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Functions in Rats with Blood  
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المجلة العلمية المحكمة لدراسات وبحوث التربية النوعية

المجلد الثامن - العدد الثالث - مسلسل العدد (17) - يوليو 2022

رقم الإيداع بدار الكتب 24274 لسنة 2016

ISSN-Print: 2356-8690 ISSN-Online: 2356-8690

موقع المجلة عبر بنك المعرفة المصري <https://jsezu.journals.ekb.eg>

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## Effect of the Consumption of Some Vegetables on Oxidative Stress Biomarkers and Renal Functions in Rats with Blood Acidosis

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### **Abstract:**

The present study was conducted to evaluate the beneficial effect of eggplant, sweet green pepper and parsley powder on the biomarkers of oxidative stress and renal functions in rats with blood acidosis. Thirty healthy male albino rats were divided into five equal groups. The first group rats were fed on basal diet as a negative control. The second group rats were fed on basal diet mixed with white bread powder (15% of diet) to induced acidity as positive control. The third group rats were fed on basal diet mixed with white bread (15% of diet) and 5 % eggplant powder (EP). The fourth group rats were fed on basal diet mixed with white bread (15% of diet) and 5% green pepper powder (GP). The fifth group rats were fed on basal diet mixed with white bread (15% of diet) and 5% parsley powder (P). The rats' weight was recorded weekly for each rat during the experimental period, and gains in body weight of rat groups were calculated. Blood samples were collected for assessment of some biochemical markers of kidney functions (Urea, creatinine and uric acid), malonaldehyde (MDA) and total antioxidant capacity (TCA). pH value of the blood and stomach were determined. Results showed that all experimental groups showed varied degrees of weight lose which considered as an indicator for impaired growth compared to the negative control group. MDA levels were decreased in experimental groups when compared with the positive control group and these decrements were only significant in EP 5%. On the other hand, TAC was increased in groups of rats fed on EP 5%, GP 5% and P 5% in comparison with positive control value. Serum creatinine values were increased in trial groups, whereas serum urea was decreased in all groups when compared with positive control. Serum uric acid levels were increased in EP 5% and GP5%, on the contrary, the P 5% group showed lower uric acid level when compared with positive control. Calcium levels of trial groups showed

increments in EG 5%, P 5% and GP 5%. Blood pH levels were slightly increased only in GP 5% and P 5% groups in comparison with the positive control group. Stomach pH levels were increased only in EP 5% and decreased in GP 5% and P 5% groups in comparison with the positive control group. In conclusion, eggplant, sweet green pepper and parsley powder can be administrated in diet of rats with blood acidosis up to 5% and may improve kidney functions and used as anti-acidity agent.

**Keywords:** eggplant, sweet green pepper, parsley, stomach, kidney function, acidity.

## Introduction

The possible toxicity of synthetic antioxidants has been a major concern for consumers and the potential of plant parts to serve as antioxidants to protect against various diseases induced by free radicals has been explored (Hou *et al.*, 2003). In fact, supplementary antioxidants from natural sources such as plant parts are efficient in protection against oxidative stress. They may prompt more food manufacturers to replace synthetic antioxidants with ingredients containing natural antioxidative compounds. Therefore, natural additives have gained more attention as they are perceived as posing no health risk to the consumers (Shahidi and Wanasundara, 1995 and Shahidi and Ambigaipalan, 2015). The antioxidant protection mechanism acting against the reactions of the free radicals is made up of enzymatic and non-enzymatic elements, part of which is synthesized only in plants and the body can get them only from foods (Butnariu and Grozea, 2012).

Plants belonging to *Solanaceae* family, which have high amount of phenolic content, include eggplant (*Solanum melongena*) and pepper (*Capsicum annum*) which were considered as rich sources of phenolics with antioxidant activity (Martínez-Ispizua *et al.*, 2021). Parsley (*Petroselinum crispum*) belongs to the *Umbelliferae* family of plants. Parsley is rich in flavonoids and essential oil compounds which act as powerful antioxidants. Parsley is a diuretic that purifies the blood and accelerates the excretion of toxins (Chevallier, 1996: El Gindy *et al.*, 2017).

The protective action of vegetables has been attributed to the presence of antioxidants, and the majority of the antioxidant activity may be from compounds such as flavonoids, isoflavone, flavones, anthocyanin, catechin and isocatechin rather than from Vitamin C, E and b-carotene (**Kahkonen et al., 1999**). Also, **Kaur and Kapoor (2002)** indicated that antioxidant activity correlated significantly and positively with the total phenolics in vegetables. Natural phenolic compounds have been suggested as ideal substitutes for preservatives in food formulations due to their antioxidant and antimicrobial properties (**Acosta-Estrada et al., 2014**). In addition to scavenging free radicals, the multiple activities of antioxidants include inactivating metal catalysts by chelation, reducing hydroperoxides into stable hydroxyl derivatives (**Frankel and Finley, 2008; and Shahidi & Ambigaipalan, 2015**). Antioxidants (e.g., flavonoids, phenolic acids, tannins, vitamin C, and vitamin E), interacting synergistically with other reducing compounds and have diverse biological properties such as anti-inflammatory, anti-carcinogenic and anti-atherosclerotic effects (**Cosem et al, 2020**).

Metabolic acidosis is characterized as an abnormal state of reduced alkalinity in the blood and body tissues and can occur in a variety of medical conditions. Even a modest degree of metabolic acidosis can be harmful and can initiate a series of maladaptive responses that are not easily reversed (**Bailey, 2005**). The kidneys are vital organs essential for excretion of metabolic wastes as well as maintaining chemical homeostasis among other functions and studies have linked oxidative stress as a potential cause of different forms of renal damage and nephrotoxicity (**Samue et al., 2018**). It has been shown that increase in oxidative stress due to free radical generation is a likely result of inflammatory responses (**Himmelfarb et al., 2004 and Tomsa et al, 2019**). Therefore, the aims of the study were to examine the effect of vegetables i.e. eggplant, sweet green pepper and parsley consumption on the oxidative stress biomarkers and renal functions in rats with blood acidosis.

## Materials and methods

Fresh eggplant (*Solanum melongena*), sweet green pepper (*Capsicum annuum*) and parsley (*Petroselinum crispum*) were obtained from Cairo local market, washed with water then dried at 40°C in an oven, grounded and stored in air tight container under refrigeration.

Standard basal diet was prepared according to **Reeves et al., (1993)**. Experimental diets were prepared by mixing of eggplant, sweet green pepper and parsley powder at 5 g/100 g diet, as replacements of corn starch.

## Experimental design

Thirty male adult albino rats of Sprague Dawely strain weighing 150- 185 g were obtained, and housed in wire cages at 25° C. Rats were then divided into 5 groups (Sex rats in each group) as follow:

- Group 1: Rats were fed on basal diet as a negative control.
- Group 2: Rats were fed on basal diet mixed with white bread powder (15% of diet) to induced acidity according to (**Robertson et al., 2007**) as positive control.
- Group 3: Rats fed on basal diet mixed with white bread (15% of diet) and 5 % eggplant powder (EP).
- Group 4: Rats fed on basal diet mixed with white bread (15% of diet) and 5% green pepper powder (GP).
- Group 5: Rats fed on basal diet mixed with white bread (15% of diet) and 5% parsley powder (P).

The rats' weight was recorded weekly for each rat during the experimental period, and gains in body weight of rat groups were calculated. At the end of the experimental period (28 days), animals were lightly anesthetized with diethyl ether, and blood was collected from the hepatic portal vein. The blood samples were collected and centrifuged at 3000 rpm for 15 min to separate serum, which stored at -40° C until biochemical analysis.

### **Biochemical analysis**

The method of **Caraway (1955)** was used to determine serum uric acid, serum creatinine level was measured by the method of **Bohmer (1971)** and serum urea was determined according to **Marsch *et al.*, (1965)**. Total antioxidant capacity (TAC) and malondialdehyde (MDA) were determined in serum according to **Koracevic *et al.* (2001)** and **Sato (1979)**, respectively. Calcium content: Absorption method (serum were measured at. Calcium determination using the atomic absorption pye Unicom mod AW according to **Pearson (1970)**. pH value of the blood and stomach were determined by direct immersion of pH electrode in blood and gastric fluid at the room temperature (25 °C) using the digital pH meter model 3020 Dunmou (Jenway, Essex, UK).

### **Histopathological examination**

Specimens from lung and stomach were collected directly after scarification of animals at the end of experimental period, fixed in 10% formalin, dehydrated in ethyl alcohol, cleared in xylene and embedded in paraffin wax 4-6 thick sections were prepared and stained with hemetoxlin and eosin (**Carleton 1976**).

### **Statistical analysis**

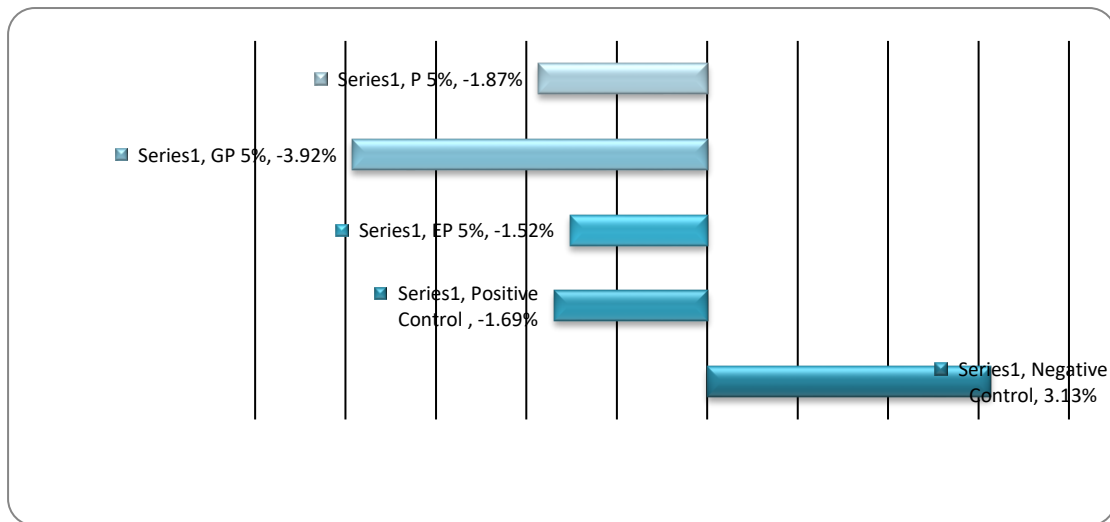
One way analysis of variance (ANOVA) was used to test the statistical significance of mean differences between groups. Least Significant Difference (LSD) test at  $P < 0.05$  was used to test the differences between means. SPSS software package (Version 16; SPSS Inc Chicago., USA) was used for all Data analysis.

#### *- Results and discussion*

### **Final weight and body weight gain**

Figure (1) illustrated that all experimental groups showed varied degrees of weight lose which considered as an indicator for impaired growth compared to the negative control group. These results were in agreements with the studies on rats which indicated that when metabolic acidosis is induced in rats they lose weight and muscle protein degradation is accelerated (**Mitch *et al.*, 1994**). Chronic metabolic acidosis increases the net protein dialysis in muscle, which might be

caused by stimulation of proteolysis (May *et al.*, 1986). Moreover, Bailey, (2005) showed that metabolic acidosis has deleterious effects, skeletal growth is impaired, muscle protein is subject to increased catabolism and amino acids undergo increased oxidation, negative nitrogen balance results, and muscle wasting occurs. However the use of selected vegetables was not efficient to enhance gain in body weight as it contains high amount of dietary fiber which considered as a tool for reducing body weight. These results are in the line with those reported by Alzergy *et al.*, (2018), Scorsatto *et al.* ,(2019), and Nwankpa *et al.* ,(2018).



**Figure (1):** Percentage of body weight gain in rats groups fed basal diet or acidic diet with examined vegetables.

### **Serum MDA, TAC, creatinine, urea, uric acid and calcium levels in negative and positive control groups**

From Table (1) it could be noticed that rats group fed on acidic diet showed significant ( $P < 0.01$ ) increments in serum levels of urea and calcium, with significant decrements ( $P \leq 0.01$ ) in serum TAC and blood pH when compared with values of negative control group. Serum creatinine and uric acid levels showed insignificant increments when compared with that of negative control group. These results concerning elevation of MDA and reduction of TAC in positive control group fed on acidic diet were in agreement with the findings of Epler *et al.*, (2003) and LaMonte *et al.*, (2013) who illustrated that metabolic acidosis increases



ROS levels within the cells and this could be due to the fact that metabolic acidosis increases glutamine and glutamate metabolism in renal cells. In addition, acidosis redirects cellular glutamine to the TCA cycle for cellular bioenergetics (ATP generation) which leads to depletion of other glutamine dependent metabolites such as glutathione (GSH).

All parameters of renal function were affected by the feeding of acidic diet, and that was clear from the elevation in serum creatinine, urea ( $P \leq 0.01$ ) and uric acid as compared to levels of negative control. These results were in line with that of **Garibotto *et al.*, (2004)** who stated that both *in vitro* and *in vivo* studies in animals have shown that metabolic acidosis causes several biochemical and morphologic changes in tubule cells which are ultimately associated with kidney hypertrophy, and the rates of whole body protein turnover tended to be higher in subjects with metabolic acidosis as compared with controls. Chronic acidosis causes several metabolic alterations in the renal proximal tubule, including increased  $H^+$  secretion, ammonia synthesis, and citrate reabsorption. Rats group fed on acidic diet showed significant ( $P \leq 0.01$ ) increments in serum calcium levels, with significant decrements ( $P \leq 0.01$ ) in blood pH as compared to the values of negative control group, and this could be attributed to the finding of **Sebastian *et al* (1994)** who reported that intake of a high protein diet resulted in a negative calcium balance with a significant increase in urinary calcium losses, suggesting that excess acid generated by the diet was buffered by endogenous alkali from bone.

**Table (1):** Mean serum MDA, TAC, creatinine, urea, uric acid and calcium levels in negative and positive control groups (Mean $\pm$  SE).

	Negative Control	Positive Control
MDA (nmol/ml)	25.00 $\pm$ 0.58	26.00 $\pm$ 0.58
TAC (mm/l)	0.88 $\pm$ 0.04	0.50 $\pm$ 0.03 **
Creatinine (mg/dl)	0.49 $\pm$ 0.06	0.53 $\pm$ 0.05
Urea (mg/dl)	17.00 $\pm$ 0.58	24.00 $\pm$ 1.00 **
Uric Acid (mg/dl)	2.77 $\pm$ 0.15	3.13 $\pm$ 0.18



Calcium (mg/dl)	4.32± 0.19	5.16± 0.09 **
Blood pH	7.20± 0.01	7.02± 0.02 **
Stomach pH	4.35± 0.31	3.96± 0.35

\* Significant difference from negative control group at  $P \leq 0.05$ , \*\* Significant difference from negative control group at  $P \leq 0.01$ .

### Serum MDA, TAC, creatinine, urea, uric acid and calcium levels in rats fed on diets with EP 5%, GP 5% and P 5%

Table (2) illustrated that MDA levels were decreased in experimental groups when compared with the positive control group, although, these decrements were only significant ( $P \leq 0.05$ ) in EP 5%. On the other hand, TAC were significantly increased ( $P \leq 0.01$ ) in groups of rats fed on EP 5%, GP 5% and P 5% in comparison with positive control value. Serum creatinine values were insignificantly increased in trial groups whereas serum urea were decreased significantly ( $P \leq 0.05$ ) in all groups when compared with positive control. Serum uric acid levels were significantly ( $P \leq 0.01$ ) increased in EP 5% and GP5%. On the contrary, the P5% group showed significantly ( $P \leq 0.05$ ) lower uric acid level when compared with positive control. Calcium levels of trial groups showed significantly increments in EG 5% ( $P \leq 0.05$ ) and P 5% ( $P \leq 0.01$ ) and insignificantly in GP 5%. Blood pH levels were slightly and insignificantly increased only in GP 5% and P 5% groups in comparison with positive control group. Stomach pH levels were insignificantly increased only in EP 5% and insignificantly decreased in GP 5% and P 5% groups in comparison with positive control group. These results could be explained in according to the findings of **Ou et al., (2002)** who reported that green pepper considered as one of the leading sources of antioxidants with activities against lipid peroxyl radicals. Also, **Di Sotto (2018)** reported that sweet pepper has been highlighted to be an important source of vitamins C and A, carotenoids, diterpene glycosides and polyphenols (**Materska, 2014 and Asnin and Park, 2015**), particularly polyphenols are the most abundant bioactive food compounds (reaching about a 1 g daily intake) (**Mokhtar et al., 2015 and Sricharoen et al., 2017**). Also, eggplants are a rich source of vitamins and dietary fiber, as well as phytonutrients, including phenolic compounds such as caffeic and

chlorogenic acids, and flavonoids , anthocyanin phytonutrient called nasunin (Singh *et al.*, 2009 and Naeem and Ugur, 2019). Nasunins are potent antioxidants by its ability to remove excess iron; it does not directly scavenge free radicals, rather it interferes with hydroxyl radical generation by chelating iron (Ichiyanagi *et al.*, 2005; Matsubara *et al.*, 2005 and Solanke and Tawar, 2019). Although, they are primarily present in their purple skin, they are equally present in freeze-dried eggplants containing both flesh and skin (Martínez-Ispizua *et al.*, 2021). On the other hand, parsley extracts having a wide range of phenolic compounds, flavonoids, essential oils, cumarines and vitamin C, and its protective effect may be attributed to its higher content of these flavonoids which scavenge free radicals and/or increase the production of the detoxifying enzyme glutathione S- transferase (GST) (Tahoon , 2016 and Danciu *et al.*, 2018). Oral administration of parsley expressed nephroprotective and diuretic effects, as it reversed the biochemical and antioxidant activity as evident by decreasing lipid peroxidation, increasing content of reduced glutathione and restoring activities of antioxidant enzymes (superoxide dismutase, SOD, glutathione peroxidase, GPx and catalase, CAT) in renal tissue (Shalaby *et al.*, 2014). The nephroprotective effect of parsley was attributed to the antioxidant activity due to its high content of flavonoids. Parsley leaves are rich in Apigenin and its glucosidal flavonoids that were found to possess anti-inflammatory especially for renal inflammation; antioxidant and anticancer activities (Dorman *et al.*, 2011 and Papay *et al.*, 2012). Oral pretreatments with ethanolic extracts of parsley leaves and turmeric roots in nephrotoxic rats produce nephroprotective, diuretic and antioxidant activities. These effects were confirmed via improvements of serum, urine and renal biochemical parameters as well as mitigation of acute renal tubular necrosis (Elkhamisy, 2015). Phenolic compounds including anthocyanins, flavols, flavones, flavanol, flavonones and isoflavones are widespread in vegetables and fruits. Indeed, chronic consumption of diets rich in plants polyphenols helps reduce the development of several cardiometabolic disorders including hyperuricemia and gout (Panche *et al.*, 2016). Empirical evidence indicates these compounds exert their anti-hyperuricemic effect via their antioxidant/radical-scavenging activities and interactions with enzymes involved in uric acid synthesis particularly the xanthine oxidase system.

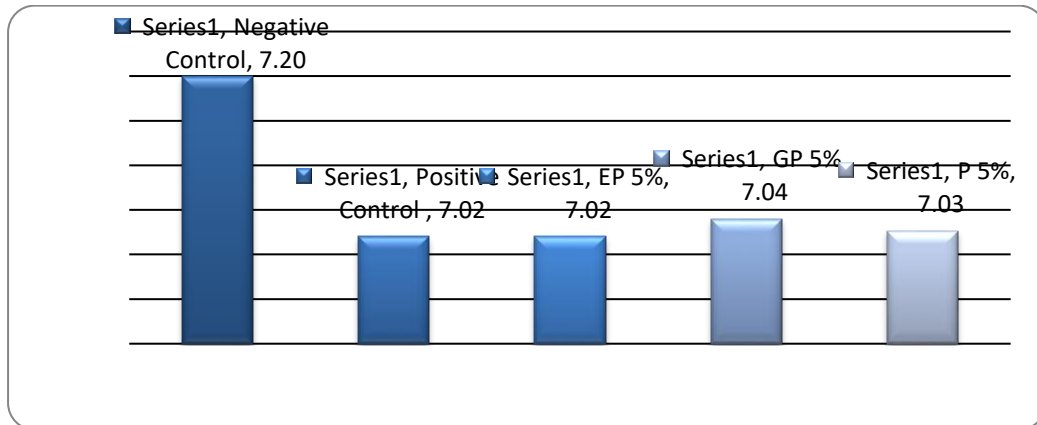
Xanthine oxidase catalyzes the hydroxylation of hypoxanthine to xanthine and UA in the purine metabolic pathway (**Abdulhafiz et al, 2020**). Phenolic compounds are classical antioxidant agents which increase the bioavailability of endothelial nitric oxide leading to dilatation of the renal afferent arterioles and increasing glomerular filtration rate (**Gasparotto et al., 2012**). The endogenous antioxidant defense system (antioxidant enzymes, uric acid, bilirubin, metal-binding proteins like ferritin, transferrin, lactoferrin and ceruloplasmin) is complemented by the intervention of exogenous antioxidants present in diet or in nutritional supplements (ascorbic acid, tocopherols, carotenoids, phenolics, flavonoids and nonflavonoids). Nevertheless, it has been suggested that the organisms can keep constant their level of oxidative stress, irrespective of the intake of antioxidant supplements. It has been stated that antioxidant supplementation proves its effectiveness if the initial oxidative stress is above normal or above the individual's stabilized level (**Pisoschi and Pop 2015**). These results in our study were the line with those reported by **Alzergy et al, (2018)** demonstrated that *P.crispum* improved the kidney Function Indices of mice injected with gentamicin, **Ali et al, (2016)**, concluded that the addition of parsley leaves by 1000 and 1500 mg / kg feed to the ration can lead to improve in some blood serum biochemical traits of broiler Ross 308. **Scorsatto et al, (2019)** showed that eggplant flour improved the anti-oxidant status in overweight women-a randomised clinical trial. Also, **Nwankpa et al, (2018)** demonstrated that green pepper improved kidney function indices in rats.

**Table (2):** Mean serum MDA, TAC, creatinine, urea, uric acid and calcium levels in rats fed on diets with EP 5%, GP 5% and P 5% (Mean± SE)

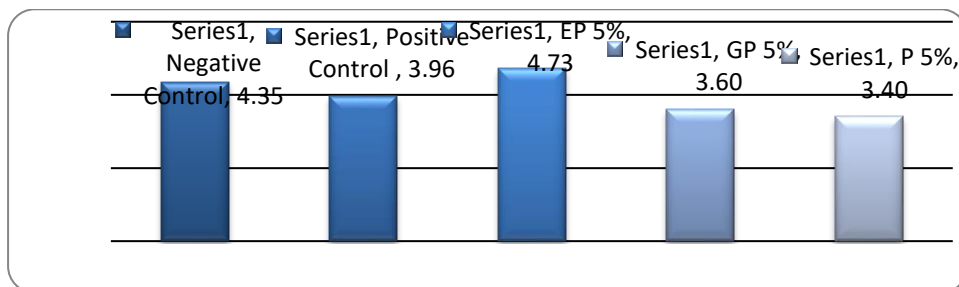
	Positive Control	EP 5%	GP 5%	P 5%
MDA (nmol/ml)	26.00± 0.58	21.67± 1.86 *	24.33± 1.85	22.33± 1.20
TAC (mm/l)	0.50± 0.03	0.78± 0.02 **	1.39± 0.12 **	0.89± 0.01 **

Creatinine (mg/dl)	0.53± 0.05	0.56± 0.02	0.61± 0.02	0.58± 0.01
Urea (mg/dl)	24.00± 1.00	20.00± 1.16 *	19.00± 2.08 *	19.78± 0.40 *
Uric Acid (mg/dl)	3.13± 0.18	3.77± 0.09 **	4.53± 0.09 **	2.70± 0.06 *
Calcium (mg/dl)	5.16± 0.09	5.70± 0.14 *	5.24± 0.14	8.46± 0.13 **
Blood pH	7.02± 0.02	7.02± 0.01	7.04± 0.01	7.03± 0.02
Stomach pH	3.96± 0.35	4.73± 0.35	3.60± 0.19	3.40± 0.04

\* Significant difference from positive control group at  $P \leq 0.05$ . \*\* Significant difference from positive control group at  $P \leq 0.01$ .



**Figure (2):** Blood pH for the experimental rats



**Figure (3):** Stomach pH for the experimental rats

### Histopathological examination of lung

Figure (4) illustrated the histopathological examination of lung in of control and treated rats (fed on diets with EP 5%, GP 5% and P 5%). Lung of rats from group 1 revealed no histopathological changes (Photos. 1 & 2). In contrary, lung of rats from group 2 revealed focal interstitial pneumonia (focal mononuclear inflammatory cells infiltration) (Photo 3), marked perivascularitis (Photos. 4 & 5), hyperplasia and vacuolation of bronchial epithelium (Photo 6). Some examined sections from groups 3 & 4 revealed interstitial pneumonia (Figs. 7 & 9), whereas, other sections from those groups showed no histopathological changes (Figs. 8 & 10). However, most examined sections from group 5 revealed perivascularitis (Photo 11) and slight interstitial pneumonia (Photo 12), whereas, few sections revealed no histopathological changes (Photo 13).

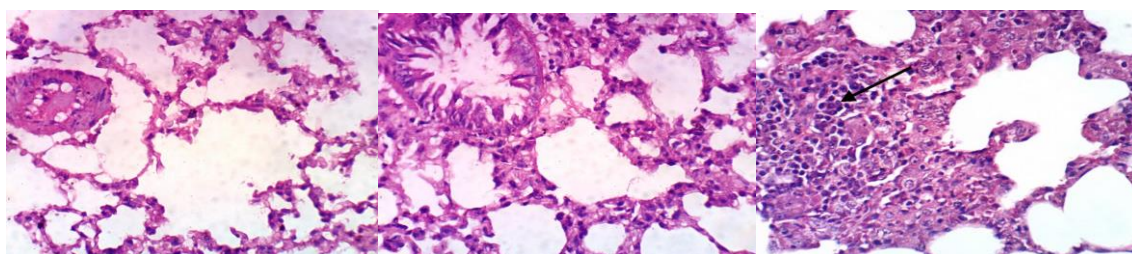


Photo (1): Lung of rat from group 1 showing no histopathological changes (H & E X 400).

Photo (2): Lung of rat from group 1 showing no histopathological changes (H & E X 400).

Photo (3): Lung of rat from group 2 showing focal interstitial pneumonia. Note focal mononuclear inflammatory cells infiltration (H & E X 400).

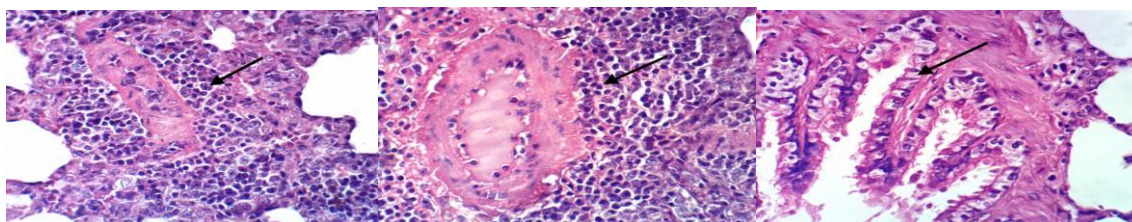


Photo (4): Lung of rat from group 2 showing marked perivascularitis (H & E X 400).

Photo (5): Lung of rat from group 2 showing marked perivascularitis (H & E X 400).

Photo (6): Lung of rat from group 2 showing hyperplasia and vacuolation of bronchial epithelium



(H & E X 400).

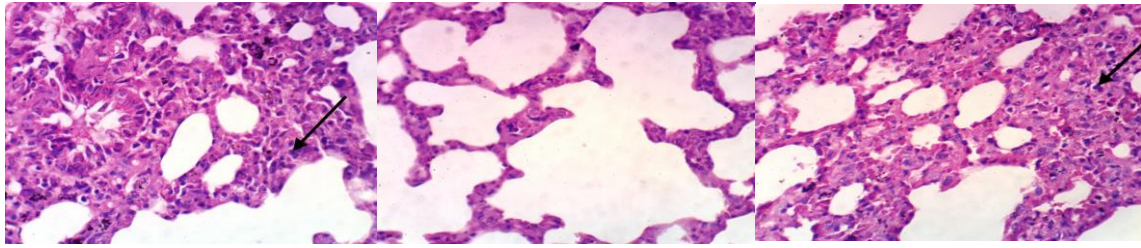


Photo (7): Lung of rat from group 3 showing interstitial pneumonia (H & E X 400).

Photo (8): Lung of rat from group 3 showing no histopathological changes (H & E X 400).

Photo (9): Lung of rat from group 4 showing interstitial pneumonia (H & E X 400).

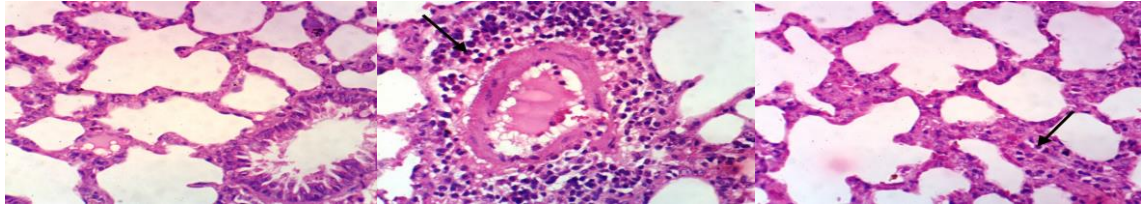


Photo (10): Lung of rat from group 4 showing no histopathological changes (H & E X 400).

Photo (11): Lung of rat from group 5 showing perivascularitis (H & E X 400).

Photo (12): Lung of rat from group 5 showing interstitial pneumonia (H & E X 400).

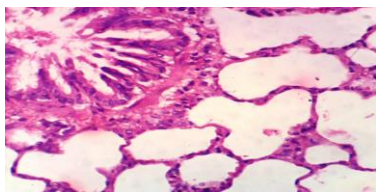


Photo (13): Lung of rat from group 5 showing no histopathological changes (H & E X 400).

**Figure (4):** Histopathological examination of lung in of control and treated rats (fed on diets with EP 5%, GP 5% and P 5%)

### Histopathological examination of the stomach

Figure (5) illustrated the histopathological examination of stomach in of control and treated rats (fed on diets with EP 5%, GP 5% and P 5%). Stomach of rats from group 1 revealed the normal histological structure of gastric layers (mucosa, submucosa and muscosa) (Photos. 1 & 2). In contrary, stomach of rats from group 2 revealed submucosal inflammatory cells infiltration (Photo 3) and marked submucosal oedema (Photo 4). Slight submucosal oedema (Photo 5) was the only histopathological change observed in stomach of rats from group 3 (Photo 6). Moreover, stomach of rats from groups 4 & 5 revealed no histopathological changes (Photos 7, 8, 9 & 10).

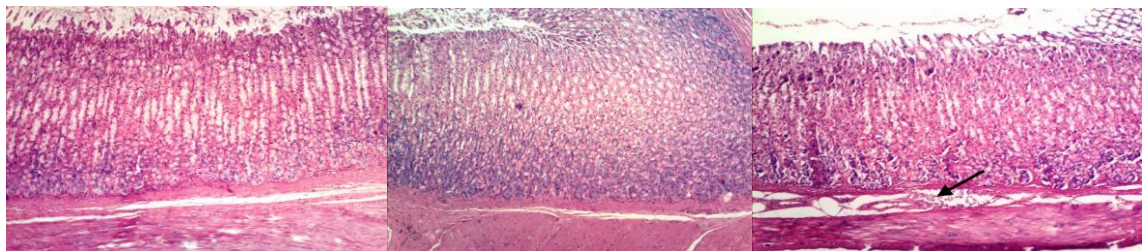


Photo (1): Stomach of rat from group 1 showing the normal histological structure of gastric layers (mucosa, submucosa and muscosa) (H & E X 100).

Photo (2): Stomach of rat from group 1 showing the normal histological structure of gastric layers (mucosa, submucosa and muscosa) (H & E X 100).

Photo (3): Stomach of rat from group 2 showing submucosal inflammatory cells infiltration (H & E X 100).

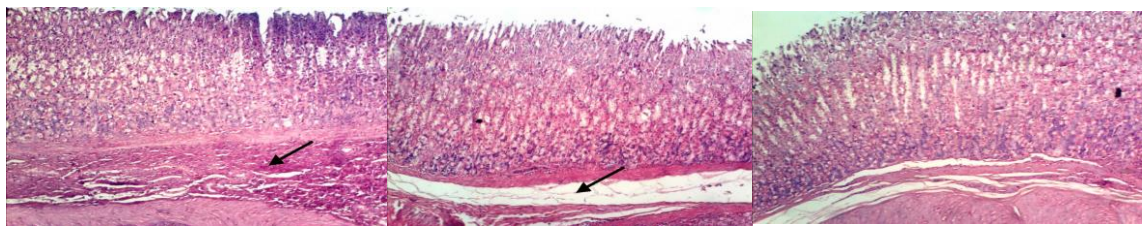


Photo (4): Stomach of rat from group 2 showing marked submucosal oedema (H & E X 100).

Photo (5): Stomach of rat from group 3 showing slight submucosal oedema (H & E X 100).

Photo (6): Stomach of rat from group 3 showing no histopathological changes (H & E X 100).



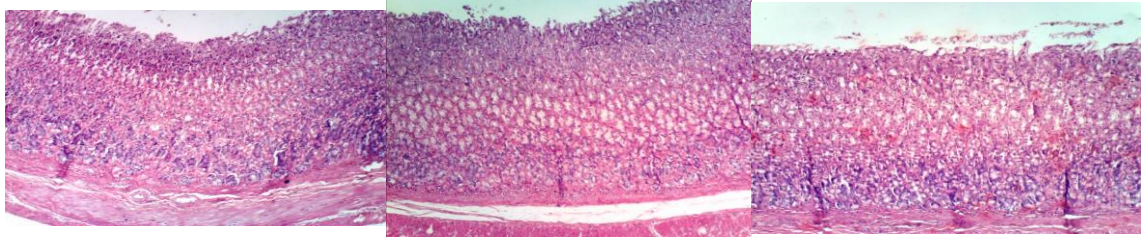


Photo (7): Stomach of rat from group 4 showing no histopathological changes (H & E X 100).

Photo (8): Stomach of rat from group 4 showing no histopathological changes (H & E X 100).

Photo (9): Stomach of rat from group 5 showing no histopathological changes (H & E X 100).

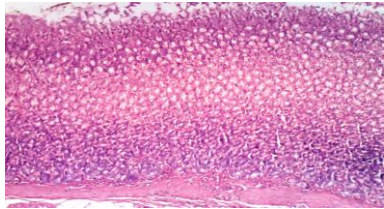


Photo (10): Stomach of rat from group 5 showing no histopathological changes (H & E X 100).

**Figure (5):** Histopathological examination of stomach in of control and treated rats (fed on diets with EP 5%, GP 5% and P 5%)

## Conclusion

From obtained results it could be concluded that the use of eggplant, sweet green pepper and parsley powder as a dietary supplement is useful in maintaining stomach and blood pH and preserving a good oxidative status which positively reflects on general health. Thus, we recommended that eggplant, sweet green pepper and parsley powder could be introduced in our daily diet by the ratio up to 5%.

## References

- [Abdulhafiz , F., Mohammed,A., Kayat, F., Bhaskar, M., Hamzah ,Z., Podapati , S.k., and Reddy,L.V.\(2020\). Xanthine Oxidase Inhibitory Activity, Chemical Composition, Antioxidant Properties and GC-MS Analysis of Keladi Candik \(\*Alocasia longiloba\* Miq. Molecules 2020, 25\(11\), 2658.](#)
- [Acosta-Estrada, B.A., Gutierrez-Uribe, J.A., and Serna-Saldívar, S.O. \(2014\). Bound phenolics in foods, a review. Food Chem., 152:46–55.](#)
- [Acosta-Montoya, O. , Vaillant, F. , Cozzano, S. , Mertz, C. , Pérez, A.M. ,and Castro, M.V.\(2010\).Phenolic content and antioxidant capacity of tropical highland blackberry \(\*Rubus adenotrichus Schltl.\*\) during three edible maturity stages. Food Chemistry, 119: 1497-1501.](#)
- [Ali1, N. A, AL-Kaissy, G. A. , and AL- Nasrawi, M.A. M.\(2016\). Effect of Addition Different Levels of Parsley Leaves Powder \(\*petroselinum sativum\*\) to the Ration on Some Blood Serum Biochemical Traits of Broiler Ross 308. Journal of Natural Sciences Research,6\(20\):18-21.](#)
- [Alzergy1;A.A., Mabruka S. Sitmo, and Sofia, S. Hazawy \(2018\). Role of \*Petroselinum crispum\* \(Parsley\) against gentamicin induced nephrotoxicity in albino mice. Nature and Science , 16\(5\):55-74.](#)
- [Asnin, L., and Park, S. W. \(2015\). Isolation and analysis of bioactive compounds in Capsicum peppers .Critical Reviews in Food Science and Nutrition, 55\(2\), 254–289.](#)
- [Bailey , J.L.\(2005\).Metabolic acidosis: An unrecognized cause of morbidity in the patient with chronic kidney disease. Kidney International, 68 \( 96\): 515-523.](#)
- [Bohmer, H.B. \(1971\): Micro- determination of creatinine. Clin. Chem.Acta. 32: 81-85.](#)
- [Butnariu, M., and Grozea, I. \(2012\) Antioxidant \(Antiradical\) Compounds. J Bioequiv Availab 4: xvii-xix.](#)
- [Caraway, W. \(1955\): Determination of serum urate. Am. J. Clin. Path.25: 840.](#)

Carleton, H. (1976). *Histological Technique*, 4 Ed London Oxford University Pers, New York, Toronto.

[Chevallier, A., \(1996\). The Encyclopedia of Medicinal Plants Dorling Kindersley. London October,http://www.alibris.com/TheEncyclopediaofMedicinalPlants AndrewChevallier/book/2038786.](http://www.alibris.com/TheEncyclopediaofMedicinalPlantsAndrewChevallier/book/2038786)

[Cosme, P., Ana B. Rodríguez Javier Espino and María Garrido\(2020\). Plant Phenolics: Bioavailability as a Key Determinant of Their Potential Health-Promoting Applications. Antioxidants 2020, 9\(12\), 1263.](#)

[Danciu ,C., Istvan Z. , Andrea B. , Anja S., Heinfried R., Monica H., Oana C., Ersilia A., Camelia O., Florina B., Codruta S., Virgil P. and Cristina A.\(2018\). Botanical Therapeutics: Phytochemical Screening and Biological Assessment of Chamomile, Parsley and Celery Extracts against A375 Human Melanoma and Dendritic Cells. Int. J. Mol. Sci., 2018,19, 3624.](#)

Di Sotto, A., Martina V., Lorena A., Chiara T., Anna M., Luisa M., Locatelli, M., Nicoletti, M., and Silvia D. (2018). *Capsicum annum* L. var. Cornetto di Pontecorvo PDO: Polyphenolic profile and in vitro biological activities. *Journal of Functional Foods* 40 , 679–69.

Dorman HJ, Lantto TA, Raasmaja A and Hiltunen R. (2011). Antioxidant, pro-oxidant and cytotoxic properties of parsley. *Food Func*, 2(6): 328-337.

[El Gindy, A. A., Mona E. and Youssif, M.R. \(2017\). Effect of Adding Drying Parsley Leaves on Processing and Quality of "Crackers". Middle East Journal of Applied,7\(3\):421-429.](#)

[Elkhamisy, A.E. \(2015\). Protective effect of parsley leaves and turmeric roots extracts against gentamicin induced nephrotoxicity in male rats. World J Day Food Sci, 10 \(1\): 01-08.](#)

Epler, M.J., Souba, W.W., Meng, Q., Lin, C., Karinch, A.M., Vary, T.C., and Pan, M.(2003):Metabolic acidosis stimulates intestinal glutamine absorption. *J Gastrointest Surg*, 7:1045–1052.

[Frankel, E.N., and Finley, J.W.\(2008\). . How to standardize the multiplicity of methods to evaluate natural antioxidants Journal of Agricultural and Food Chemistry, 56 : 4901-4908.](#)

Garibotto, G., Sofia, A., Cristina Robaudo, Stefano Saffiotti, Maria R., Daniela V., Monica V., Russo, R., Vanessa P., Deferrari ,G., and Tessari, P.(2004). Kidney Protein Dynamics and Ammoniogenesis in Humans with Chronic Metabolic Acidosis. ASN, 15 (6) 1606-1615.

Gasparotto, A. Jr., Prando T.B.L., Leme T.S.V., Gasparotto F.M., Lourenço E.L.B., Rattmann Y.D., Silva-Santos J.E., Kassuya C.A.L., and Marques M.C.A. (2012).Mechanisms underlying the diuretic effects of *Tropaeolum majus* L. extracts and its main component isoquercitrin .J. Ethnopharmacol., 141 (2012), pp. 501-509.

Himmelfarb, J., McMonagle, E., Freedman, S., Klenzak, J., McMenamin, E., Le P, Pupim, L.B., and Ikizler, T.A.(2004). The PICARD Group Oxidative stress is increased in critically ill patients with acute renal failure. Journal of the American Society of Nephrology, 15(9):2449–2456.

Hou W.C., Lin R.D., Cheng K.T., Hung, Y.T. , Cho, Chen, C.H. , Hwang, S.Y. , and Lee, M.H. (2003). Free radical-scavenging activity of Taiwanese native plants Phytomedicine: International Journal of Phytotherapy and Phytopharmacology, 10 : 170-175.

Ichiyanagi, T., Kashiwada, Y., Shida, Y., Ikeshiro, Y., Kaneyuki, T., & Konishi,T. (2005). Nasunin from eggplant consists of cis-trans isomers of delphinidin 3-[4-(p-coumaroyl)-L-rhamnosyl (1–6)glucopyranoside)-5-glucopyranoside,Journal of Agricultural and Food Chemistry,53, 9472–9477.

Kähkönen, M.P. , Hopia, A.L. , Vuorela, H.J. , Rauha, J.P. , Pihlaja, K. , Kujala, T.S. ,and Heinonen, M.(1999).Antioxidant activity of plant extracts containing phenolic compounds Journal of Agricultural and Food Chemistry, 47 : 3954-3962.

- Kaur, C., and Kapoor, H. C. (2002). Antioxidant Activity and Total Phenolic Content of Some Asian Vegetables. *Int. J. Food Sci. Tech.*, 37, 153–161.
- Koracevic, D., Koracevic, G., Djorjevic, V., Anderjevic, S., and Cosic, V. (2001). Methods for measurement of antioxidant activity in human fluids. *J. Clinpathol*; 54:356-361.
- LaMonte, G., Tang, X., Chen, J.L.Y., Wu, J., Ding, C.C., Melissa M Keenan, Carolyn Sangokoya, Hsiu-Ni Kung, Olga Ilkayeva, László G Boros, Christopher B Newgard, and Jen-Tsan. (2013). Acidosis induces reprogramming of cellular metabolism to mitigate oxidative stress. *Cancer Metab.*, 1: 23:2-19.
- Marsch, W.H.; Fingerhut, B. and Miller, H. (1965): Automated and manual direct methods for the determination of blood urea. *Clin. Chem.* 11: 624-27.
- Martínez-Ispizua, E.; Martínez-Cuenca, M.-R.; Marsal, J.I.; Díez, M.J.; Soler, S.; Valcárcel, J.V.; and Calatayud, Á. (2021). Bioactive Compounds and Antioxidant Capacity of Valencian Pepper Landraces. *Molecules*, 26, 1031.
- Materska, M. (2014). Bioactive phenolics of fresh and freeze-dried sweet and semi-spicy pepper fruits (*Capsicum annuum* L.). *Journal of Functional Foods*, 7, 269–277.
- Matsubara, K., Kaneyuki, T., Miyak, T. & Mori, M. (2005). Antiangiogenic activity of nasunin, an antioxidant anthocyanin, in eggplant peels. *Journal of Agricultural and Food Chemistry*, 53, 6272–6275.
- May, R.C., Kelly, R.A., and Mitch, W. E. (1986). Metabolic acidosis stimulates protein degradation in rat muscle by a glucocorticoid-dependent mechanism. *J. Clin. Invest.* 77:614-621.
- Mitch, W.E., Medina, R., Griebler, S., May, R.S., England, B.K., Price, S.R., Bailey, J.L., and Goldberg, A.I. (1994). Metabolic Acidosis Stimulates Muscle Protein Degradation by Activating the Adenosine Triphosphate-dependent Pathway Involving Ubiquitin and

- Proteasomes. The American Society for Clinical Investigation, Inc., 93,2127-2133.
- Mokhtar, M., Soukup, J., Donato, P., Cacciola, F., Dugo, P., Riazi, A., and Mondello, L. (2015). Determination of the polyphenolic content of a *Capsicum annuum* L. extract by liquid chromatography coupled to photodiode array and mass spectrometry detection and evaluation of its biological activity. *Journal of Separation Science*, 38(2),171–178.
- Naeem, M.Y., and Ugur, S.(2019). Nutritional Content and Health Benefits of Eggplant. *Turkish Journal of Agriculture -Food Science and Technology*, 7(sp3): 31-36.
- Nwankpa, P., Ekweogu, C.N., Egwurugwu, J.N., Chukwuemeka, O.G., Etteh, C.C., Ugwuezumba, P.C., and Emengagha, F.C.(2018). Assessment of Kidney Function Indices in Male Albino Wistar Rats Administered Ethanol Stem Extract of *Dennettia tripetala* (Pepper fruit). *Biochemistry & Pharmacology*,7(1):1-4.
- Ou, B.X.; Huang, D.J.; Hampsch–Woodill, M.; Flanagan, J.A.; and Deemer, E.K. (2002).Analysis of antioxidant activities of common vegetables employing oxygen radical absorbance capacity (ORAC) and ferric reducing antioxidant power (FRAP) assays: A comparative study. *J. Agric. Food Chem.*, 50, 3122–3128.
- Panche, A. N. , Diwan, A. D. and Chandra, S. R.(2016). Flavonoids: an overview. *Journal of Nutritional Science* , 5 (47): 1 – 15.
- Papay Z.F., Kosa A, Boldizsar I, Ruskai A, Balogh E and Antal I. (2012). Pharmaceutical and formulation aspects of *Petroselinum crispum* extract. *Acta Pharmaceut Hung*, 82(1): 3-14.
- Pearson, D.(1970).The chemical analysis of foods ;national collage of Food Techn. Univ. of Rading, pp. 1919-1977.
- Pisoschi, A.M., and Pop, A.(2015). The role of antioxidants in the chemistry of oxidative stress: A review. *Eur. J. Med. Chem.*, 5; 97:55-74.



- Reeves, P.G., Nielsen, F.H., and Fahmy, G.G. (1993): AIN-93.Purified diets for laboratory rodents: Final report of the American Institute of Nutrition adhocwritng committee on the reformulation of the AIN-76 A Rodent diet. *J. Nutrition*, 123: 1939-151.
- Robertson, G., Carrihill, M., Hatherill, M., Waggie, Z., Reynolds, L., and Argent, A. (2007) .Relationship between fluid management , changes in fluid management , changes in serum sodium and outcome in hypernatraemia associated with gastroenteritis . *Journal of Pediatrics and Child Health*, 43:291-296.
- Samue, S.A., Francis, A.O., and Anthony, O.O.(2018). Role of the Kidneys in the Regulation of Intra- and Extra-Renal Blood Pressure. *Ann Clin Hypertens*; 2: 048-058.
- Satoh, K. (1978).Serum lipid peroxide in cerebrovascular disorders determined by a new colorimetric method, *Clinchim Acta Nov* 15; 900(1):37-43.
- Scorsatto, M., Rosa, G., Raggio Luiz, R., da Rocha Pinheiro Mulder, A., Junger Teodoro, A., and Moraes de Oliveira, G.M.(2019). Effect of eggplant flour (*Solanum melongena*) associated with hypoenergetic diet on anti-oxidant status in overweight women-a randomised clinical trial. *Int J Food Sci Technol.*; 54:2182–2189.
- Sebastian, A., Harris, S.T., Ottaway, J.H., Todd, K.M., and Morris, R.C. Jr. (1994). Improved mineral balance and skeletal metabolism in postmenopausal women treated with potassium bicarbonate. *N Engl J Med* 330:1776–1781.
- Shahidi, F., and Ambigaipalan, P.(2015). Phenolics and polyphenolics in foods, beverages and spices: Antioxidant activity and health effects – A review. *Journal of Functional Foods*, 18, (B) : 820-897.
- Shahidi, F., and Wanasundara, U.(1995) . Effect of natural antioxidants on the stability of canola oil *Developments in Food Science*, 37 : 469-479.
- Shalaby, M.A.,Ashraf Abd-Elkhalik Hammouda.2014. Nephroprotective, diuretic and antioxidant effects of some medicinal herbs in



- gentamicin-nephrotoxic rats. *Intercult Ethnopharmacol* 2014; 3(1):1-8.
- Singh, A. P., Luthria, D., Wilson, T., Vorsa, N., Singh, V., Banuelos, G. S., and Pasakdee, S. (2009). Polyphenols content and antioxidant capacity of eggplant pulp. *Food Chemistry*, 114(3): 955–961.
- Solanke, S.B., and Tawar, M.G. (2019). Phytochemical Information and Pharmacological Activities of Eggplant (*Solanum Melongena* L.): A Comprehensive Review. *EASJ Pharm & Pharmacol*; 1, (5): 103-114 .
- Sricharoen, P., Lamaiphan, N., Patthawaro, P., Limchoowong, N., Techawongstien, S., and Chanthai, S. (2017). Phytochemicals in *Capsicum oleoresin* from different varieties of hot chilli peppers with their antidiabetic and antioxidant activities due to some phenolic compounds. *Ultrasonics Sonochemistry*, 38: 629–639.
- Tahoon, N.A.(2016). Biological effect of Parsley and honey on side effects of Cisplatin induced nephrotoxicity in experimental male rats. *Bulletin of the National Nutrition Institute of the Arab Republic of Egypt*. 48: 244-261.
- Tomsa, A.M., Alexa, A.L., Junie, M.L., Rachisan, A.L, and Ciumarnean, L. (2019). Oxidative stress as a potential target in acute kidney injury. *Peer. J* 7: e8046.

## تأثير تناول بعض الخضروات على المؤشرات الحيوية للإجهاد التأكسدي والوظائف الكلوية في الجرذان المصابة بحموضة الدم

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### الملخص العربي

أجريت الدراسة الحالية لتقييم التأثير المفيد للبادنجان والفلفل الأخضر الحلو ومسحوق البقدونس على المؤشرات الحيوية للإجهاد التأكسدي ووظائف الكلى في الفئران المصابة بحموضة الدم. تم تقسيم 30 من ذكور الفئران البيضاء السليمة إلى 5 مجموعات متساوية. تم تغذية فئران المجموعة الأولى على النظام الغذائي الأساسي كمجموعة ضابطة سالبة، بينما تم تغذية فئران المجموعة الثانية على النظام الغذائي الأساسي المخلوط بمسحوق الخبز الأبيض (15% من العلف) لتحفيز الحموضة كمجموعة ضابطة موجبة، أما المجموعة الثالثة فقد تم تغذيتها على النظام الغذائي الأساسي المخلوط مع الخبز الأبيض (15% من العلف) و 5% مسحوق البادنجان (EP)، تم تغذية فئران المجموعة الرابعة على النظام الغذائي الأساسي المخلوط بالخبز الأبيض (15% من العلف) و 5% مسحوق الفلفل الأخضر (GP) والمجموعة الخامسة تتغذى على حمية قاعدية مخلطة بخبز أبيض (15% دايت) و 5% مسحوق بقدونس (ف). تم تسجيل وزن الفئران أسبوعياً لكل فأر خلال فترة التجربة، وتم حساب الزيادة في وزن الجسم لمجموعات الفئران. تم جمع عينات الدم لتقييم بعض المؤشرات البيوكيميائية لوظائف الكلى (اليوريا، الكرياتينين، حمض البوليك، المالنواهديد (MDA) و السعة الكلية للنشاط المضاد للأكسدة (TAC). تم تحديد قيمة الرقم الهيدروجيني للدم والمعدة. أظهرت النتائج أن جميع المجموعات التجريبية أظهرت درجات متفاوتة من فقدان الوزن والتي تعتبر مؤشراً لضعف النمو مقارنة بالمجموعة الضابطة السالبة، وانخفضت مستويات MDA في المجموعات التجريبية عند مقارنتها بالمجموعة الضابطة الإيجابية وكانت هذه الانخفاضات معنوية فقط في المجموعة EP (5%). من ناحية أخرى، تمت زيادة TAC في مجموعات الفئران التي تم تغذيتها على 5% EP و 5% GP و 5% P مقارنة مع المجموعة الضابطة الموجبة. زادت قيم

الكرياتينين في الدم في المجموعات التجريبية ، بينما انخفض اليوريا في الدم في جميع المجموعات عند المقارنة مع السيطرة الإيجابية. تم زيادة مستويات حمض اليوريك في الدم في EP 5% و GP 5% ، على العكس من ذلك ، أظهرت مجموعة P 5% انخفاض مستوى حمض اليوريك بالمقارنة مع المجموعة الضابطة الموجبة. أظهرت مستويات الكالسيوم في المجموعات التجريبية زيادات في EG 5% و P 5% و GP 5%. وزادت مستويات pH الدم بشكل طفيف فقط في مجموعات GP 5% و P 5% مقارنة مع المجموعة الضابطة الموجبة. زادت مستويات الأس الهيدروجيني في المعدة فقط في EP 5% وانخفضت في مجموعات GP 5% و P 5%. مقارنة بالمجموعة الضابطة الموجبة. خلصت هذه الدراسة إلى أنه يمكن تناول الباذنجان والفلفل الأخضر الحلو ومسحوق البقدونس في النظام الغذائي للفئران المصابة بحموضة الدم بنسبة تصل إلى 5% وقد يحسن وظائف الكلى والعوامل المضادة للحموضة .

**الكلمات المفتاحية:** الباذنجان، الفلفل الأخضر الحلو، البقدونس، المعدة، وظائف الكلى، الحموضة.