grown in Mexico، Bolivia, Argentina, Ecuador and Guatemala **(Martínez-Cruz & Paredes-López, 2014)**.

Most of the species from genus *Salvia* have homeopathic and horticultural importance as a source of many useful natural constituents, including terpenes and flavonoids. The high diversity of secondary metabolites like phenolic compounds isolated from *Salvia* plants possess excellent antimicrobial activity, as well as antioxidant capacity and some are used against a number of pathological disturbances, such as atherosclerosis, brain dysfunction, and cancer **(Cvetkovikj *et al.,* 2013).**

In Mexico, chia seeds are currently used for their nutritional and medicinal properties, i.e., endurance for athletes, appetite suppressor, weight loss agent, blood glucose control, and intestinal regulation. Recently, it has been reported the potential use of chia seeds as a good source of proteins with a remarkable thermal stability **(Sandoval-Oliveros & Paredes-López, 2013)**. Additionally, chia has been an important raw material to obtain functional foods due to its special characteristics, such as the high content of fatty acids; it offers advantages over other available omega 3 fatty acid sources. Chia seeds have been used successfully to increase the omega 3 fatty acid content of animal products like eggs، poultry, rabbit, and also as an ingredient of bread and other bakery products **(Borneo *et al*., 2010).**

## Materials and Methods:

### Materials:

Moringa leaves and chia seeds were obtained dry from herb shop in Cairo, Egypt.

### Chemicals:

Alloxan obtained from El-Gomhoria Company, Cairo. Egypt.

### Animals:

Thirty (30) adult male Sprague Dawley rats, average body weight (150±10 g) were used in this study. Rats were obtained from Research Institute of Ophthalmology, Medical Analysis Department, Giza, Egypt.

**Methods:**

**Basal diet composition of tested rats**:

The basal diet in the experiment consisted of casein (12%), corn oil (10%), mineral mixture (4%), vitamin mixture (1%), cellulose (5%), chorine chloride (0.2%), methionine (0.3%) and the remained is corn starch (67.5%) according to **AIN (1993)**.

**Preparation of materials**:

All materials were milled to soft powder by using electric grinder and kept in dusky stoppered glass bottles in a cool and dry location till use according to **Russo (2001)**.

**Induced diabetic for rats:**

Rats were injected by Alloxan at 150 mg /kg body weight (3times in three days) to induce male diabetic for rats. After 7 days of injection serum glucose was determined. Rats with about 200 mg/dl considered diabetic **(NDDG 1994).**

**Experimental design and animal groups:**

Rats were housed in wire cages under the normal laboratory condition, and were fed on basal diet for a week as an adaptation period. The rats were divided into 5 groups each of 6 rats. All groups of rats were housed in wire cages at room temperature 25 $C^0$. Rats were divided into the following groups:

**Group (1):** Control negative group (-), in which normal rats were fed on basal diet.

**Group (2):** Control positive group (+), in which diabetic rats were fed on basal diet.

**Group (3):** Diabetic rats fed on moringa leaves 5% diet.

**Group (4):** Diabetic rats fed on chia seeds 5% diet.

**Group (5):** Diabetic rats fed on diet mixture of both 5%.

**Determination of Biochemical Blood Parameters:**

Blood samples were collected after 12 hours fasting at the end of experiment using the abdominal aorta. The rats were scarified under ether anaesthesia. Blood samples were received into in clean dry centrifuge tubes, in which blood was left to clot at room temperature, and then centrifuged for 10 minutes at 3000 r.p.m to separate the serum. Serum was carefully aspirated and transferred into clean cuvette tubes and stored frozen at-20$^oC$ for biochemical analysis as described by **Schermer, (1967)**. All blood samples were analyzed for determination the following parameters:

Hemoglobin, Hematocrit, Red Blood Cells, Platelets, White Blood Cells, Neutrophils, Lymphocytes, Monocytes, Eosinophils and Basophils.

The organs (liver, kidney, heart, lungs and spleen) were removed, washed in saline solution, wiped by filter paper and weighted. Liver and kidney stored in formalin solution 10% for histological testing according to method mentioned by **(Drury and Wallington, 1980).**

**Statistical Analysis:**

The data were statistically analyzed using a computerized Costat Program by one way ANOVA using a Completely Randomized Factorial Design **(SAS, 1988)** when a significant mean effect was detected, the means were separated with the Duncan's Multiple Range Test. Differences between treatments at $P \leq 0.05$ were considered significant. The results are presented as mean ± SD.

**Results and Discussion:**

Data presented in table (1) show the effect of moringa leaves, chia seeds and mixture of both on organs weight of diabetic rats. It could be observed that the mean value of liver weight of control (+) group was higher than control (-) group, being 8.5±0.29 and 6.8±0.01 g respectively. The best liver weight was showed for groups 5 (rats fed on basal diet containing 5% mixture of both) when compared to control (+) group .

It could be observed that the mean value of heart weight of control (+) group was higher than control (-) group, being 1.41±0.022 and 0.64±0.009 g respectively. The best heart weight showed for group 5 (rats fed on basal diet + 5% mixture of both tested plants) when compared to control (+) group .

The same table indicated that the mean value of lungs weight of control (+) group was higher than control (-) group, being 1.51±0.009 and 0.82±0.001 g respectively. The best lungs weight showed for group 5 (rats fed on basal diet containing 5% mixture of both) when compared to control (+) group .

Also, data of table (1) illustrated that the mean value of spleen weight of control (+) group was higher than control (-) group, being 0.90±0.009 and 0.65±0.006 g respectively. The best spleen weight was shown for group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

It could be noticed that the mean value of kidneys weight of control (+) group was higher than control (-) group, being 2.2±0.05 and 1.6±0.08 g respectively. The best kidneys weight showed for group 5 (rats fed on basal diet + 5% mixture of both suggested immune booster plants) when compared to control (+) group.

**El-bakry *et al.*, (2016)** Found that administration of *Moringa oleifera* leaves extract decreased liver weight in rats were injected with $CCl_4$ when compared to control (+) group.

**Table (1): Effect of moringa leaves, chia seeds and mixture of both on organs weight (g) of diabetic rats**

| Parameters / Groups | Liver (g) Mean ±SD | Heart (g) Mean ±SD | Lungs (g) Mean ±SD | Spleen (g) Mean ±SD | Kidneys (g) Mean ±SD |
|---|---|---|---|---|---|
| **G1:** Control – ve | $6.8^{c}$±0.01 | $0.64^{d}$± 0.009 | $0.82^{c}$± 0.001 | $0.65^{b}$± 0.006 | $1.6^{c}$±0.08 |
| **G2:** Control+ve | $8.5^{a}$± 0.29 | $1.41^{a}$± 0.022 | $1.51^{a}$± 0.009 | $0.90^{a}$± 0.009 | $2.2^{a}$±0.05 |
| **G3:** Moringa leaves (5%) | $7.5^{b}$± 0.05 | $0.71^{b}$± 0.003 | $0.95^{b}$± 0.024 | $0.64^{b}$± 0.003 | $1.71^{b}$± 0.009 |
| **G4:** Chia seeds (5%) | $7.4^{b}$± 0.09 | $0.68^{c}$± 0.006 | $0.83^{c}$± 0.007 | $0.62^{c}$± 0.006 | $1.65^{bc}$± 0.004 |
| **G5:** mixture of both (5%) | $7.2^{b}$± 0.08 | $0.65^{d}$± 0.001 | $0.82^{c}$± 0.032 | $0.60^{d}$± 0.002 | $1.62^{bc}$± 0.001 |
| **LSD** | 0.26 | 0.02 | 0.034 | 0.01 | 0.08 |

Values of same letters in the same column indicate nonsignificant difference at ($p \leq 0.5$).

Data presented in table (2) show the effect of moringa leaves, chia seeds and mixture of both on Hb, Ht, RBC, PLt and WBC of diabetic rats.

It could be observed that the mean value of (Hb) of control (-) group was higher than control (+) group, being 19.9±0.36 and 11.2± 0.009 g/dl respectively. The best Hb concentration was shown for group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

It could be showed that the mean value of (Ht) of control (-) group was higher than control (+) group, being 56±1.22 and 33.8±1.16% respectively. The best Ht was shown for group 5 (rats fed on basal diet containing 5% mixture of both) when compared to control (+) group.

The same table indicated that the mean value of (RBC) of control (-) group was higher than control (+) group, being 4.9±0.01 and 2.9±0.05

($10^{6}/\mu L$) respectively. The best RBC was shown for group 5 (rats fed on basal diet containing 5% mixture of both) when compared to control (+) group.

Also, data of table (2) observed that the mean value of (Plt) of control (+) group was higher than control (-) group, being 692±5.14 and 397±6.85 ($10^{3}/\mu L$) respectively. The best Plt was shown for group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

It could be noticed that the mean value of (WBC) of control (-) group was higher than control (+) group, being 11±0.25 and 7.2±0.09 ($10^3$/µL) respectively. Group 5 (rats fed on basal diet +5% mixture of both) recorded the best result as compared to control (+) group.

**Ibrahim *et al*., (2014)** found that moringa seeds increased hemoglobin concentration and mean corpuscular hemoglobin concentration ($P < 0.05$). Also, increased Ht, RBC & WBC ($P < 0.05$) when compared with control (+) group in growing rabbits.

**Table (2): Effect of moringa leaves, chia seeds and mixture of both on Hb, Ht, RBC, PLt and WBC of diabetic rats**

| Parameters / Groups | Hb (g/dl) Mean ±SD | Ht (%) Mean ±SD | RBC ($10^6$/µL) Mean ±SD | PLt ($10^3$/µL) Mean ±SD | WBC ($10^3$/µL) Mean ±SD |
|---|---|---|---|---|---|
| **G1:** Control –ve | $19.9^{a}$±0.36 | $56^{a}$±1.22 | $4.9^{a}$±0.01 | $397^{d}$±6.85 | $11^{a}$±0.25 |
| **G2:** Control+ve | $11.2^{e}$± 0.009 | $33.8^{c}$±1.16 | $2.9^{c}$±0.05 | $692^{a}$±5.14 | $7.2^{d}$±0.09 |
| **G3:** Moringa leaves (5%) | $17.2^{d}$±0.007 | $49.9^{b}$± 1.42 | $4.5^{b}$± 0.09 | $435^{c}$±4.28 | $8.4^{c}$±0.06 |
| **G4:** chia seeds (5%) | $17.6^{c}$± 0.001 | $51.1^{b}$± 1.86 | $4.6^{b}$± 0.08 | $420^{b}$±3.76 | $8.5^{c}$±0.08 |
| **G5:** mixture of both (5%) | $18.7^{b}$± 0.004 | $54.3^{a}$± 1.48 | $4.8^{a}$± 0.07 | $398^{d}$±6.67 | $10.4^{b}$±0.01 |
| **LSD** | 0.29 | 2.64 | 0.12 | 9.97 | 0.23 |

Values of same letters in the same column indicate nonsignificant difference at ($p \leq 0.5$).

Data presented in table (3) illustrate the effect of moringa leaves, chia seeds and mixture of both on Neutrophils, Lymphocytes, Monocytes, Eosinophils and Basophils ($10^9$/L) of diabetic rats.

It could be noticed that the mean value of (Neutrophils) of control (-) group was higher than control (+) group, being 4.6±0.06 and 3.03± 0.001 respectively. The best Neutrophils was shown for group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

It could be observed that the mean value of (Lymphocytes) of control (-) group was higher than control (+) group, being 5.10±0.009 and 3.34±0.002 respectively. The best Lymphocytes was shown for group 5 (rats fed on basal diet containing 5% mixture of both) when compared to control (+) group.

The same table revealed that the mean value of (Monocytes) of control (-) group was higher than control (+) group, being 1.05±0.001and 0.68±0.009 respectively. The best Monocytes was shown for group 5 (rats fed on basal diet +5% mixture of both) when compared to control (+) group.

Also, data of table (3) observed that the mean value of (Eosinophils) of control (-) group was higher than control (+) group, being 0.15±0.001 and 0.10±0.009 respectively. The best Eosinophils was shown for group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

It could be noticed that the mean value of (Basophils) of control (-) group was higher than control (+) group, being 0.07±0.002 and 0.04±0.001 respectively. Group 5 (rats fed on basal diet +5% mixture of both) recorded the best result as compared to control (+) group.

**Auwal *et al*., (2013)** found that aqueous seed extract of *Moringa oleifera* induced significant increase in neutrophils, lymphocytes, monocytes, eosinophils and basophils in albino rats.

**Table (3): Effect of moringa leaves, chia seeds and mixture of them on Neutrophils, Lymphocytes, Monocytes, Eosinophils and Basophils ($10^9$/L) of diabetic rats**

| Parameters / Groups | Neutrophils Mean ± SD | Lymphocytes Mean ± SD | Monocytes Mean ± SD | Eosinophils Mean ± SD | Basophils Mean ± SD |
|---|---|---|---|---|---|
| **G1:** Control – ve | $4.6^{a}$± 0.06 | $5.10^{a}$± 0.009 | $1.05^{a}$± 0.001 | $0.15^{a}$± 0.001 | $0.07^{a}$± 0.002 |
| **G2:** Control+ve | $3.03^{d}$± 0.001 | $3.34^{e}$± 0.002 | $0.68^{e}$± 0.009 | $0.10^{c}$± 0.009 | $0.04^{c}$± 0.001 |
| **G3:** Moringa leaves (5%) | $3.54^{c}$± 0.005 | $3.90^{d}$± 0.008 | $0.80^{d}$± 0.007 | $0.12^{b}$± 0.003 | $0.05^{bc}$± 0.009 |
| **G4:** chia seeds (5%) | $3.58^{c}$± 0.008 | $4.64^{c}$± 0.007 | $0.81^{c}$± 0.002 | $0.12^{b}$± 0.005 | $0.05^{bc}$± 0.003 |
| **G5:** mixture of all 5% | $4.38^{b}$± 0.003 | $4.83^{b}$± 0.005 | $0.95^{b}$± 0.004 | $0.15^{a}$± 0.008 | $0.06^{b}$± 0.005 |
| **LSD** | 0.049 | 0.012 | 0.009 | 0.011 | 0.008 |

Values of same letters in the same column indicate nonsignificant difference at ($p \leq 0.5$).

**Histopathological changes of liver:**

Microscopically section of liver from healthy group 1 (control "-") revealed the normal histological structure of hepatic lobule (Photo 1). Meanwhile section of liver from diabetic group 2 (control"+") showed vacuolar degeneration of hepatocytes and fibro plasia in portal triad (Photo 2 A) as well as inflammatory cells infiltration in the portal triad (Photo 2 B). liver sections of rat from moringa diet group 3 was showing slight hydropic degeneration hepatocytes, associated with slight inflammatory cells infiltration (Photos 3 A, 3 B). Livers of rats from shea group 4 showed slight hydropic degeneration of hepatocytes (Photo 4A), and slight congestion of hepatoportal blood vessel (Photo 4B). liver sections of rat from mix diet group 5 revealed only slight hydropic degeneration of hepatocytes and slight activation of Kupffer cells (Photo 5A and 5B).

**Fernández-Martínez *et al.*, (2019)** found that the dyslipidemic, nonalcoholic steatohepatitis (NASH) and combined injury groups fed on chia seeds exhibit lower accumulation of lipids, no necrosis or progression to microvesicular steatosis exists in rats.

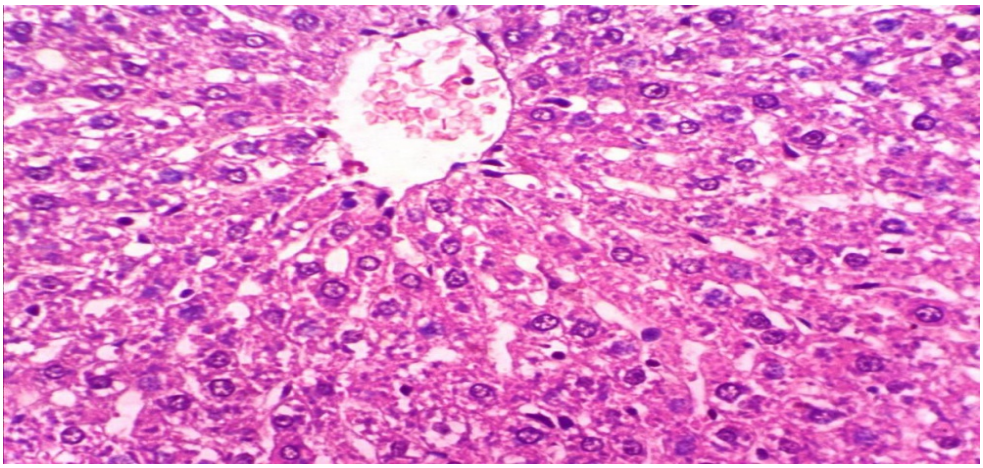

**Photo (1): Liver of rat from healthy group 1(control "-") showing the normal histological structure of hepatic lobule (H & E X 400).**

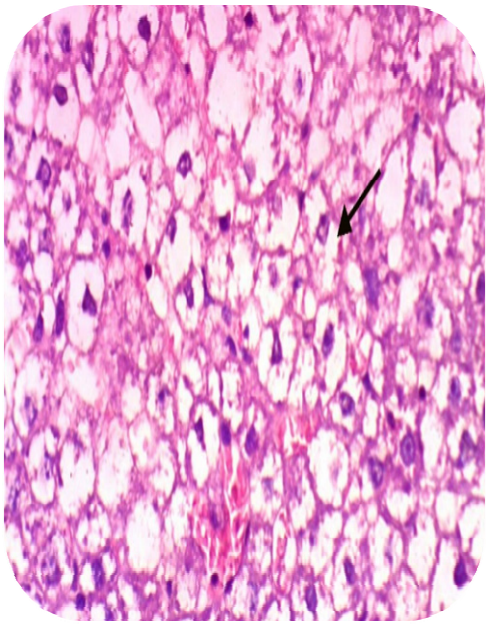

Photo (2 A): Liver of rat from diabetic group 2 (control"+") showing vacuolar degeneration of hepatocytes (H & E X 400).

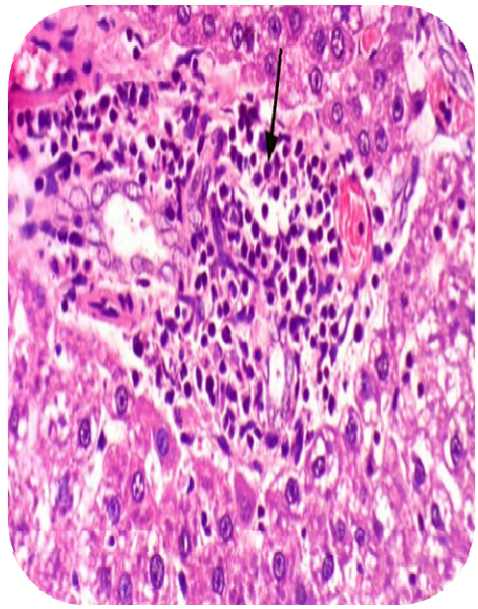

Photo (2 B): Liver of rat from diabetic group 2 (control"+") showing vacuolar degeneration of hepatocytes and inflammatory cells infiltration in the portal triad (H & E X 400).

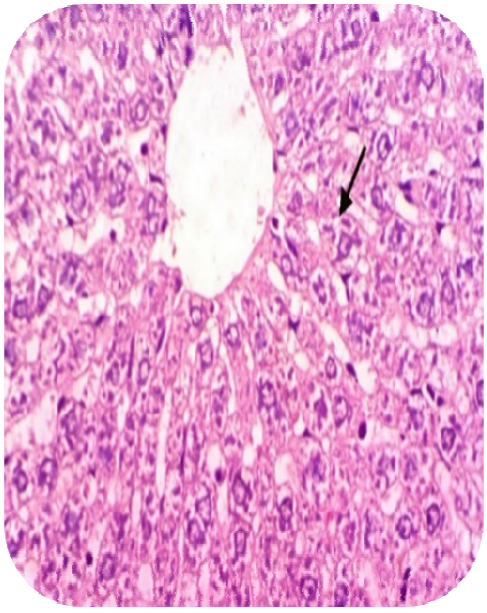

Photo (3 A): Liver of rat from moringa diet group 3 showing slight hydropic degeneration of hepatocytes (H & E X 400).

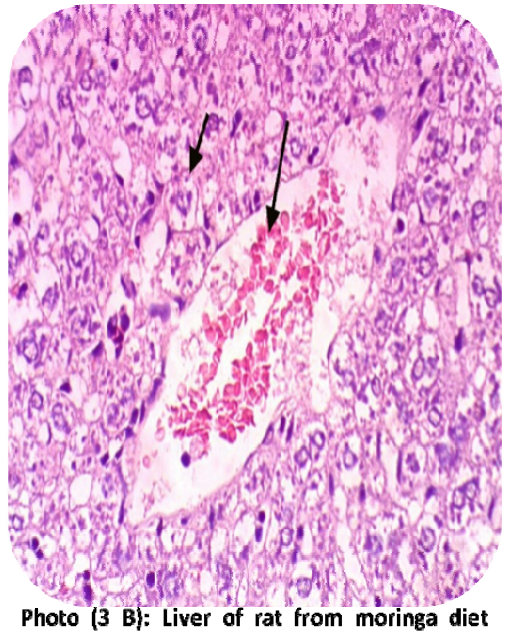

Photo (3 B): Liver of rat from moringa diet group 3 showing slight hydropic degeneration of hepatocytes and slight congestion of central vein (H & E X 400).

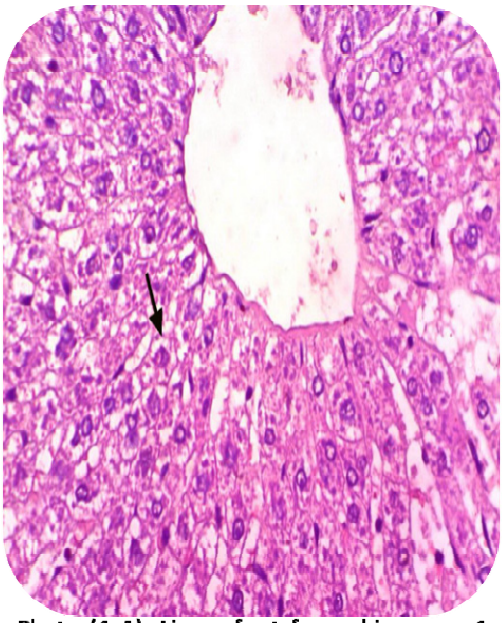

Photo (4 A): Liver of rat from chia group 4 showing slight hydropic degeneration of hepatocytes (H & E X 400).

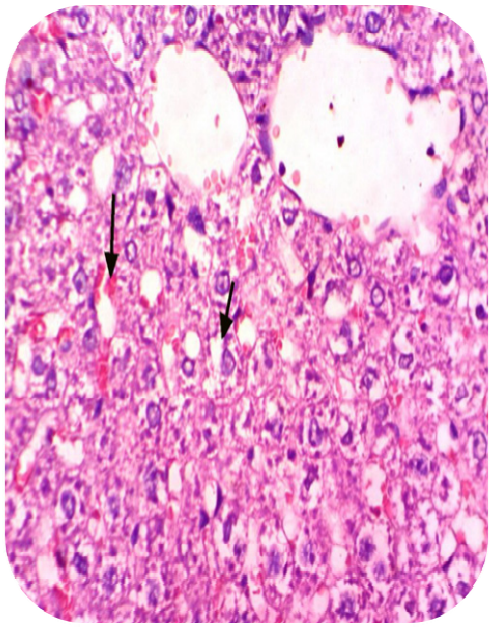

Photo (4 B): Liver of rat from chia group 4 showing slight hydropic degeneration of hepatocytes and slight congestion of hepatic sinusoids (H & E X 400).

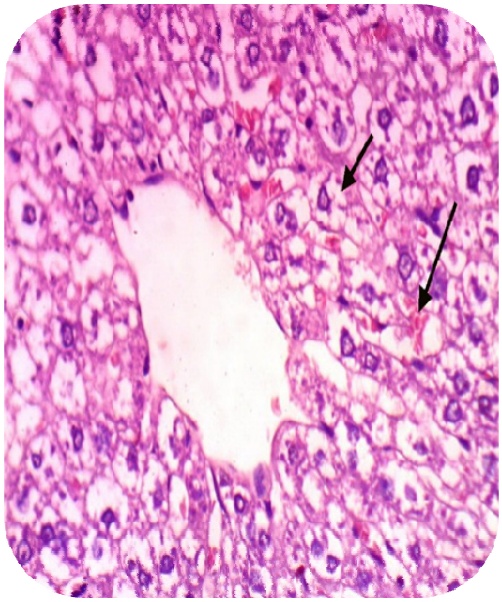

Photo (5 A): Liver of rat from mix diet group 5 showing hydropic degeneration of hepatocytes and slight congestion of hepatic sinusoids (H & E X 400).

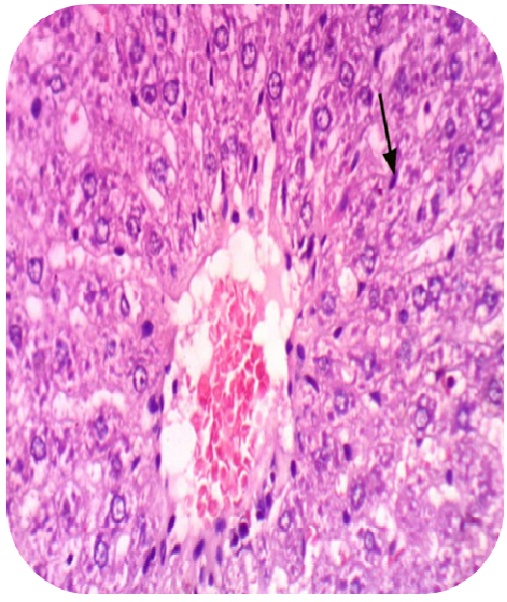

Photo (5 B): Liver of rat from mix diet group 5 showing slight activation of Kupffer cells (H & E X 400).

**Histopathological changes of kidneys:**

Photomicrograph of rat kidney from healthy group 1 (control "-") showing the normal histological structure of normal parenchyma (Photos 6A & 6B). Meanwhile kidney of diabetic group 2 (control"+") showed marked cytoplasmic vacuolization of epithelial lining renal tubules and congestion of glomerular tuft (Photos 7A & 7B). No histological alterations observed from moringa diet group 3 (Photo 8A), and slight local congestion renal blood vessel and glomerular tuft (Photo 8B). Kidney section of rat from shea group 4 showed congestion of renal blood vessel and glomerular tuft (Photo 9A), while most places revealed no histopathological alterations (Photo 9B). Rat kidney section from the mix diet group 5 showed cytoplasmic vacuolization of epithelial lining some renal tubules (Photo 10A), whilst other areas revealed no histopathological alterations (Photo 10B)

It is clear from above results that the histopathological structure of liver and kidney followed the biochemical changes due to diabetes mellitus, and moringa & chia. The mixed diet recorded greatly the original organs structure of healthy rat.

Although some improvement in the histopathological structure of liver took place due to diets containing moringa leaves and chia seeds, these changes were pronounced to indicate the noticeable restoration of original status as was found for internal organs weight and immunity blood cells, indicating that more time of feeding with suggested diets is needed. However, the case was not so for kidneys, where the suggested immune supporting diets revealed pronounced restoration of the original structure for diabetic rats kidneys, being good marked for the strengthening of immunity.

Histopathological changes of kidney while was acceptable for indicating the restoration of original structure of diabetic rats, may not be able to indicate the better diet (either moringa leaves or chia seeds). Nevertheless, internal organs weight, biochemical parameters of blood, in particular the immunity cells, besides showing the superiority of the mix diet due to synergistic action, was able to indicate that chia seeds diet revealed much more desirable action of supporting the immunity of diabetic rats.

**Al-Malki & El Rabey (2015)** showed that kidney tissue of diabetic rats which treated with a higher dose of Moringa (100 mg/kg b.w.) restored the kidneys of diabetic rats to their normal case with no histopathological changes

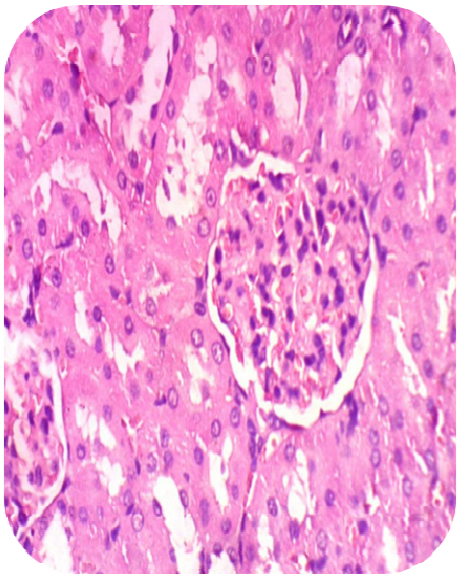

Photo (6 A): Photomicrograph of kidney of rat from healthy group 1(control "-") showing the normal histological structure of renal parenchyma (H & E X 400).

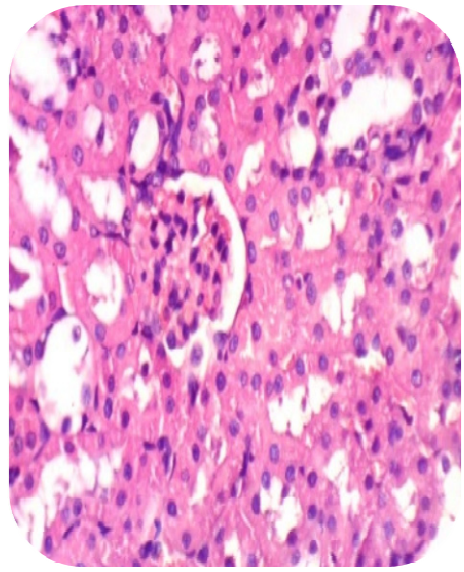

Photo (6 B): Photomicrograph of kidney of rat from healthy group 1(control "-") showing the normal histological structure of renal parenchyma (H & E X 400).

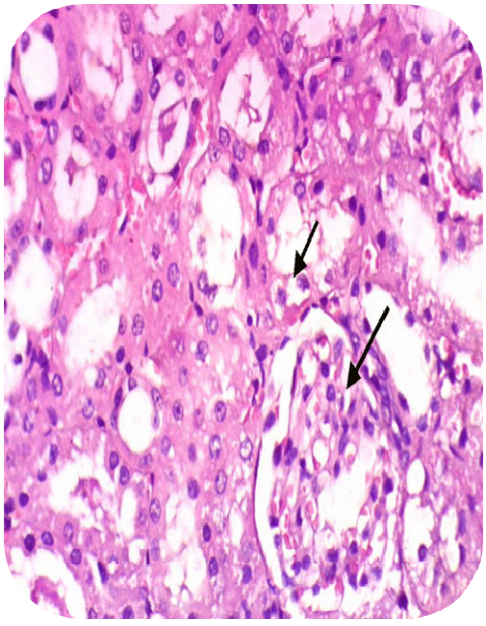

Photo (7 A): Kidney of rat from diabetic group 2 (control "+") showing marked cytoplasmic vacuolization of epithelial lining renal tubules and endothelial lining glomerular tuft (H & E X 400).

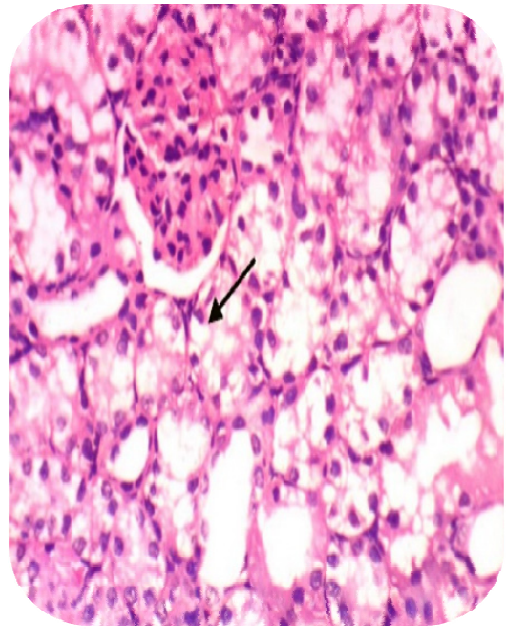

Photo (7 B): Kidney of rat from group 2 showing marked cytoplasmic vacuolization of epithelial lining renal tubules (H & E X 400).

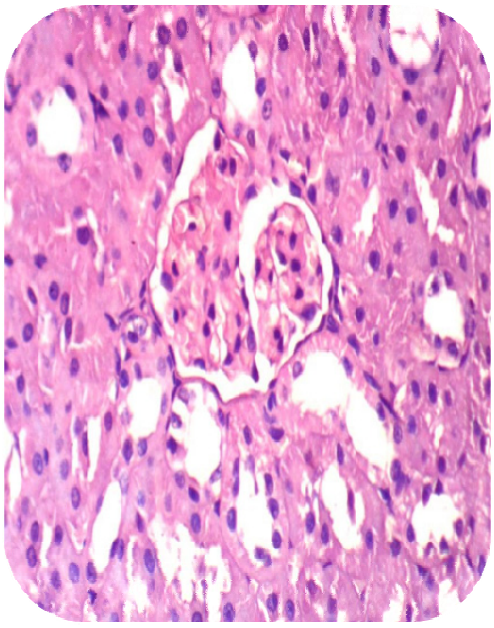

Photo (8 A): Kidney of rat from moringa group 3 showing no histopathological alterations (H & E X 400).

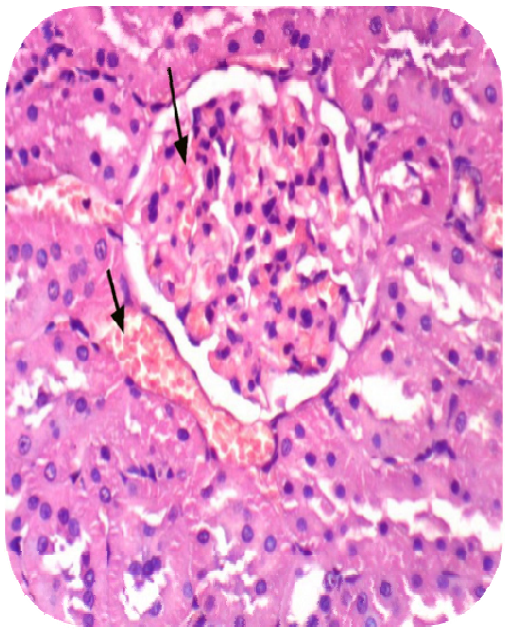

Photo (8 B): Kidney of rat from moringa group 3 showing local slight congestion of renal blood vessels and glomerular tuft (H & E X 400).

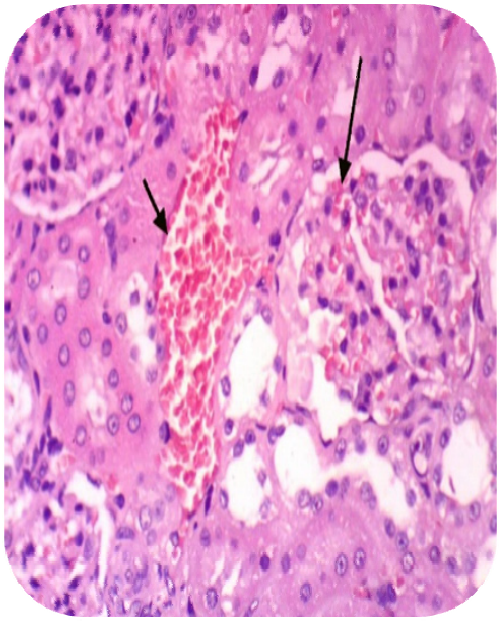

Photo (9 A): Kidney of rat from chia group 4 showing congestion of renal blood vessels and glomerular tuft (H & E X 400).

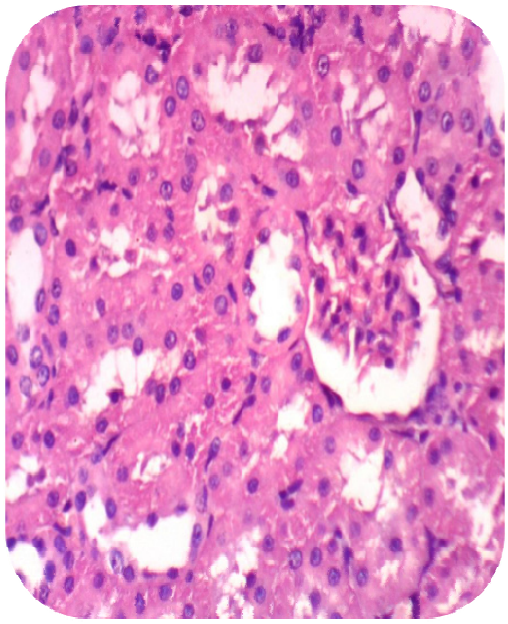

Photo (9 B): Kidney of rat from chia group 4 showing no histopathological alterations (H & E X 400).

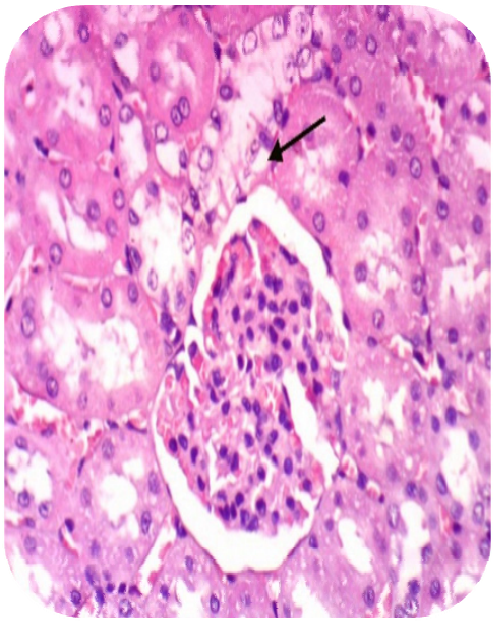

Photo (10 A): Kidney of rat from mix diet group 5 showing local cytoplasmic vacuolization of epithelial lining some renal tubules (H & E X 400).

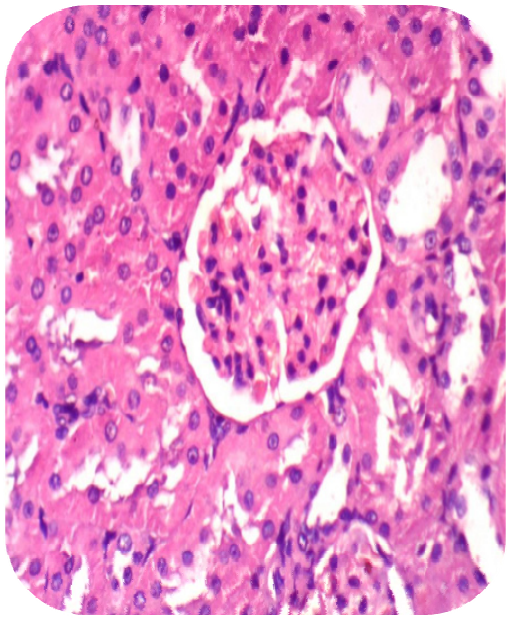

Photo (10 B): Kidney of rat from mix diet group 5 showing no histopathological alterations (H & E X 400).

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## الملخص العربى

## دراسة تأثير أوراق المورينجا وبذور الشيا على عوامل الدم والتركيب الهستولوجى للفئران البيضاء المصابة بالسكرى لتعزيز المناعة

يهدف هذا البحث إلى تقييم تأثير أوراق المورينجا وبذور الشيا والخليط منهما علي رفع مناعة ذكور الفئران المصابة بالسكر. تم تقسيم ثلاثون فأر من الذكور البالغين سبراغ داولي إلى خمس مجموعات. مجموعة (١): وهي المجموعة الضابطة السالبة (–) تغذت علـى الوجبـة الأساسـية ، المجموعـة (٢): وهـي المجموعـة الضـابطة الموجبـة (+) وهـي الفئران المصابة بالسكر وتغذت على الوجبة الأساسية. المجموعة (٣): الفئران المصابة بالسكر التي تغذت علي اوراق المورينجا بنسبة ٥%. المجموعة (٤): الفئران المصابة بالسكر التي تغذت على بذور الشيا بنسبة ٥ %. المجموعة (٥): الفئران المصابة بالسكر التي تغذت على الاثنين معا بتركيز ٥%.. في نهاية التجربة ، بعد ٢٨ يومًا من التغذية ، تم تقدير الاختبارات البيوكيميائية للدم. الحقن بالألوكسان سبب ارتفاع الصفائح الدموية و وزن الأعضاء وانخفاض مستويات الهيموجلوبين والهيماتوكريت وكرات الدم الحمراء والبيضاء و العدلات ، الخلايا الليمفاوية ، الوحيدات ، الحمضات والخلايا القاعدية في الفئران المصابة بالسكر وتحسنت النتائج باستخدام الأغذية المعالجة مما يدل على تعزيز المناعة. ولقد تحسنت المناعة اكثر عند استخدام بذور الشيا بالمقارنة بأوراق المورينجا – مع ملاحظة ان الغذاء الخليط كان هو الأفضل مما يشير إلى وجود تأثير معزز عند استخدام كلا المصدريين النباتيين فى الغذاء.

**الكلمات المفتاحية :** مرض السكرى – اوراق المورينجا – بذور الشيا.