

Effect of Ajwa and Dried Date (*Phoenix dactylifera*) on Male Albino Rats Affected by High Oxidative Stress

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Abstract

This study was carried out to determine the effect of mature dried date powder and ajwa powder on males of white rats weighing 150-200 g. Rats were divided into six groups (one for control "-" group) and one control (+) group inflicted with oxidation stress. Also, inflicted rats were fed on the basal diet with aiwa powdered (5%,10%) and two groups with dried date powders (5%,10%) daily. Oxidation stress of male rats caused by KBrO₃ (125 mg/kg body weight, intraperitoneally). At the end of the experiment (28 days) body weight gain (BWG), feed intake (FI) and feed efficiency ratio (FER) calculated and the blood samples were taken from ventricular vein to serum separate for biochemical analysis. Slaughtering carried out for rats after 12 hours of fasting under anesthesia. Blood samples were taken in dry tubes and left to coagulate at room temperature, then centrifuged for 10 min at 3000 rpm to separate the serum. The serum was aspirated carefully in clean cuvette tubes. Serum samples were kept for analysis until in the freezer at - 20°C. The biological parameters calculated included (BWG, FI & FER). Kidneys function evaluated by determining creatinine, urea & uric acid. Lipids profile of serum also evaluated. Liver function parameters included (AST, ALT, ALP). The best results of the study to compact oxidation stress recorded for groups treated with the dried palm date 10%. While oxidation stress mean ajwa date powder 5% showed also marked amelioration of oxidation stress and reduced its side effects.

Keywords: Palm date, ajwa, dried date, oxidation stress, rats.

Introduction

Need for identifying alternative natural and safe sources of food antioxidants has been created, and the search for natural antioxidants, especially of plant origin, has notably increased in recent years. The date palm is largely grown in arid and semiarid regions of the world (Lourenço *et al.*, 2019 ; Anwar *et al.*, 2018). 'Tree of Life' by the Arabs, and considered as one of the oldest cultivated fruit trees, indigenous to the countries around the Arabian Gulf. Different parts of this plant are traditionally claimed to be used for the treatment of a broad spectrum of ailments including memory disturbances, fever, loss of consciousness and nervous disorders. *Phoenix dactylifera* (date palm) is the major fruit of gulf region. In folk medicine; dates have been traditionally used as hypoglycaemic, expectorant, tonic, aphrodisiac, antidiarrheic and mouth hygiene (Ghnimi *et al.*, 2017). The date fruit (*Phoenix dactylifera*) is known since the ancient times as a nutrient and also as a traditional remedy. Besides its economic value, the nutritive values are pronounced. A literature search reverted that especially raw date fruit is superior to many other fruits by its nutritive value. Its value in medicine is not just because of its relatively low glycemic index and high fiber content, there are clinical trials demonstrating its antioxidant features and usefulness to decrease postpartum bleeding (Rekha *et al.*, 2017). The incidence of drug resistance against microbial pathogens is increasing significantly worldwide. Bacterial resistance against antimicrobial agents is one of the major difficulties in treatment. The present mode of treatment of bacterial infection/disease is based on antibiotics, which is expensive and also causes adverse side effects. Natural products and their constituents is good approach in the control of infection as they are inexpensive, effective without side effects. *Phoenix dactylifera* and its constituents play a significant effect in the prevention or treatment of bacterial diseases (Ahmed *et al.*, 2016). Examine the impacts of palm date powder (ajwa and dried date) on the biological, biochemical and histopathological changes of male albino rats inflicted with oxidation stress. Other side effects of these diseases such as renal dysfunction and lipids disorders will be considered.

Materials and Methods

Used plants and thier preparation:

- Ajwa (*Phoenix dactylifera* L.).
- Dried palm date(*Phoenix dactylifera*.).

Palm date (Siwi variety) product cleaned thoroughly by washing. Then wet clean dates were minced and sun dried.

Experimental animals:

Since raised oxidation in rats closely resembles that of human, albino rats are recommended to be used for atherosclerosis research (Leong *et al.*,

2015). In this concern fourty two male adult albino rats weighing (120 ± 10 g) each, (3 months old) 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 for one week on basal diet prior to start feeding on experimental diets for acclimatization.

Animal, had accessed to diets and water ad libitum. Feeds and water checked daily and rats weighed weekly.

Experimental design:

After the period of acclimatization rats were assigned to six groups (7 rats in each group):

The first group (7 rats): Rats of group1 fed on the basal diet (control -ve). On the contrary, in other five groups (35 rats) the oxidation stress was raised by intramuscular injection with potassium bromate ($KBrO_3$) (125 mg/kg body weight, intraperitoneally) for 3 weeks.

Group 2 (7 Rats): Raised oxidation stress (Rose) rats were fed on the basal diet only (as control +ve).

Group 3 (7 rats): Rats fed on diet with (5%) ajwa powder.

Group 4 (7 rats): Rats fed on diet with (10%) ajwa powder.

Group 5 (7 rats): Rats fed on diet with (5%) dried date powder.

Group 6 (7 rats): Rats fed on diet with (10%) dried date powder.

5. RESULTS AND DISCUSSION

Feeding on a diet that contains potasum bromate for three weeks raised oxidation level in rats. This group were maintained for four weeks on diet supplemented with some palm date producta such as jwa and dried date.

Control (+ve) (raised oxidation group) and control (-ve) group chealtly rats, both were fed on the basel diet.

Clinical Manifestation:

The rats groups which contains boromate potasum diet for three weeks at the beging of the experiment to raise oxidation and free radicals showed less activity, some loss of hair, decrease of appetite, light dullness of eyes and death, however, for very few rats. The treatment of raised oxidation rats with palm date diets improved the clinical signs, and rats started to be of apparent health with increased activity.

Nutrition Results:

A-Biological changes

1-Weight gain, feed intake and feed efficiency ratio:

Feeding merit and growth performance in terms of feed intake, body weight gain and feed efficiency ratio of (-ve), (+ve) and raised oxidation rats treated with palm date diets are presented in table (1) and which show the effects of Ajwa and dried date. **Figs. (1- a, b, c)**

BWG (\pm SD) in case of control (-ve) was relative high group ($1.10\pm$

0.024g), while for control (+ve) group (0.5g) was lower (1.08 ± 0.017 g), the decrease was significant, showing about 116% change compared to control (+ve) group.

Feed intake (FI) of control (-ve) group was (14.2 ± 1.789 g) while in control (+ve) was (10.9 ± 0.005 g). This decrease in feed intake of control (+ve) group as compared to control (-ve) was significant.

BWG increased significantly compared to control (+) group, when rats fed on ajwa, dried date diets 5 or 10%.

Feed efficiency ratios also significantly increased in comparison with the control (+) group when rats fed on diets containing Ajwa and dried date

Highest BWG recorded for dried date 10% group. Also highest FI & FER was found for dried date 10% diet which feeding of stress oxidation rate with dried palm date 10% diet caused really restorage of the original values recorded for control (-ve) healthy rats.

It may be concluded that oxidation stress by barum bromate lowered the appetite of rats, leading to loss in BWG and FER, while the reverse occurred, especially when feeding dried palm date diet.

This may be a result of palm date antioxidant compounds (*Ragab et al., 2013*).

Table (1): Effect of Ajwa and Dried palm date on feed intake (FI), body weight gain (BWG) and feed efficiency ratio (FER).

Parameters Groups	FI (g/day)	BWG (g/day)	FER
	Mean \pm SD	Mean \pm SD	Mean \pm SD
C (-)	14.2 ^a \pm 0.003	1.10 ^a \pm 0.024	0.078 ^a \pm 0.0009
C (+)	10.9 ^f \pm 0.005	0.51 ^e \pm 0.017	0.047 ^e \pm 0.0003
Ajwa (5%)	11.5 ^e \pm 0.025	0.64 ^d \pm 0.003	0.056 ^d \pm 0.0015
Ajwa (10%)	13.0 ^d \pm 0.101	0.83 ^c \pm 0.057	0.064 ^c \pm 0.0024
Dried Palm Date (5%)	13.5 ^c \pm 0.009	0.95 ^b \pm 0.034	0.070 ^b \pm 0.0001
Dried Palm Date (10%)	14.0 ^b \pm 0.25	1.06 ^a \pm 0.001	0.076 ^a \pm 0.0002
LSD	0.197	0.0528	0.0022

Values different letters in some column are significantly different ($P \leq 0.05$).

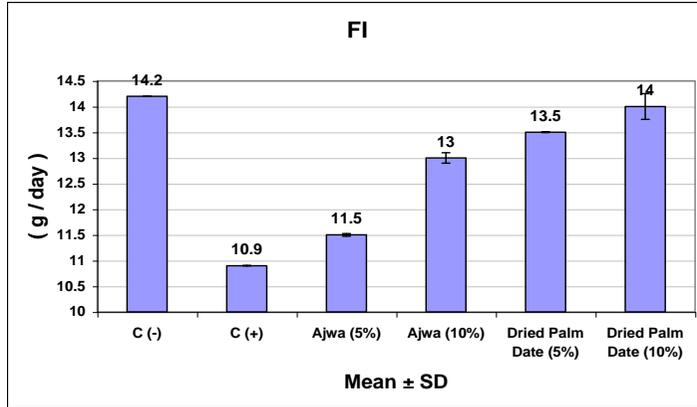


Fig. (1-a) Effect of agwa and Dried palm data on feed intake (FI) of rats with raised oxidation stress

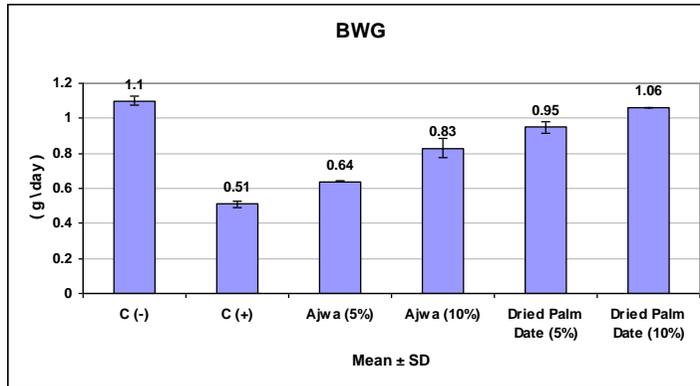


Fig. (1-b) Effect of agwa and Dried palm data on feed intake (BWG) of rats with raised oxidation stress

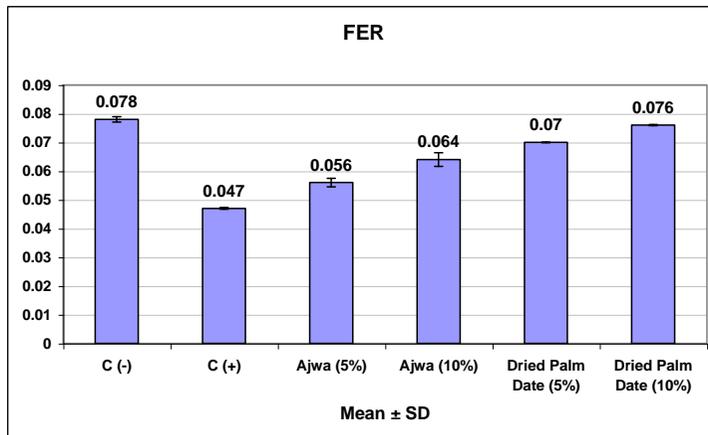


Fig. (1-c) Effect of agwa and Dried palm data on feed intake (FER) of rats with raised oxidation stress

2- Organs weight:

Table (2) and figures (a, b, c) presents the mean values of different organs weights of control and **raised oxidation** rats treated with two palm date products (Agwa & Dried palm date).

The mean values of different organs weight of dried date (5%, 10%) treated groups were significantly lower than control (-ve) group. Control (+ve) group indicated inflammation and increase of weights compared to control (-ve).

In most organs dried palm date diet lowered the internal organs weight, even to less value needed for the control (-ve) rats.

It means that dried date (10%) treatment was the best showing maximum correction of internal organs due to oxidation stress atrophy, normal rats. On the other hand ajwa (5%) was showing pronounced healing of internal organs inflammation, although complete correction was not achieved.

Kiran (2018) showed palm dates are rich in antioxidants, being excellent anti-inflammatory agent this was also reported by *Thalhok et al., (2007)* and *Rahmani et al., (2013)* working on diabetes rats.

The decrease of internal organs weight to less than that of healthy rats, may possibly indicate that control (ve-) rats initially had even small level of oxidation.

Table (2): Effect of Ajwa and Dried palm date on internal organs weight of rate with raised oxidation stress.

Parameters Groups	Liver (g)	Heart (g)	Lungs (g)	Spleen (g)	Kidneys (g)
	Mean±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
C (-)	3.5 ^d ±0.015	0.73 ^d ±0.009	0.80 ^d ±0.017	0.5 ^e ±0.039	1.0 ^d ±0.017
C(+)	4.9 ^a ±0.001	1.20 ^a ±0.02	1.40 ^a ±0.05	0.9 ^a ±0.016	1.8 ^a ±0.009
Ajwa (5%)	3.9 ^b ±0.009	0.87 ^b ±0.001	1.0 ^b ±0.009	0.8 ^b ±0.006	1.2 ^b ±0.002
Ajwa (10%)	3.6 ^c ±0.006	0.80 ^c ±0.005	0.9 ^c ±0.005	0.7 ^c ±0.011	1.1 ^c ±0.004
Dried Palm Date (5%)	3.3 ^e ±0.003	0.74 ^d ±0.004	0.8 ^d ±0.003	0.6 ^d ±0.005	1.0 ^d ±0.025
Dried Palm Date (10%)	3.1 ^f ±0.025	0.71 ^e ±0.011	0.7 ^e ±0.025	0.5 ^e ±0.002	0.9 ^e ±0.011
LSD	0.023	0.018	0.043	0.0322	0.024

Values different letters in some column are significantly different ($P \leq 0.05$).

The changes of weight of liver, heart, spleen, lungs and kidney of raised oxidation stress rats agreed with results of *Durrington (2003)* for all internal organs. **Raised oxidation** stress showing more weights, is indicating to some possible inflammation, or decreased atrophy.

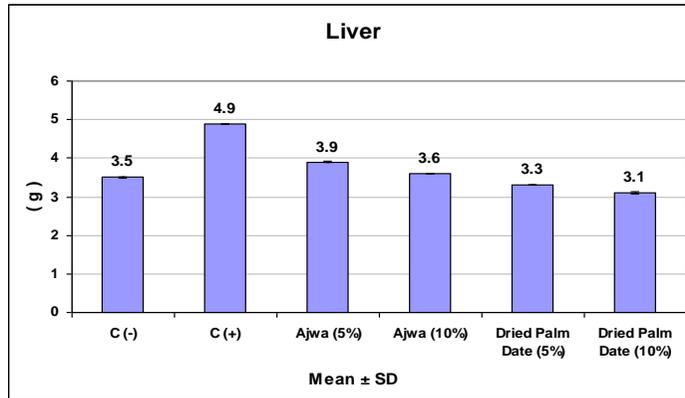


Fig. (2-a) Effect of agwa and Dried palm data on feed intake (Liver) of rats with raised oxidation stress

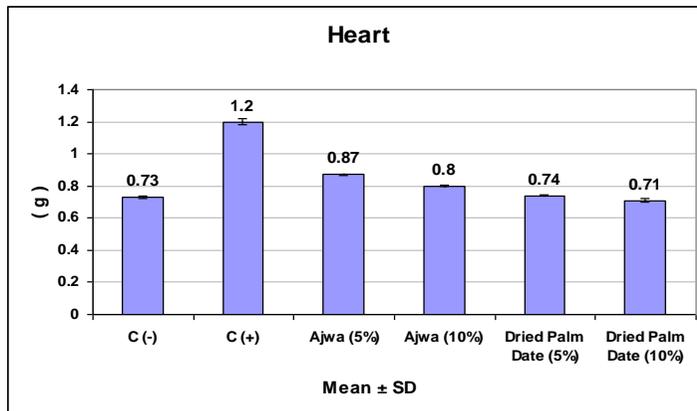


Fig. (2-b) Effect of agwa and Dried palm data on feed intake (Heart) of rats with raised oxidation stress

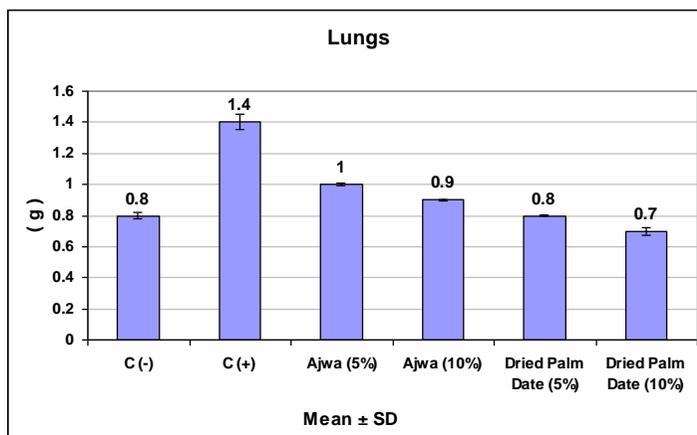


Fig. (2-c) effect of agwa and Dried palm data on feed intake (Lungs) of rats with raised oxidation stress

Results of histopathological examination:

Microscopic examination of liver sections of control rats showed normal central veins, portal areas and hepatic cells (**Photo 1**). The kidney sections of those control rats showed normal histological structure of the renal glomeruli and renal tubules (**Photo 2**).

While microscopic examination of different sections livers and kidneys of control positive rats showed marked histological alterations

Livers sections of control positive rats showed severe congestion of the central veins and portal vessels with severe swelling, granular and vacuolar degeneration and necrosis of the hepatic cells (**Photo 3**). Those hepatocellular necrobiotic changes were particularly observed in the pericentral areas as well as widely spread (**Photo 4**). The kidney tissue of those control positive rats showed severe congestion of the interstitial blood vessels, widespread inter-tubular hemorrhages and various necrobiotic changes in the renal tubular epithelial cells (**Photo 5**). A widespread vacuolar degeneration and necrosis of the tubular epithelial linings was observed with marked presence of granular renal casts in the lumens of most of the tubules with presence of cast in the glomerul Bowman's' space (**Photo 6**). The glomeruli showed congestion of their capillaries and thickening of the parietal layer of Bowman's' capsule (**Photo 7**). Focal mononuclear inflammatory cells infiltration was observed in some areas.

Regarding the treated groups, it was observed that the treatment with Agwa & dried palm date 5% & 5% for confral (+) group showed more restorative effect on both hepatic and renal tissues than that noticed.

Regarding livers of control positive rats and treated with Agwa 5%, the examination of which showed regression of the congestion status and mild restoration of the hepatic parenchyma with appearance of some degree of vacuolar degeneration and scattered necrosis of the hepatic cells (**Photo 8**). The kidneys of control positive rats and treated with Agwa 5% showed mild necrobiotic changes of the renal tubular epithelium and mild renal cast in the lumen of some tubules with mild glomerular changes (**Photo 9**).

While, livers of control positive rats and treated with Agwa 10% showed moderate degree of restoration of the hepatic parenchymal cells particularly in the pericentral areas with mild vacuolar degeneration and scattered necrotic cells (**Photo 10**). Kidneys of control positive rats and treated with Agwa 10% showed good restoration of the renal parenchyma with only mild degeneration and necrosis of some tubular epithelial linings as well as mild hypercellularity of the glomerular tuft (**Photo 11**). Livers of control positive rats that treated with dried palm data 5% or 10% showed widespread mild vacuolation and necrosis of the hepatic cells with a good restoration (**Photo 12**). While kidney of control positive rats and treated with dried palm data 5% or 10% showed

mild degenerative and necrotic changes in the tubular epithelial linings with few renal casts in some tubular lumens (**Photo 13**), with a good degree of restoration of the renal tubular epithelium (**Photo 14**).

Finally feeding on agwa and specially on dired palm date indicated better restoration of the original histological structure possibly due to antioxidant effect, which was in line with biological & biochemical analyses.

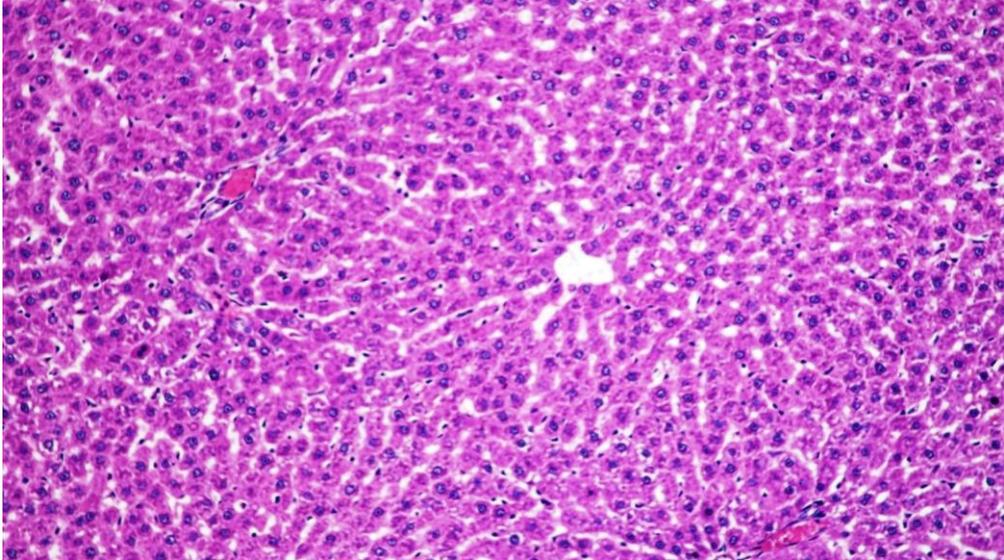


Photo 1: Liver of control rat showing normal central vein (C), portal area (arrow) and hepatic cells (dashed arrow).

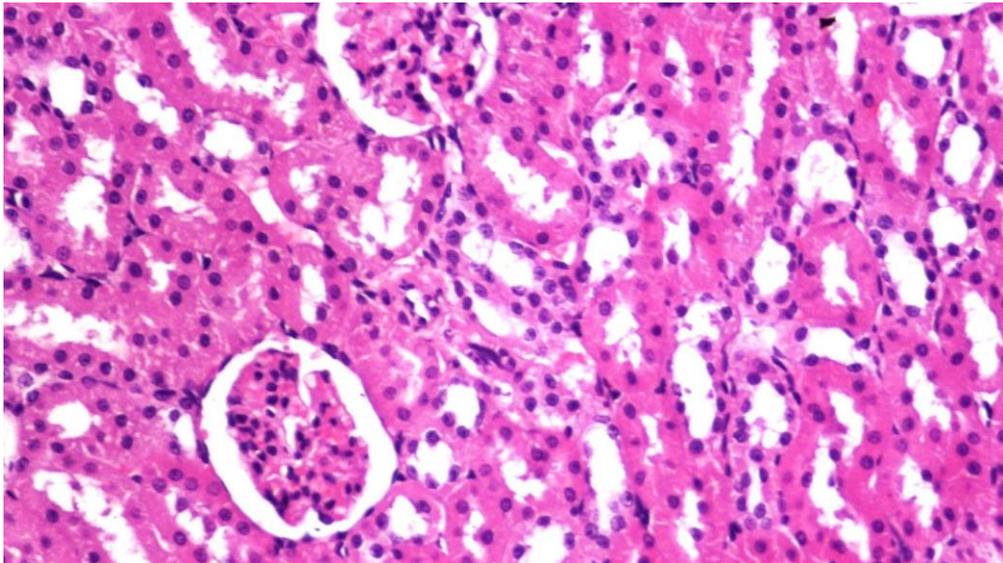


Photo 2: Kidney of control rat showing normal histological structure of the renal glomeruli (G) and renal tubules (T).

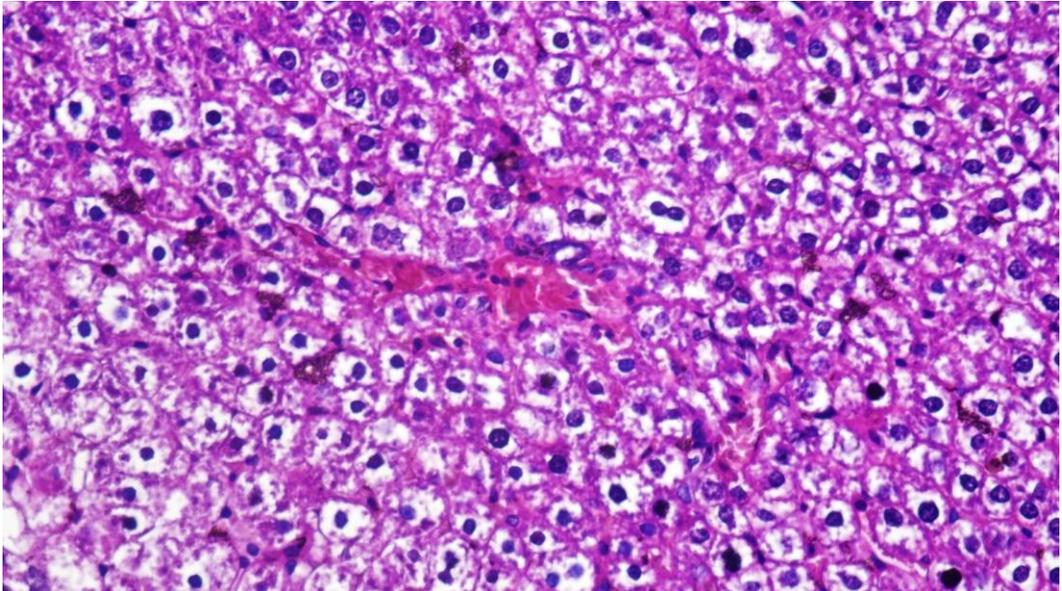


Photo 3: Liver of control positive rat showing congestion (CO) of the portal vessels and severe swelling, vacuolar degeneration (arrow) and necrosis (dashed arrow) of the hepatic cells.

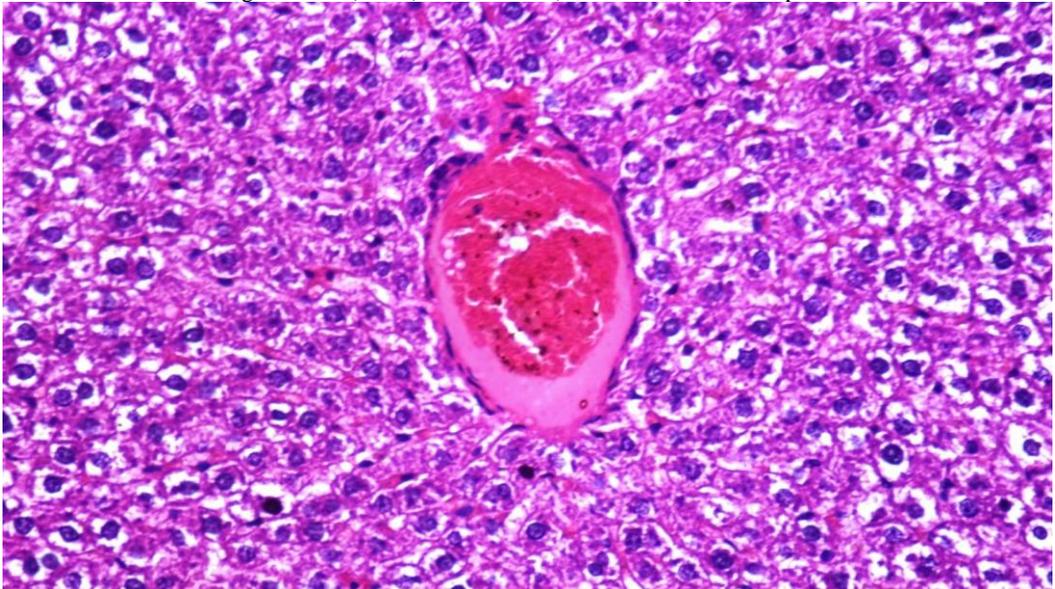


Photo 4: Liver of control positive rat showing congestion (CO) of the central vein and hepatocellular necrosis (arrow) and vacuolation (dashed arrow), particularly in the pericentral area.

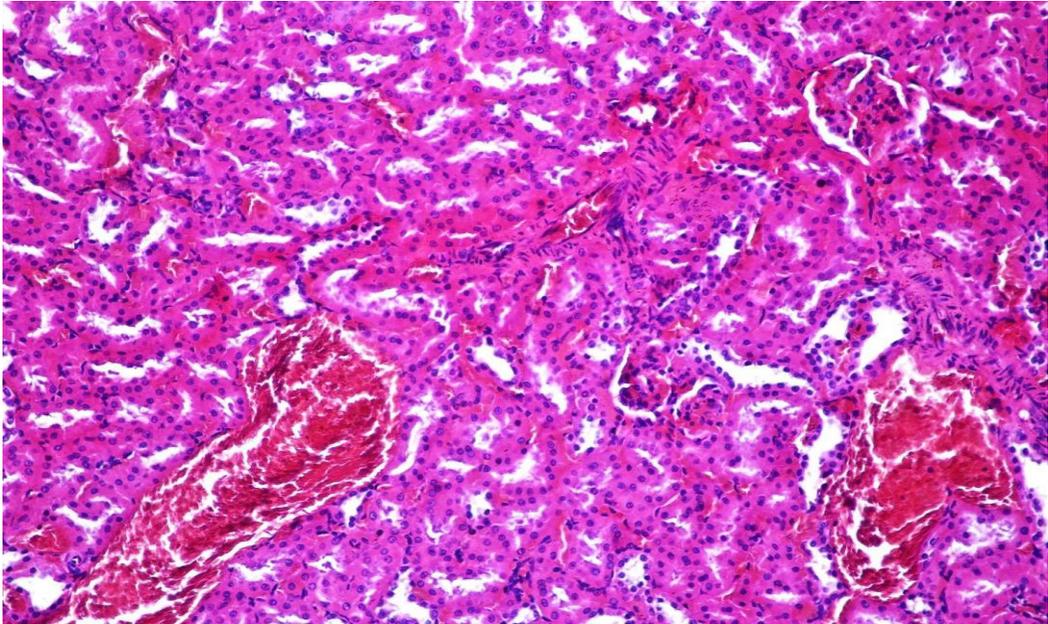


Photo 5: Kidney of control positive rat showing severe congestion of the interstitial blood vessels (CO), widespread inter-tubular hemorrhages (arrow) and necrobiotic changes in the renal tubular epithelium.

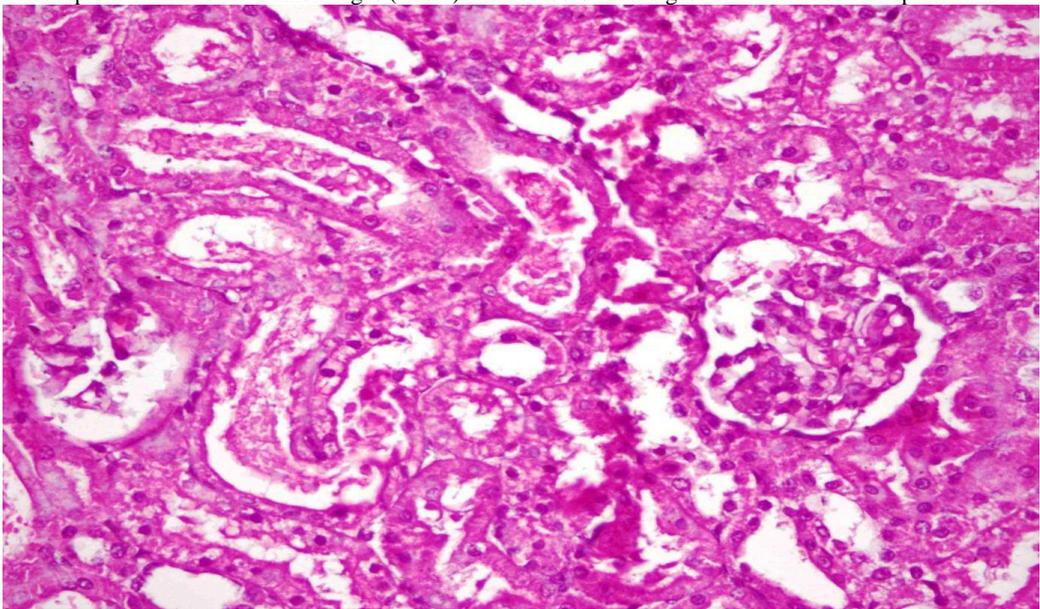


Photo 6: Kidney of control positive rat showing vacuolar degeneration (short arrow) and necrosis (dashed arrow) of the tubular epithelial linings, presence of granular renal casts (arrow) in the tubular lumens, congestion of Capillaries with presence of cast in the glomerul Bowman's space (arrow head).

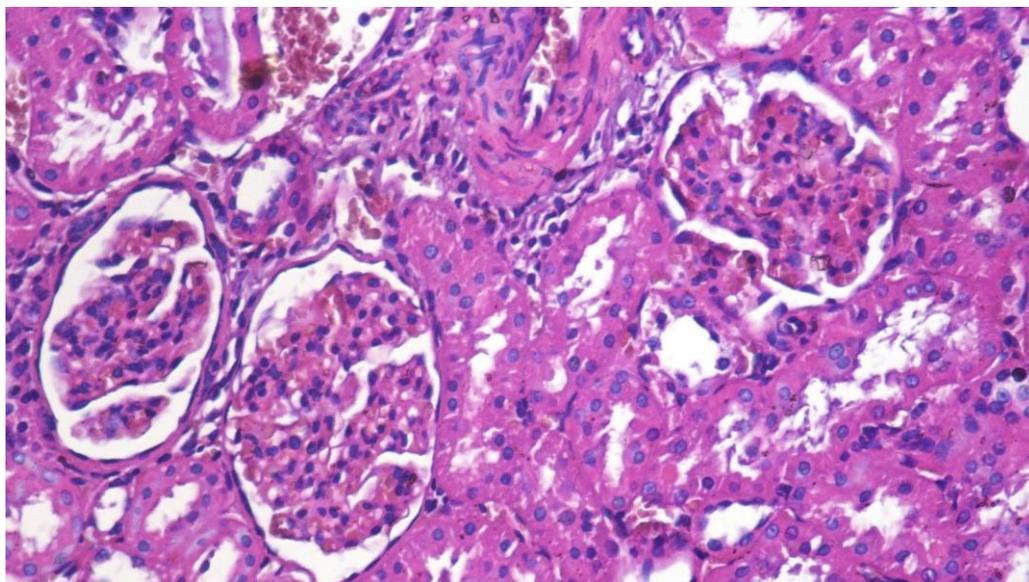


Photo 7: Kidney of control positive rat showing congestion of the glomerular capillaries (arrow), thickening of the parietal layer of Bowmans' capsule (dashed arrow), mononuclear interstitial inflammatory cells infiltration (short arrow).

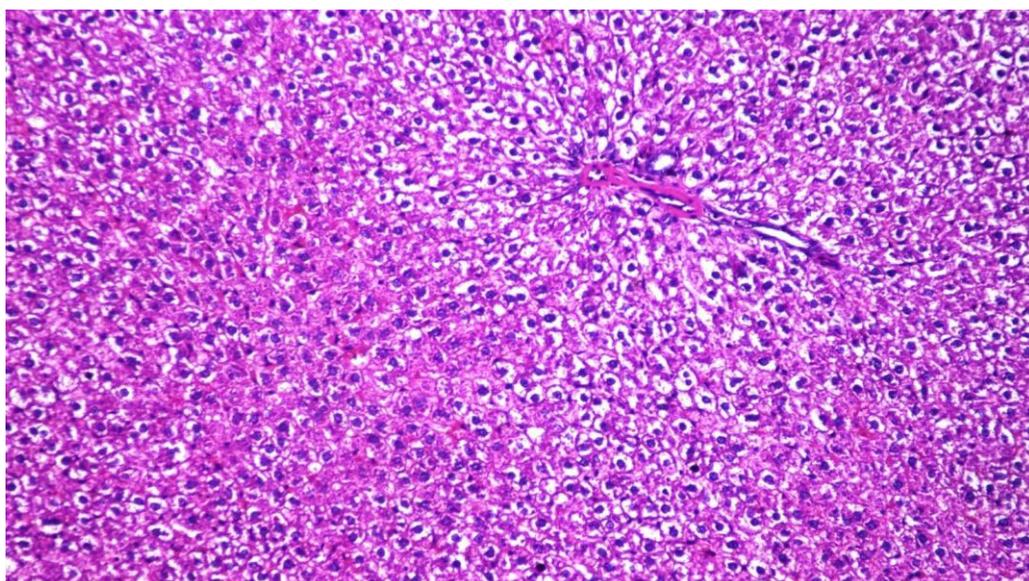


Photo 8: Liver of control positive rat and treated with drug 1 showing regression of the congestion status and mild restoration of the hepatic parenchyma, notice the vacuolar degeneration (arrow) and scattered necrosis (dashed arrow) of the hepatic cells

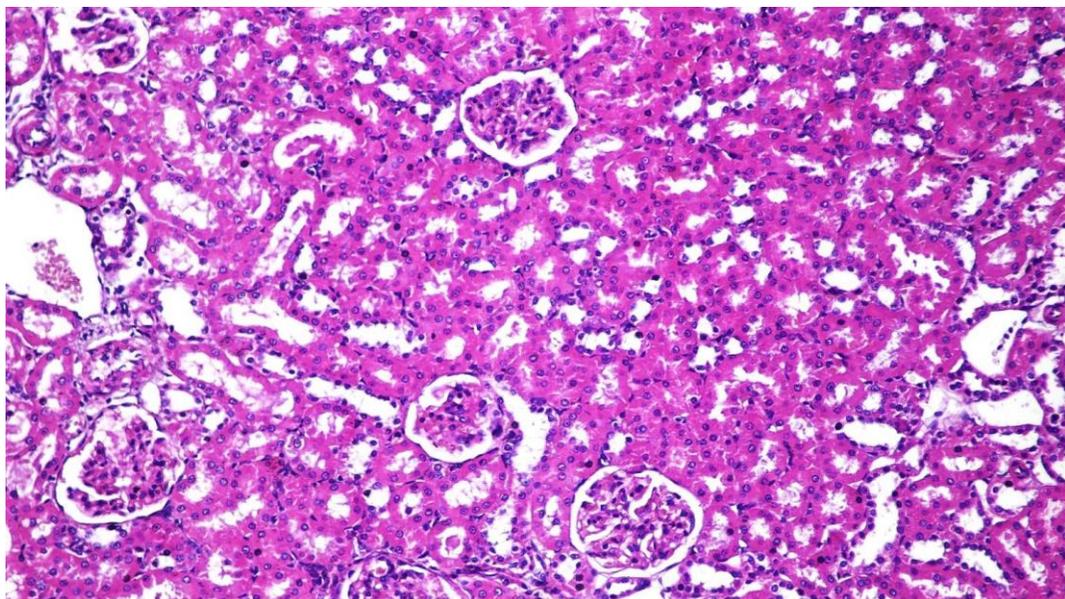


Photo 9: Kidney of control positive rat and treated with drug 1 showing mild necrobiotic changes, mild renal cast (arrow) in the lumen of some tubules with mild glomerular changes.

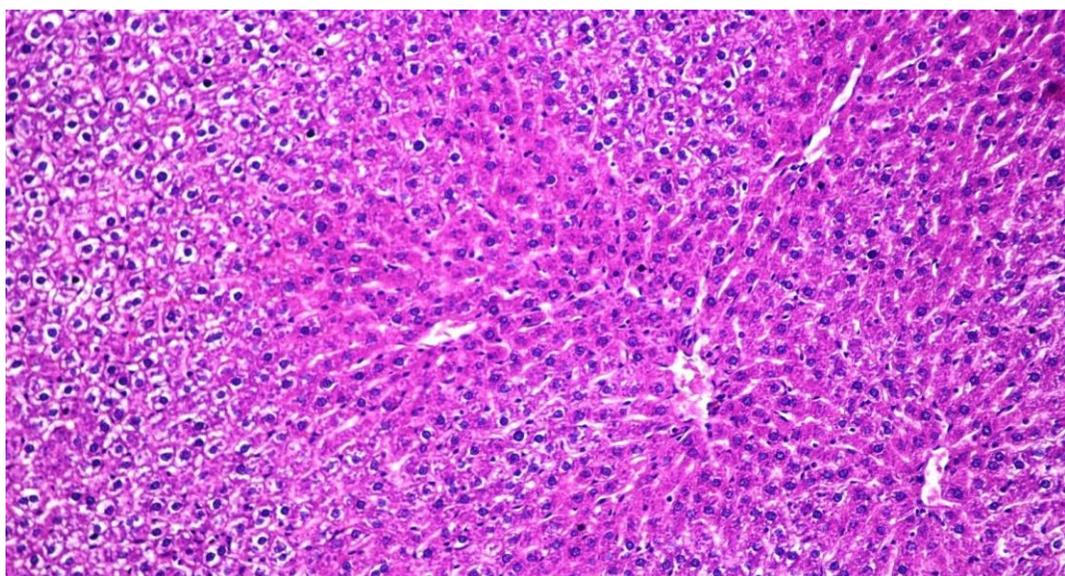


Photo 10: Liver of control positive rat and treated with drug 2 showing moderate degree of restoration of the hepatic parenchymal cells particularly in the peri central areas with mild vacuolar degeneration (arrow) and scattered necrotic cells (dashed arrow).

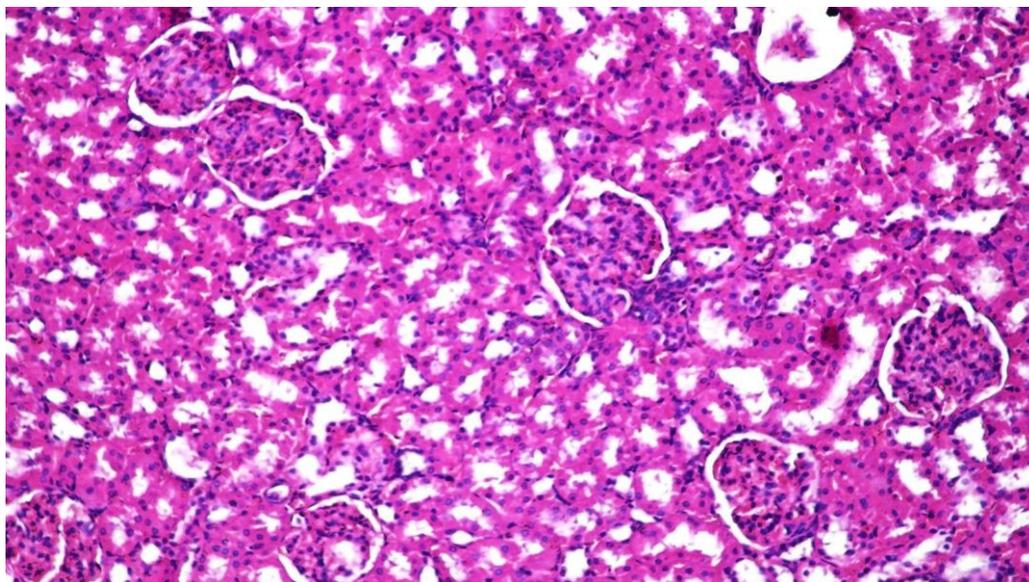


Photo 11: Kidney of control positive rat and treated with drug 2 showing good restoration of the renal parenchyma with only mild degeneration and necrosis (dashed arrow) of some tubular epithelial linings as well as mild hypercellularity (arrow) of the glomerular tuft.

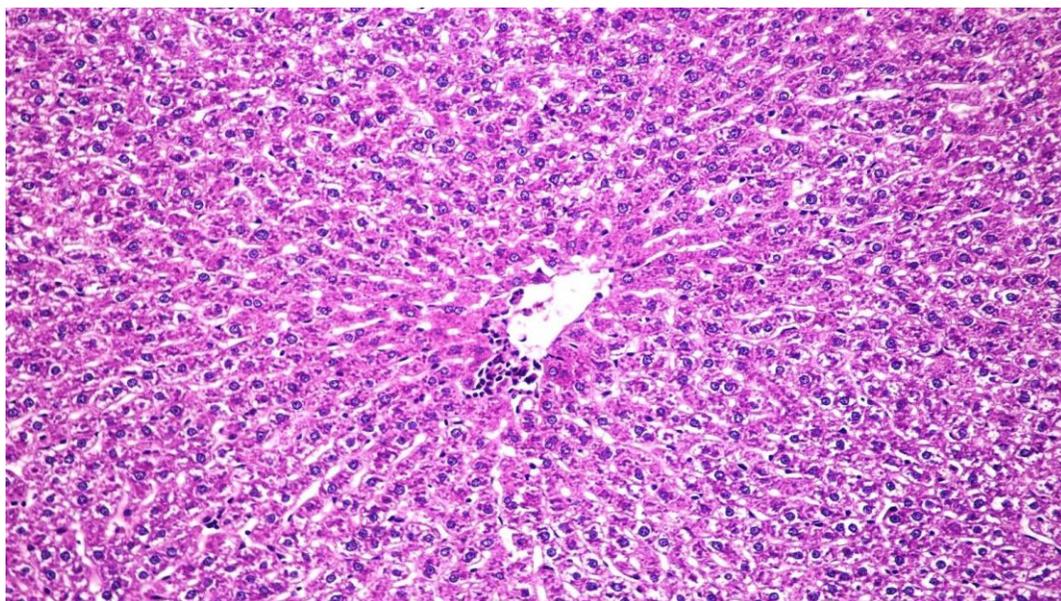


Photo 12: Liver of control positive rat and treated with drug 3 showing widespread mild vacuolation (arrow) and necrosis (dashed arrow) of the hepatic cells with a good restoration.

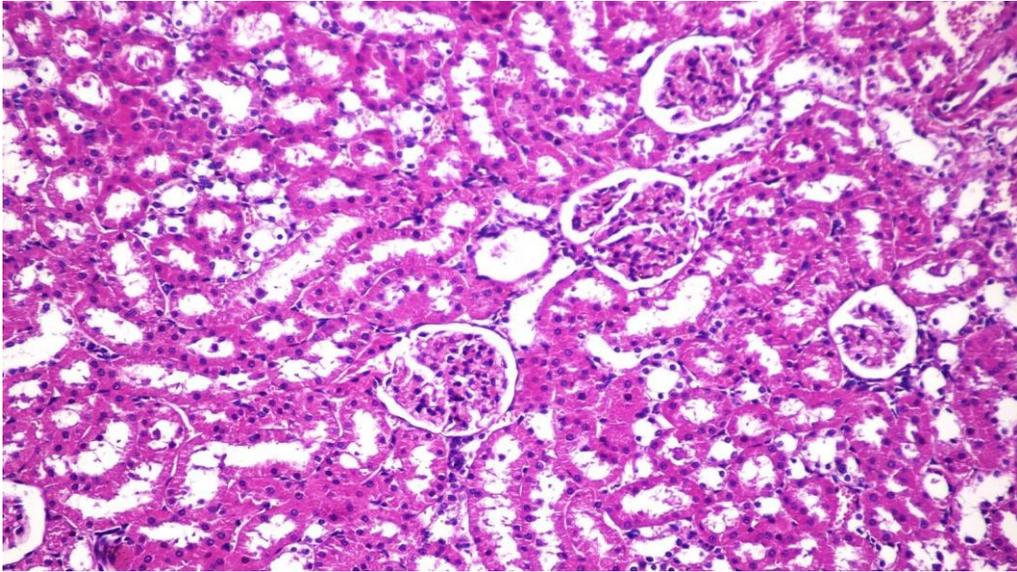


Photo 13: Kidney of control positive rat and treated with drug 3 showing mild degenerative (arrow) and necrotic (dashed arrow) changes in the tubular epithelial linings with few renal casts in some tubular

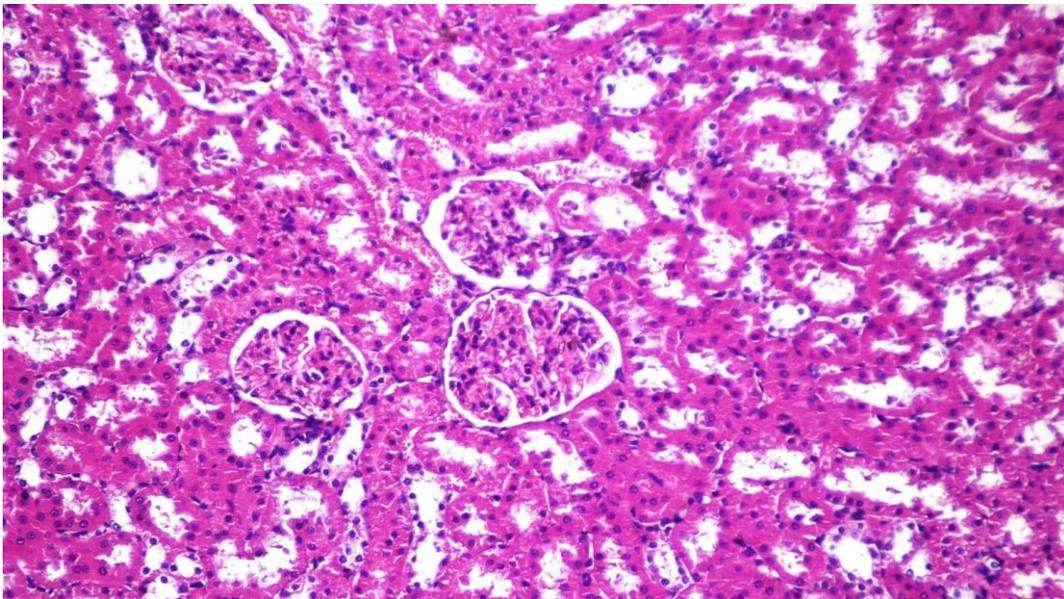


Photo 14: Kidney of control positive rat and treated with drug 3 showing good degree of restoration of the renal tubular epithelium with mild necrobiotic changes (arrow)

References

- Ahmed, A., Bano, N., and Tayyab, M. (2016).** Phytochemical and therapeutic evaluation of date (*Phoenix dactylifera*). A review. *J Pharm Altern Med*, 9, 11-17.
- Al-Alawi, R. A., Al-Mashiqri, J. H., Al-Nadabi, J. S., Al-Shihi, B. I., and Baqi, Y. (2017).** Date palm tree (*Phoenix dactylifera* L.): natural products and therapeutic options. *Frontiers in plant science*, 8, 845.
- Bancroft, D.; Steven, A.; and Tunner, R. (1996):** Theory and practices of Histological Techniques, 4th Ed. Churchill Livingstone, Edinburg, London, Melbourne .
- Ghnimi, S., Umer, S., Karim, A., and Kamal-Eldin, A. (2017).** Date fruit (*Phoenix dactylifera* L.): An underutilized food seeking industrial valorization. *NFS journal*, 6, 1-10
- Kiran Patil (2018):** 13 Proven Health Benefits of Dates. See more at: <https://izoguern.com/2019/10/05/13-benefits-of-dates/?q=2019%2F10%2F05%2F13-benefits-of-dates%2F&v=fbe46383db39>.
- Leong, X. F., Ng, C. Y., and Jaarin, K. (2015).** Animal models in cardiovascular research: hypertension and atherosclerosis. *BioMed research international*, 2015.
- Lourenço, S. C., Moldão-Martins, M., and Alves, V. D. (2019).** Antioxidants of natural plant origins: From sources to food industry applications. *Molecules*, 24(22), 4132.
- Ragab, A. R.; Elkablawy, M. A.; Sheik, B. Y. and Baraka, H. N. (2013):** Antioxidant and tissue-protective studies on Ajwa extract: Dates from Al Madinah Al-Monwarah, Saudia Arabia. *J. Environ. Anal. Toxicol.*, 3:2161–0525.
- Rahmani, A. H.; Alzohairy, M.; Babiker, A. A. Y.; Khan, A. A.; Aly, S. M. and Rizvi, M. A. (2013)** Implication of androgen receptor in urinary bladder cancer: A critical mini review. *Int. J. Mol. Epidemiol. Genet.*, 4:150–155.
- Rekha, V. R., Sunil, S., and Rathy, R. (2017).** Evaluation of oxidative stress markers in oral lichen planus. *Journal of oral and maxillofacial pathology: JOMFP*, 21(3), 387.
- Talhok, R.; Karam, C.; Fostok, S.; El-Jouni, W. and Barbour, E. (2007):** Anti-inflammatory bioactivities in plant extracts. *J. Med. Food.*, 10:1–10.

تأثير العجوة والبلح المجفف على ذكور الفئران البيضاء المصابة بارتفاع الجهد التأكسدي

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ليلى عفت السيد على عامر

كلية التربية النوعية - قسم الاقتصاد المنزلى

الملخص العربي

لقد تم عمل هذه الدراسة لتحديد تأثير مسحوق البلح المجفف ومسحوق العجوة المجففة علي ذكور الفئران البيضاء التي تزن (١٥٠ ± ٢٠٠) ولقد قسمت الفئران الي ٦ مجموعات :

- ١- المجموعة الضابطة السالبة.
- ٢- المجموعة الضابطة الموجبة والتي تعرضت للإصابة بالجهد التأكسدي.

مجموعة مصابة تم اطعامها علي نظام غذائي مضاف اليه مسحوق العجوة بنسبة ٥% ومجموعة علي نسبة ١٠% ومجموعتين تم اطعامهم بمسحوق البلح المجفف بنسبة ٥% ونسبة ١٠%.

يتم اصابة الفئران بارتفاع الجهد التأكسدي عن طريق حقنهم بمادة برومات البوتاسيوم (١٢٥ ملي جرام لكل كجم من وزن الجسم) وفي نهاية التجربة التي استمرت ٢٨ يوم يتم حساب BWG, FI, FER ويتم أخذ عينات الدم من الأوردة وكذلك يتم فصل السيرم لعمل التحاليل البيوكيميائية (تم ذبح الفئران بعد مرور ١٢ ساعة صيام تحت تأثير مخدر وسحب عينات الدم في أنابيب جافة في درجة حرارة الغرفة مع اضافة مادة مانعة للتخثر) وبعد فصل السيرم يوضع في عناية في أنابيب نظيفة ويتم حفظة بالفرزير في درجة -٢٠ درجة مئوية لحين تحليلها وتشمل التحاليل (التحاليل البيولوجية (BWG, FI, FER) وكذلك تقدير وظائف الكلي بتحديد الكرياتينين واليوريا وكذلك حمض اليوريك كما يتم تقدير دهون الدم وقياس وظائف الكبد وهي AST, ALT, ALP .

وتم تسجيل أفضل النتائج للدراسة للقضاء علي الجهد التأكسدي وكانت المجموعة المعالجة بمسحوق البلح المجفف بنسبة ١٠% كما اظهرت المجموعة المعالجة لمسحوق العجوة المجففة بنسبة ٥% تحسنا ملحوظا كما قللت الآثار الجانبية للجهد التأكسدي.

الكلمات الإفتتاحية :

نخيل البلح - العجوة - البلح المجفف - جهد الأكدسة - الفئران