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المجلة العلمية المحكمة لدراسات وبحوث التربية النوعية

المجلد الثامن– العدد الثاني– مسلسل العدد (16)– أبريل 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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Abstract

The aim of the study was to evaluate the potential effect of Alhagi maurorum bread on nephrotoxicity caused by CCl4 in rats. In addition, the chemicals composition (moisture, protein, fat. fiber, ash and carbohydrates). Determined also total phenolic, flavonoids and total antioxidant content of Alhagi maurorum. Forty-two rats were divided into six equal groups. Group 1: control group (normal). Group2: treated with CCl4 (1ml/kg body weight (b.w)), twice a week for 4 weeks. Groups 3, 4, 5 and 6 were treated with the same dose of CCl4 administered with Alhagi maurorum bread at concentrations 2.5, 5, 7.5 and 10% of Alhagi maurorum bread respectively. Results appeared that rats treated with CCl4 showed a significant increment in kidney function (urea and creatinine), total lipid, cholesterol, triglycerides and malondialdehyde (MDA), but a significant decline in the mean values of Glutathione peroxidase (GPx) and Total Antioxidant capacity (TAC) as compared with the control group. The treatment with Alhagi maurorum bread (7.5 and10 %) improved the functions of the kidney These protective effects were depends on concentration of Alhagi maurorum in bread. Alhagi maurorum has a protective effect against the loss of antioxidant activities as a result of the oxidative process caused by CCl4 injection due to its

phytochemicals compounds (phenolic and flavonoids) and antioxidants. This protective activity of Alhagi maurorum bread suggests that regular consumption of it or food containing phenolic, flavonoids and antioxidants may protect against Nephrotoxicity and imbalanced antioxidants. Thus, the possibility that Alhagi maurorum bread reduces the risk Nephrotoxicity.

Keywords: Alhagi maurorum, Nephrotoxicity, Kidney function, Malondialdehyde,

Introduction:

Kidneys are one of the key organs of the body which carry out several important roles in the body. Removal of waste from the bloodstream (urine formation) is considered the main function of the kidney. Also, the kidney performs many homeostatic functions example maintaining volume, pH and ionic balance. Also, toxic metabolic by-products such as urea, ammonia, and uric acid are excreted according by **Stevens et al., (2006) & Alam et al., (2016) & Jose et al., (2017) & Al-Naimi et al., (2019).** By these facts related to these multiple functions, especially the detoxification property, the kidneys remain the most exposed organ in our body to different xenobiotics. Moreover, in clinical practice, several drugs were proved to be nephrotoxic according by **Karie et al., (2010).**

Bhatia et al. (2017) & AL-kuraishy et al. (2019) mentioned that nephrotoxicity is defined as a renal-specific circumstance due to toxic agents and drugs. About 20% of nephrotoxicity is induced and caused by drugs.

In the context of this concern, natural resources such as medicinal plants provide a reservoir of natural antioxidants that can be used as a treatment to attenuate the nephrotoxicity produced by the drugs that stimulate oxidative stress**.** For this reason, Alhagi maurorum (Fabaceae) is a spiny up shrub according to **Suthar (2016)** native to South East Europe, North Africa, the Middle East and [**International Union for Conservation of Nature and Natural Resources 2005**]. It has numerous appellations such as Shprim, Shook, Aqool, Lehlah and Shooq El Jamal as reported by **AE (2015)**, and therapeutic properties e.g., to remove kidney stones, ureter relaxer, as laxative, diaphoretic, diuretic and

expectorant agent according to **Marashdah, and Farraj (2010)**. Regarding the literature, numerous phytochemical constituents have been identified from the plant such as glycosides, flavonoids, alkaloids, saponins, tannins and steroids, followed by multiple pharmacological activities as antibacterial, anti-inflammatory, antipyretic, analgesic, antioxidant and diuretic ones according by **Al-Snai et al., (2019).**

To date, there are no data concerning the in vivo effect of Alhagi maurorum bread on nephrotoxicity damage and oxidative stress induced by CCl4. Thus, the present study evaluates the protective effect of Alhagi maurorum against CCl4-induced oxidative stress and nephrotoxicity in rats.

Materials and methods:

Materials:

Camel thorn plant (Alhagi maurorum) was collected in a semi-desert area north south of ً Nag Hammadi city, Qena, Egypt in summer season 2020. The whole parts of Alhagi maurorum were collected, washed three times with tap water and two times with distilled water, dried in the shade, and milled to fine powder by Wiley (Model 4- GMI, Germany. Powder of plant was stored in brown glass jars to Determination chemical composition of plant and other analyses.

Wheat flour (72%) extract was purchased from a hypermarket, Nag Hamady city, Egypt. Salt, dry yeast, bread improvers, sugar and corn oil were bought from local market, Nag Hammadi city, Egypt.

Rats and Basal diet:

Forty-two male albino rats (Sprague-Dawley strain) weighting 200+5 g were obtained from the Laboratory Colony, Helwan, Egypt. The rats were kept under controlled hygienic condition in plastic cages and fed on the basal diet for one week before starting the experiment. Basal diet constituents (Casein, cellulose, vitamin mixture, mineral mixture and choline chloride) were purchased from El- Gomhorya Company for Pharmaceutical and Chemical, Cairo, Egypt.

Carbon tetrachloride:

Carbon tetrachloride (CCl4) was purchased from El Gomhorya Co., Egypt in the form of 99.9 % liquid dispensed in 1 L plastic bottles.

3.1.4 Kits for biochemical analysis:

All kits were purchased from Bio diagnostic Dokki, Giza, Egypt Gamma Trade Company for Pharmaceutical, Dokki, Egypt.

Experiment and grouping of rats:

All animals were housed at a controlled room temperature of 23±1 ^{o}C,55% humidity and under a 12 h light /12-h dark schedule. The animals were fed on basal diet and water was provided ad libitum for two weeks before starting of the of experiment for acclimatization. After two-week adaptation period, the rats were randomly distributed into 6 equal groups of 7 rats each.

Group (1): was fed on basal diet and bread Wheat Flour Bread and kept as (+ positive) control group (normal rats).

Group (2): (Nephrotoxicity group) was fed on basal diet and bread Wheat Flour Bread. Rats injected subcutaneously by a single dose of CCL4(0.5 ml/kg bw. i.p.) twice weekly for two consecutive weeks. (- negative group)

Group (3): was fed on basal diet and bread Wheat Flour Bread Mixed with Alhagi Powder (97.5% wheat flour 2.5% Alhagi) Rats injected subcutaneously by a single dose of CCL4(0.5 ml/kg bw. i.p.) twice weekly for two consecutive weeks.

Group (4): was fed on basal diet and bread Wheat Flour Bread Mixed with Alhagi Powder (95% wheat flour 5% Alhagi) Rats injected subcutaneously by a single dose of CCL4(0.5 ml/kg bw. i.p.) twice weekly for two consecutive weeks.

Group (5): was fed on basal diet and bread Wheat Flour Bread Mixed with Alhagi Powder (92.5% wheat flour 7.5% Alhagi) Rats injected subcutaneously by a single dose of CCL4(0.5 ml/kg bw. i.p.) twice weekly for two consecutive weeks.

Group (6): was fed on basal diet and bread Wheat Flour Bread Mixed with Alhagi Powder (90% wheat flour 10% Alhagi) Rats injected subcutaneously by a single dose of CCL4(0.5 ml/kg bw. i.p.) twice weekly for two consecutive weeks.

At the last day of experiment all animals were sacrificed; blood was collected to separate serum for biochemical analysis. Liver was excised out, washed in ice cold saline and small portion was fixed in 10% formalin for histopathological analysis and the other portion was frozen to homogenate.

Preparation of toast bread

The flour mixtures used to produce bread samples were prepared according to the ratios as follows:

Control A: 100g wheat flour only.

Sample B:97.5g wheat flour +2. 5g Alhagi maurorum powder.

Sample C:95g wheat flour + 5g Alhagi maurorum powder.

Sample D:92.5g wheat flour + 7.5g Alhagi maurorum powder.

Sample E:90g wheat flour + 10g Alhagi maurorum powder

Baking process of Toast bread:

Toast bread baking using the straight method was carried out as described by **Lazaridou et al., (2007).** Bread dough was baked at 240°C for 20-25 min. in an electric oven (Mondial Formi, 4T 40/60, Italy). The resulted pan bread samples were allowed to cool at room temperature for 2 hours before being packed in polyethylene bags and stored at room temperature for further examinations.

Chemical composition of raw materials and processed toast bread samples:

Moisture, fat, ash, Crude protein and crude fiber were determined using **AOAC (2012)** method. While carbohydrate content was calculated by subtraction according to the following equation: Carbohydrate % = (100 - Moisture% +ash% +fat% +crude protein% +crude fiber%).

Determination of total phenolic contents in Alhagi: -

Total phenolic compound concentrations were determined spectrophotometrically **Mohammadzadeh et al., (2007).** Briefly, 1 mL of extract was mixed with 1 mL of Folin- Ciocalteu reagent. After 3 min, 1 mL of saturated sodium carbonate solution (20%) was added to the mixture and adjusted to 10 mL with distilled H2O. The reaction mixture was kept in the dark for 1 h with intermittent shaking. The absorbance was measured at 725 nm using a spectrophotometer. Phenolic contents were calculated based on the standard curve of Gallic acid and three measurements were performed to obtain a mean value.

Determination of total flavonoids contents in Alhagi: -

Total flavonoids content was evaluated according to a colorimetric assay with aluminum chloride **Zhishen et al., (1999).**

Evaluation of Antioxidant activity in Alhagi: -

Procedure DPPH (2,2-diphenyl-1-picryl-hydrazyl-hydrate) free radical assay was carried out according to the method of **Boly et al., (2016)**. Briefly, 100µL of freshly prepared DPPH reagent (0.1% in methanol) were added to 100 µL of the sample in 96 wells plate (n=6), the reaction was incubated at room temp for 20 min in dark. At the end of incubation time the resulting reduction in DPPH color intensity was measured at 540 nm. Data are represented as means ± SD according to the following equation: percentage inhibition= ((Average absorbance of blank-average absorbance of the test)/ (Average absorbance of blank)) *100.

Biochemical estimations

Kidney function tests

Urea and creatinine levels were assayed in the samples by a colorimetric method **Fawcett and Scott (1960) & Szaszet al., (1979**, respectively). Serum albumin level was assayed using the method described by **Dumas et al., (1972).** Creatinine /albumin ratio (C/A) was calculated from the results obtained.

Determination of total lipids, cholesterol and triacylglycerol

Serum samples were used for determination of total lipids **(Zollner and Kirsch, (1962)** total cholesterol (TC) **Allain et al., (1974**), triacylglycerol (TG) (**Fossati and Prencipe (1982).**

Determination of lipid peroxide level

Lipid peroxidation level in the kidney homogenate was determined as thiobarbituric acid reactive substances (TBARS) by measuring malondialdehyde (MDA) level spectrophotometrically in kidney homogenates according to **Mihara et al., (1978)** and catalase (CAT) and nitric oxide (NO) were determined according to **Yoshioka et al.,1979. & Green et al., (1982).**

Statistical Analysis: -

Statistical analysis was carried out using Statistical Package for the Social Science (SPSS) for windows. Version 25 (SPSS Inc., Chicago, IL, USA). Collected data was presented as mean ± standard deviation (SD). Analysis of Variance (ANOVA) test was used for determining the

significances among different groups according to **Dowdy et al., (2004)** All differences were considered significant if P 0.05.

Results and Discussion

Effect of Alhagi maurorum powder addition on chemical composition content of wheat and Alhagi maurorum:

Effect of addition Alhagi maurorum powder on the proximate chemical composition of processed toast bread samples was studied and the results are presented in Table (1). It could be easily observed that lipids and ash contents were gradually increased with an increase of Alhagi maurorum powder ratios. Whereas moisture and carbohydrates contents were gradually decreased. The moisture content of many foods is usually considered as an indicator of food quality and shelf life. It is important to measure the moisture content of bakery products because of their potential effect on the sensory, physical, and microbial properties of such products. The obtained data showed that moisture content was gradually decreased from 11.36% in the control bread sample to 11.00 % in E sample, the low moisture content in Alhagi maurorum powder used in the bread blends might have effective implications in texture and microbiological quality of bread processed according by **Summaya et al., (2016).**

Data found decreased of protein, total carbohydrates, and energy (K cal/100 g) compared with control. On the other hand, result recorded highest value of energy in toast mixed by 2.5% Alhagi maurorum flowed by toast mixed by 7.5 % Alhagi maurorum. The least value of energy found in toast mixed by 5% Alhagi maurorum. In any case, fortifying wheat flour with percentages of Alhagi flour leads, of course, to an improvement in the quality and quality of protein as reported by **El-Absy (2018).**

Table (1): Proximate chemical composition of raw materials of toast bread samples:

Concentration of blend		Moisture	Ash	Protein	lipids	Fiber	Total carbohydrates*	Calorie value
Wheat flour	**Alhagi flour**	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
100 %	**0%**	11.36 a ± 1.20	0.41 c ± 0.08	10.47 a ± 1.47	5.62 b ± 0.72	0.22 c ± 0.09	72.14 a ± 2.35	381.02 c ± 12.56
97.5 %	**2.5%**	11.03 a ± 2.30	0.50 c ± 0.02	10.21 a ± 1.90	7.23 a ± 0.72	0.40 c ± 0.04	71.03 b ± 1.89	390.03 a ± 13.78
95%	**5%**	11.22 a ± 2.10	1.15 b ± 0.01	10.21 a ± 2.56	6.06 b ± 0.72	0.94 b ± 0.06	71.36 c ± 2.69	380.82 e ± 10.59
92.5 %	**7.5%**	11.00 a ± 1.90	1.25 ab ± 0.01	10.30 a ± 1.36	7.79 a ± 0.72	1.49 a ± 0.50	69.66 c ± 3.59	389.95 b ± 19.23
90%	**10%**	11.00 a ± 1.70	1.60 a ± 0.03	9.71 a ± 1.79	6.24 b ± 0.72	1.01 b ± 0.06	71.45 b ± 4.69	380.8 d ± 20.68
F		0.30	15.12	0.92	9.15	15.12	31.47	688.73
Sig.		0.88	0.00	0.47	0.00	0.00	0.00	0.00
		**	**	**	**	**	**	**

***** Carbohydrates were calculated by difference:
Values are expressed as mean ± SD

**Values at the same columns with different letters are significance at P < 0.1

Total phenols and flavonoids of Alhagi maurorum: -

Total phenols are shown in Table (2), Gallic acid, Rutin and Ellagic acid were presented in Alhagi maurorum, and the highest content of Gallic acid was found in Alhagi maurorum (63.48%) followed by Rutin (42.27%) these results disagree with **Armin et al. (2011).** is found 23.83 mg gallic acid equivalent/g dried-weight and 11.53 mg rutin equivalent/g dried-weight respectively.

Ellagic acid content was found by (36.08%). Also results recorded high content of Ferulic acid (32.52%) followed by Chlorogenic acid (25.38%). While data recorded lowest of content Naringenin and Syringic acid was found in Alhagi maurorum (12.08% and 11.69%; respectively. The lower content of Vanillin, Pyro catechol, Methyl gallate, Taxifolin, Catechin, Coumaric acid, Coffeic acid and Cinnamic acid recorded 2.55, 2.05, 1.44, 1.23, 0.69, 0.54, 0.36 and 0.11%; respectively. These results are in concordance with **Ahmed. (2019) & Al-Saleem et al., (2019).**

Table (2) Total phenols of Alhagi maurorum: -

Sample (AL HGI) 1g/20ml		
Phenols	**Area**	**Conc. (µg/ml)**
Gallic acid	732.31	63.48
Chlorogenic acid	350.49	25.38
Catechin	5.17	0.69
Methyl gallate	101.77	1.44
Coffeic acid	10.19	0.36
Syringic acid	299.57	11.69
Pyro catechol	26.74	2.05
Rutin	336.57	42.27
Ellagic acid	531.07	36.08

Coumaric acid	28.73	0.54
Vanillin	114.18	2.55
Ferulic acid	987.96	32.52
Naringenin	216.85	12.08
Taxifolin	16.03	1.23
Cinnamic acid	11.20	0.11

The results given in Table (3) show the total flavonoids composition in Alhagi maurorum were Isorhamnetin, Chrysoeriol and Chrysoeriol-7-oxylosoid was recorded 10.64, 7.320 and 5.875%; respectively. while Kaempferol recorded low values 0.17 % in Alhagi maurorum. These results agree with the results obtained by **El-Sayed et al. (1993); Kamil et al. (2001)** and **Ahmad et al. (2010).**

Table (3): Total flavonoids of Alhagi maurorum:

Sample (AL HGI) 1g/20ml		
	Area	Conc. (µg/ml)
Kaempferol	4.10	0.17
Chrysoeriol	22094	7.320
Isorhamentin	17381	10.64
Chrysoeriol-7-oxylosoid	30215	5.875

Antioxidant activity of Alhagi maurorum

Total antioxidant activity of Alhagi maurorum as shown in Table (4). The results found antioxidant activities in Alhagi maurorum recorded

342.95%. These results agree with the results obtained by **Armin et al., (2011)** & **Sulaiman. (2013).**

Table (4): Antioxidant activity of Alhagi maurorum

Samples	Antioxidant activity %	Tested Parameter	Unit
Alhagi maurorum	342.95	DPPH	µMT eq/mg

Effect of Alhagi maurorum bread on weight gain and average kidney weight in albino rats:

The effect of Alhagi maurorum bread on weight gain (g) and average kidney weight (g) are represented in Table (5). Treatment of rats with CCl4 led to an increase in weight gain compared with the treatment group. Treatment with Alhagi maurorum bread markedly improved the growth. The average weight of the kidney was increased in the CCl4 group compared with the normal group. Administration of Alhagi maurorum bread leads to a significant reduction in the average kidney weight compared with the CCl4 group ($P< 0.05$).

This increase in the weight of the kidney may be imputed to lesions and injuries related to xenobiotics according by **Wong et al., (2010)** like CCl4 which peroxidases proteins of cells that way stimulating pathway of the inflammatory. Also, these results came in agreement with **Abdel Moneim and El-Deib (2012) & Sahar and Dalia (2014)** who found that CCl4 caused increasing kidney weight and relative weight of kidney. The enlargement of the kidney was significantly reduced in Alhagi maurorum groups, suggesting that the Alhagi maurorum bread includes some protecting phytomedicines. This observation of the effect on body weights of Alhagi maurorum bread groups can be explicated by its effect on the appetite center in the hypothalamus.

Table (5) Effect of Alhagi maurorum bread on weight gain and average kidney weight in albino rats

Groups	kidney	Weight gain (g)
	Mean ± SD	**Mean** ± SD
Control	0.90 ^{b} ± 0.06	34.20 a ± 2.14
CCl4	1.18 ^{a} ± 0.17	34.40 a ± 6.41
2.5% Alhagi bread	0.84 ^{b} ± 0.11	16.20 b ± 6.11
5% Alhagi bread	0.99 ^{b} ± 0.08	16.20 b ± 5.42
7.5% Alhagi bread	1.00 ^{b} ± 0.14	14.20 b ± 5.04
10% Alhagi bread	1.00 ^{b} ± 0.21	20.80 b ± 6.46
F	4.24	17.23
Sig	0.004	4.92
	*	N. S

Values are expressed as mean ± SD

*Values at the same columns with different letters are significance at P <0.0 5

(N.S) Values at the same columns with different letters are significance at P No significant

Effect Alhagi maurorum bread on renal function:

Table (6) show that urea, creatinine, and albumin levels were used as biochemical markers for evaluation of kidney injury and these parameters were significantly increased in CCl4- treated animals ($P < 0.05$). This result agrees with that of **Al-Seeni et al., (2016).** These increases could be attributed to impairment in renal functions. The increasing levels of creatinine and urea may be due to a diminish in the glomerular filtration rate caused by acute renal dysfunction as reported by **Rahmat et al., (2014).** In addition, reduced albumin concentration in CCl4- treated rats resulted in significant leakage due to hyperplasia in glomeruli and tubules

according to **Adewole et al., (2007).** Whereas, treated rats with Alhagi maurorum bread concomitantly with CCl4 afforded significant protection against CCl4-intoxication Table (6). The ameliorative effect against renal toxicity may be ascribed to high levels of polyphenols and other antioxidants like flavonoids.

Alhagi phytochemical analysis has shown that the plant has bioactive and active pharmaceutical ingredients such as flavonoids, flavone glycosides, triterpenes, tannins, etc. It seems that the mentioned active ingredients are effective in reducing pain and kidney stones expulsion as reported by **Shafaeifar et al., (2012)**

Table (6). Effect of Alhagi maurorum bread on renal function

Groups	urea	createnine	Albumin (Alb)
	Mean ± SD	Mean ± SD	Mean ± SD
Group (--)	17.67 ^{b} ± 3.39	0.68 ^{b} ± 0.12	3.75 ^{a} ± 0.87
G2: Positive control (+ve) + CCl4	28.00 ^{a} ± 3.35	0.80 ^{ab} ± 0.06	1.93 ^{c} ± 0.99
G3: Am bread (2.5%) +CCl4	22.50 ^{ab} ± 6.72	0.74 ^{ab} ± 0.12	2.47 ^{bc} ± 0.94
G 4: Am bread (5%) +CCl4	20.00 ^{b} ± 5.48	0.70 ^{a} ± 0.06	2.60 ^{bc} ± 0.70
Group 5: Am bread (7.5%) +CCl4	19.67 ^{b} ± 6.41	0.68 ^{b} ± 0.10	2.91 ^{abc} ± 0.50
Gr 6: Am bread (10%) +CCl4	17.00 ^{b} ± 8.44	0.66 ^{b} ± 0.05	3.26 ^{ab} ± 0.48
F	**2.774**	**2.010**	4.044
Sig.	**0.036**	**0.106**	0.006
	*	**N. S**	*

Values are expressed as mean ± SD

*Values at the same columns with different letters are significance at P< 0.05

(N.S) Values at the same columns with different letters are significance at P N.S No significant

Effect of Alhagi maurorum bread and CCl4 on total lipid, cholesterol, triglycerides and glucose:

The data in Table (7) shows that treatment with CCl4 to rats significantly raised the levels of total lipid, triglycerides and cholesterol compared with control. These results came in agreement with **Nwidu et al., (2017)** found that oxidative stress caused by Cl4 increased the lipid profile levels. On the other hand, it may be presumed that hypercholesterolemia in rats treated with CCl4 resulted from the damage of hepatic parenchyma cells, leading to an imbalance of lipid metabolism However, Alhagi maurorum bread significantly improved the lipid profile of rats treated with CCl4.

Alhagi maurorum at (2.5.5,7.5 and 10%) to rats intoxicated with injected of CCl4 at the experimental period caused a significant ($p<0.05$) decrease in the elevated serum TC, TG and LDL levels and increased serum HDL, when compared to CCl4 intoxicated group. These results agree with data obtained by **Zarei et al., (2014).**

Table (7) Effect of Alhagi maurorum bread CCl4 on total lipid cholesterol, triglycerides, HDL, LDL and VLDL

Groups	TG (mg/dl,)	TC (mg/dl,)	HDL (mg/dl,)	LDL (mg/dl,)	VLDL (mg/dl,)
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Group (--)	78.42 ^{b} ± 29.09	76.58 ^{b} ± 7.29	28.84 ^{c} ± 3.36	32.06 ^{a} ± 6.64	15.68 ^{b} ± 5.82
G2: Positive control (+ve) + CCl4	123.65 ^{a} ± 24.53	104.05 ^{a} ± 8.63	42.22 ^{a} ± 5.12	37.10 ^{a} ± 14.37	24.73 ^{a} ± 4.91
G3: Am bread (2.5%) +CCl4	89.80 ^{b} ± 6.61	80.58 ^{b} ± 15.39	28.52 ^{c} ± 8.42	34.10 ^{a} ± 13.78	17.96 ^{b} ± 1.32
G 4: Am bread (5%) +CCl4	98.12 ^{b} ± 23.27	81.05 ^{b} ± 18.86	30.92 ^{bc} ± 9.14	30.51 ^{a} ± 17.17	19.62 ^{b} ± 4.65

Group 5: Am bread (7.5%) +CCl4	95.44 b ± 9.31	88.69 b ± 7.16	37.50 ab ± 4.98	32.11 a ± 8.90	19.09 b ± 1.86
Gr 6: Am bread (10%) +CCl4	95.44 b ± 9.31	88.69 b ± 7.16	37.50 ab ± 4.98	32.11 a ± 8.90	19.09 b ± 1.86
F	3.633	4.207	4.702	0.216	3.633
Sig.	0.011	0.005	0.003	0.953	0.011
	**	*	*	N. S	**

Values are expressed as mean ± SD

*Values at the same columns with different letters are significance at P <0.05

**Values at the same columns with different letters are significance at P < 0.01

Values at the same columns with different letters are significance at P (N.S) No significant

Efficacy of Alhagi maurorum on TAC, Glutathione peroxidase and MDA of experimental rats:

Data given in Table (8) showed the efficacy of Alhagi maurorum on serum antioxidants enzymes .The data found injection administration of CCl4 in rats induced a significant decrease in the activities of Total Antioxidant Capacity (TAC) and Glutathione peroxidase (GPx**)** concentration with an increase in Malondialdehyde (MDA) level (lipid peroxidation marker) However, the concurrent administration of A. maurorum with CCl4 induced a significant ($P \leq 0.01$) increase in antioxidant enzymes of TAC and nonenzymatic antioxidant biomarker GPx and with a reduction in MDA level.

In the present study, injection of CCl4 significantly increased MDA, a product of lipid peroxidation, an injection that CCl4 preferentially affects cell membrane as reported by **Abdel-Wahhab et al., (2006).** These results clearly showed that CCl4 has a harmful and stressful influence on the hepatic tissues consistent with those reported in the previous literature **Chandan et al., (2007); Song et al.,**

(2007); Bhattacharjee and Sil, (2007); Armin et al., (2011); Neamah (2012); M el mallah (2016); Abdel-Malak et al., (2018); Ahmed (2019); Bencheikh et al., (2019) & **Khalifa et al., (2020).**

It is well documented that Alhagi maurorum contains a variety of phenolics and represents a good source of antioxidants, which makes it a good antioxidant additive and increases its usability potential in ethnomedicine according to **M El mallah (2016).** However, the phenolic contents are well known to be affected by the botanical origin The antioxidant activities of phenolics are related to several different mechanisms, such as free radical-scavenging, hydrogen-donation, singlet oxygen quenching, metal ion chelation, and acting as a substrate for radicals such as superoxide and hydroxyl. A direct relationship has been found between the phenolic content and antioxidant capacity of plants as reported by **Al-Mamary et al., (2002).**

Alhagi maurorum is a rich source of lupeol and has chemical ingredients as flavonoids, coumarins, fatty acids, alkaloids, and sterols with antioxidant activities according to **Loizzo et al., (2014).**

A high dose of Alhagi maurorum (600 mg/kg) resulted in a decrease in, MDA and increase TAC may be due to the phytochemical content of Alhagi plants rich in phytochemicals that possess antioxidant **Changizi-Ashtiyani et al., (2016)** & **AL-Nafea, and Aljahdali (2021).**

Table (8) Efficacy of Alhagi maurorum on Total Antioxidant capacity (TAC) , Glutathione peroxidase (GPx) and Malondialdehyde (MDA) of experimental rats

Groups	**(GPx)**	**MDA**	**TAC**
	Mean ± SD	Mean ± SD	Mean ± SD
Group (--)	91.53 ^{a} ± 5.78	6.79 ^{c} ± 1.99	7.17 ^{a} ± 1.02
G2: Positive control (+ve) + CCl4	40.44 ^{c} ± 8.62	33.46 ^{a} ± 5.06	2.89 ^{c} ± 1.07
G3: Am bread (2.5%) +CCl4	57.29 ^{b} ± 3.05	13.62 ^{b} ± 2.29	4.61 ^{bc} ± 0.67
G 4: Am bread (5%) +CCl4	61.25 ^{b} ± 9.59	10.89 ^{bc} ± 1.65	4.53 ^{bc} ± 1.89
Group 5: Am bread (7.5%) +CCl4	54.59 ^{b} ± 8.22	12.09 ^{b} ± 3.54	4.21 ^{c} ± 1.45
Gr 6: Am bread (10%) +CCl4	59.09 ^{b} ± 12.00	14.59 ^{b} ± 6.03	6.13 ^{ab} ± 1.76
F	24.182	36.290	7.205
Sig.	0.000	0.000	0.000
	**	**	**

Values are expressed as mean ± SD

*Values at the same columns with different letters are significance at P< 0.1

CONCLUSION

The current study indicates that Alhagi maurorum bread prevents biochemical change caused by CCl4. This renal protective effect of Alhagi maurorum bread can be ascribed to the presence of antioxidant contents, for example, phenol compounds and flavonoids that cause a significant reduction of the oxidative threat leading to a normal

physiological function. The results support the use of Alhagi maurorum bread ratio 7.5 % and 10% to treat nephrotoxicity.

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تأثير خبز العاقول على التسمم الكلوى الناجم من رابع كلوريد الكربون فى فئران التجارب

الملخص العربى

كان الهدف من الدراسة هو تقييم التأثير المحتمل لخبز العاقول على السمية الكلوية التي يسببها CCl4 رابع كلوريد الكربون في الفئران. بالإضافة إلى تركيب الكيمائى (رطوبة ، بروتين ، دهون ، ألياف ، رماد وكربوهيدرات). بالاضافة الى انه تم تحديد محتوى الفينولات والفلافونويد ومضادات الأكسدة الكلية في العاقول. تم تقسيم اثنين وأربعين فأرا إلى ست مجموعات متساوية. المجموعة 1: المجموعة الضابطة (عادية) المجموعة 2: عولجت بـ CCl4 (1 مل / كجم من وزن الجسم مرتين في الأسبوع لمدة 4 أسابيع. عولجت المجموعات 3 و 4 و 5 و 6 بالجرعة نفسها من CCl4 التي تم إعطاؤها مع خبزالعاقول بتركيزات 2.5 و 5 و 7.5 و 10٪ من خبز العاقول على التوالي. أظهرت النتائج أن الفئران التي عولجت بـ CCl4 أظهرت زيادة معنوية في وظائف الكلى (اليوريا والكرياتينين) ، والدهون الكلية ، والكوليسترول ، والدهون الثلاثية ، ومالونديالديهيد (MDA) ، ولكن هناك انخفاضًا ملحوظًا في متوسط قيم الجلوتاثيون بيروكسيديز (GPx) ومضادات الأكسدة الكلية. (TAC) بالمقارنة مع المجموعة الضابطة الكنترول .أظهرت النتائج ان العلاج بخبز الهاجي موروروم (7.5 و 10٪) حسن وظائف الكلى. هذه التأثيرات الوقائية تعتمد على تركيز نبات العاقول فى الخبز. ويرجع التأثير العلاجى لنبات العاقول الى احتوائه على الفلافونويد والفينولات مضادات الاكسدة ضد السمية الكلوية التي تحدث في الفئران. وبالتالي ، فإن خبز العاقول يمثل فرصة مشجعة لعلاج الإصابة الكلوية .واعتمدت هذه التأثيرات الوقائية على تركيز العاقول في الخبز. العاقول له تأثير وقائي ضد فقدان الأنشطة المضادة للأكسدة نتيجة لعملية الأكسدة التي يسببها حقن CCl4 بسبب مركباته الكيميائية النباتية (الفينولية والفلافونويد) ومضادات الأكسدة. يشير هذا النشاط الوقائي لخبز العاقول إلى أن الاستهلاك المنتظم له أو الطعام الذي يحتوي على الفينول والفلافونويد ومضادات الأكسدة قد يحمي من السمية الكلوية ومضادات الأكسدة غير المتوازنة. وبالتالي ، فإن هناك احتمال أن خبز العاقول يقلل من مخاطر السمية الكلوية.

الكلمات المفتاحية : العاقول– السمية الكلوية– وظائف الكلى – المالوندهيد .