

Efficacy of Ganoderma (Ganoderma lucidum) Against Nephrotoxicity Induced by Cisplatin in Male Rats .

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Abstract

In traditional Chinese medicine, *ganoderma lucidum* are widely used as medicine for a variety of diseases, such as chronic bronchitis inflammation, hyperlipidemia, hypertension, neurasthenia, hepatitis, leukopenia, and adjuvant treatment of cancer . The aim of this study was to evaluate its effect against cisplatin - induced nephrotoxicity in adult male albino rats . Forty five animals were classified into 5 groups 9 rats for each group . Group (1) fed on basal diet (negative group); groups (2 - 5) were injected with cisplatin (5 mg / kg body wt.) intraperitoneally to induce nephrotoxicity in rats ; group (2) fed on the basal diet as positive control group (+Ve) ; remained groups fed on the basal diet and supplemented with *ganoderma lucidum* at 5 , 10 and 15 g / kg diet , respectively . Results revealed that positive control group had significant increase in serum levels of creatinine , urea , uric acid , urea nitrogen and total protein as well as Malondialdehyde (MOD) but had significant decrease in serum levels of Superoxide Dismutase (SOD) , Catalase (CAT) , Glutathione Peroxidase (GPX) and Glutathione (GSH) as compared to the negative control groups. While supplemented with different levels of *ganoderma lucidum* caused significant decreased in serum levels of creatinine , urea , uric acid , urea nitrogen and total protein as well as (MOD) , but had significant increased in serum levels of (SOD) , (CAT) , (GPX) and (GSH) as compared to the positive control group. From the present results it can be concluded that *ganoderma lucidum* feeding possess a therapeutic effect against cisplatin that induced nephrotoxicity in rats and inhibit oxidative stress. According to above results the consumption of *ganoderma lucidum* can be used to treat nephrotoxicity .

Key words: Male albino rats, cisplatin , nephrotoxicity, Reishi mushrooms, *Ganoderma lucidum* , kidney function , antioxidant markers .

Introduction

The use of medicinal herbs is nowadays receiving an increasing attention all over the world due to their potential for health promotion and specific symptom management . Medicinal plants and herbs are used to initiate health healing through synergistic response unlike the specific properties of pharmaceuticals (**Cohen et al .,2000 ; Zenk et al ., 2001**) . For over 4000 years Reishi mushrooms (*Ganoderma Lucidum*) have been recognized by Chinese medical professionals as a valuable remedy. Its Chinese name Lingzhi, means "spiritual potency". Reishi mushrooms are regarded by the Chinese as the "Medicine of Kings" they stated that the "long-term taking of Reishi (Lingzhi) will build a strong , healthy body and assure a long life (**Wasson , 1968 and Lingzhi , 1986**) .

Ganoderma is a white root wood-degrading with hard fruiting bodies. The glycoprotein contains 10.1% of protein and 17 general amino acids and it is rich in glutamic acid, asparagic acid, alanine, glycine, threonine, and serine. It was

mainly composed of mannose, galactose and glucose . In traditional Chinese medicine, ganoderma lucidum are widely used as medicine for a variety of diseases, such as chronic bronchitis , inflammation, hyperlipidemia, hypertension, neurasthenia, hepatitis, leukopenia, and adjuvant treatment of cancer (*Stavinoha , 1990 ; Jong and Birmingham ,1992 ; Bojana et al ., 2007 and Zhaoli et al., 2014*) . In addition (*Kenneth ,1992 ; Stanislaus ,1995 and Fernández-Rojas et al., 2014*) found that Reishi contains natural substances called "triterpenes" which lowers high blood pressure, lowers cholesterol, and inhibits platelet aggregation which may lead to heart attacks and other circulation problems.

Cisplatinum (II) diamine dichloride (cisplatin) is extensively used for the management of oncological disorders, particularly of the ovary, testis, bladder, head and neck (*Hamers et al ., 1991*). Although higher doses of cisplatin are more efficacious for cancer chemotherapy, the high-dose therapy manifests toxicities such as nephrotoxicity (*Bodenner et al., 1986 and Fernández-Rojas et al., 2014*). A number of chemotherapeutic agents have been reported to render protection against cisplatin-induced nephrotoxicity. However, none of them is known to be clinically effective as a complete protective agent. Several lines of evidence indicated that free radicals are involved in the nephrotoxicity caused by cisplatin, and the damage is suggested to be the consequence of decreased renal antioxidant enzyme activity with enhanced lipid peroxidation. However, administration of antioxidants has been shown to ameliorate cisplatin-induced nephrotoxicity in animals (*Babu et al ., 1995 ; Sheena et al .,2003 and Fernández-Rojas et al., 2014*) .

In the present study, we investigate the effects of ganoderma (*ganoderma lucidum*) against cisplatin-induced nephrotoxicity in rats .

Material and Methods

Materials :

Starch , cellulose, vitamin mixture and minerals were purchased from the El-Gomhoria Company Cairo – Egypt , and cisplatin were purchased from local pharmacy Cairo- Egypt. *Ganoderma lucidum* were purchased from DXN Saudi Arabia company , as powder and used as it's .

Experimental animals; adult male albino rats of Sprague-Dawley strain were obtained from Helwan station, Cairo, Egypt.

Methods :

This study was carried out on forty five albino male rats of Sprague-Dawley strain weighing 200 - 210 g . Rats were kept in clean cages at 20-24 C temperature , 12 hour light / 12 hour dark cycle . All rats were fed and drinking water ad libitum . Rats were observed daily weighed twice weekly , feed intake was weighted daily and feed efficiency ratio were calculated .

All rats were fed the basal diet for one week before starting the experiment for acclimatization, as described by (*Reeves et al.,1993*) . It consists of casien 20 % , corn oil 10 % , fibers 5 % , salt mixture 4 % , vitamin mixture 1 % , choline chloride 0.2 % and the remainder is corn starch . After the acclimatization period , the rats groups were randomly divided into five equal groups (n=9) as follow :

The first group (n= 9) : was fed on the basal diet to eat as negative control group (-Ve).

The second group (n= 36) : was fed on the basal diet and injected with cisplatin (5 mg / kg body wt. intraperitoneally to induce nephrotoxicity in rats (*Babu et al., 1995 and Sheena et al ., 2003*). This group was divided into four sub-groups (n=9 rats/ each) as follow :

Group (1) : was fed on the basal diet as positive control group (+Ve).

Group (2) : was fed on the basal diet supplemented with 5 g *ganoderma lucidum* / kg diet

Group (3) : was fed on the basal diet supplemented with 10 g *ganoderma lucidum* / kg diet

Group (4) : was fed on the basal diet supplemented with 15 g *ganoderma lucidum* / kg diet

The *ganoderma lucidum* were added as replaced for equal amount of starch in the diet to maintain the percentage of other nutrient . Rats were kept for four weeks on the previous experimental diets and then animals were fasted overnight and sacrificed using diethyl ether for collecting blood and organs (kidneys, heart and liver) .

Blood Samples Collection :

About 7-ml blood was withdrawn from the hepatic portal vein into clean dry centrifuge plastic tubes. Blood samples were centrifuged and sera were obtained in a clean well-stoppered vials then stored at - 20°C until chemical analysis.

Biochemical analysis:

Serum creatinine and urea were estimated by the method of (*Brod and Sirota 1980 ; Marshall et al., 1980*) , respectively. The blood urea nitrogen , serum uric acid levels and total proteins concentrations were measured using methods described by *Henry et al., (1957)* ; The activity of superoxide dismutase (SOD) was assayed by the method of (*McCord and Fridovich , 1969*) , catalase (CAT) by the method of (*Beers and Sizer 1952*) , glutathione peroxidase (GPX) by the method of (*Hafemann et al., 1974*) , levels of glutathione (GSH) by the method of (*Moron et al., 1979*) and malondialdehyde (MDA) by the method of (*Ohkawa et al., 1979*) .

Biological evaluation :

Calculation of organ relative weight was calculated according to the following equation:

$$\text{Organ relative weight} = (\text{Organ weight} / \text{Animal final weight}) \times 100$$

Determination of body weight gain (BWG) and feed efficiency ratio in rats were calculated at the end of the experimental period according to the following equations :

$$\text{BWG (g)} = \text{Final weight (g)} - \text{Initial weight (g)} / \text{Initial weight (g)} .$$

$$\text{FER} = \text{Weight gain (g)} / \text{Feed intake (g)} .$$

Chemicals and Stains for Histopathological Examination:

Chemicals such as saturated formaldehyde solution 40% , sodium phosphate monobasic , sodium phosphate dibasic , Ethylene Diamine Tetra-acetic Acid (EDTA) for decalcification and haematoxyline and eosine stain were obtained from Faculty of Veterinary Medicine , Cairo University , for histopathological examination of livers and kidneys .

Statistical analysis:

Statistical analysis of the collected data was carried out using SAS (version 9.0) . Results were expressed as mean \pm SD. One way analysis of variance (ANOVA) was used . The differences among means were tested for significance using the high significant difference test (HSD) at $P \leq 0.05$ according to *SAS (2006)* .

Results and discussion .

Effect of feeding on different concentration of ganoderma on body weight gain , feed intake, and feed efficiency ratio in nephrotoxicity rats.

Data in table (1) show that , positive control group had significant decrease in feed intake , body weight gain and feed efficiency ratio comparing with rats fed on basal diet (negative control). Moreover, rats injected with cisplatin to induce nephrotoxicity and supplemented with different levels of ganoderma powder (5 , 10 and 15 g / kg diet) had significant increase in feed intake , body weight gain and feed efficiency ratio when compared with positive control group.

The present results are strongly supported by another study (*Fenglin Li , 2011*) who , found that consumption of ganoderma for 28 days had increased the body weight .

Data in Table (2) indicate that a significant decrease of organs relative weight , (liver and heart) as compared with the positive control in all experimental groups with administered cisplatin , Furthermore kidney weight recorded non significant increase for all nephrotoxic rats compared with the positive control group.

Table (3) shows that positive control group had significant increase in serum levels of urea , creatinine and urea nitrogen when compared with rats fed on basal diet negative control . Moreover, all nephrotoxic rats supplemented with different levels of ganoderma powder (5 , 10 and 15 g / kg diet) had significant decrease in serum level of urea , creatinine and urea nitrogen when compared with positive control group . This study agreed with *Babu et al., (1995)* , who reported that minimum dose of cisplatin (5 mg/kg body wt, intraperitoneum was sufficient to induce nephrotoxicity in rats . This dose of cisplatin normally used in clinical practice (*Somani et al., 2000*) . Also our results was agreement with *Sheena et al., (2003) ; Naokikashimoto et al., (2010) and Fernández-Rojas et al., (2014)* , they stated that serum creatinine and urea levels were significantly elevated ($P < 0.001$) in the cisplatin-treated animals compared to the normal group (- ve) and treatment of animals with methanolic extract of *ganoderma lucidum* significantly reduced the elevated levels of serum creatinine and urea to almost normal level. In the same line *Pillai et al., (2011)* , reported that oral administration of ganoderma at a dose of 100 mg/kg body weight prevented increase in urea, creatinine levels , this result suggested the potential therapeutic use of ganoderma to prevent nephrotoxicity caused during cisplatin chemotherapy.

Table (4) shows that positive control group had significant increase in uric acid and total protein as compared to group of rats fed on basal diet (- ve) . While , the nephrotoxicity groups supplemented with different levels of ganoderma powder (5 , 10 and 15 g / kg diet) showed significant decrease in uric acid and total protein compared with the positive control group . The significant decrease in serum level of uric acid and total protein was shown in the group supplemented with 15 g / kg diet when compared with the positive control group and non significant when compared with negative control group.

Table (5) demonstrate that, rats fed on the basal diet and treated with cisplatin (positive control group) had significant decrease in superoxide dismutase , catalase and glutathione peroxidase compared with rats fed on basal diet (control negative) . While groups injected with cisplatin to induce nephrotoxicity and supplemented with different levels of ganoderma powder at (5 , 10 and 15 g / kg diet) had significant increase in superoxide dismutase , catalase and glutathione peroxidase compared with positive control group and non significant changes when compared with negative control group especially groups supplemented with ganoderma powder at (10 and 15 g / kg diet) . The results agreed with that of *Lusania et al., (2000) ; Mora et al., (2003) ; Sheena et al., (2003) ; Alireza et al., (2014) and Zhaoli et al., (2014)* . They , found that renal CAT and GPX activities were decreased significantly ($P < 0.001$) after administration of cisplatin , while the administration of methanolic extract of *ganoderma lucidum* to cisplatin treated rats group restored the activities of CAT and GPX and SOD to almost normal level . Also , (*Nonaka et al., 2005*) reported that *ganoderma lucidum* is useful in reducing the adverse effects of anti- cancer drugs (cisplatin) .

Table (6) , indicates that rats fed on basal diet and treated with cisplatin (positive control) had significant decrease in glutathione (GSH) as compared with rats fed on basal diet (negative control) , and a significant increase in malondialdehyde (MDA) level when compared with negative control group. Our results agreed with *Somani et al., (2000) Alireza et al., (2014) ; Fernández-Rojas et al., (2014) and Zhaoli et al., (2014)* , They reported that cisplatin -induced nephrotoxicity by decrease in renal antioxidant defence system and the increase in lipid peroxidation. Furthermore all rats with induced nephrotoxicity and supplemented with different levels of ganoderma powder (5 , 10 and 15 g / kg diet) recorded a significant increase in serum level of glutathione and significant decrease in serum level

of malondialdehyde compared to positive control group. These results agreed with (*Sheena et al , 2003 ; Alireza et al., 2014 ; Fernández-Rojas et al., 2014 and Zhaoli et al., 2014*) they found that the renal glutathione (GSH) concentration significantly decreased ($P < 0.001$) in cisplatin-treated animals compared to the normal group , indicating the enhanced activity of lipid peroxidation . However, the administration of methanolic extract of *ganoderma lucidum* to cisplatin treatment rats group elevated the renal glutathione (GSH) concentration to the normal level , while the concentration of malondialdehyde (MDA) as observed, significantly decreased to the normal level compared to cisplatin-treated animals.

From the results obtained, consumption *ganoderma lucidum* is recommended for nephrotoxic patients , and we encourage foodstuff fortification with *ganoderma lucidum* since it has therapeutic effect against cisplatin that induced nephrotoxicity and inhibit oxidative stress.

Histopathological examination :

Histopathological examination of liver for rats fed basal diet (negative control) showed normal histological structure of the hepatic lobules as shown in (Fig. 1-A) . The liver of rats injected with cisplatin and fed on basal diet (positive control) showed cytoplasmic vacuolizations of hepatocytes as shown in (Fig.1-B) . While Fig. (1-C) showed the liver of rats injected with cisplatin and supplemented with *ganoderma lucidum* at 5 g / kg diet showed dilatation of hepatic sinusoids and activation of kupffer cells , while the group supplemented with level 2 (10 g / kg diet) of *ganoderma lucidum* showed kupffer cells activation as shown in Fig. (1-D) . Moreover , Fig. (1-E) showed the liver of group supplemented with level 3 (15 g / kg diet) of *ganoderma lucidum* showed no histopathological changes .

This study showed that the kidneys of the negative control group (fed on basal diet) had the normal histological structure of renal parenchyma as shown in (Fig. 2- A) , on the other hand group of rats injected with cisplatin and fed on basal diet (positive control) showed atrophy of glomerular tuft and distension of bowman's space (Fig. 2- B) , while the kidneys of rats injected with cisplatin and supplemented with *ganoderma lucidum* at 5 g / kg diet showed congestion of glomerular tuft as shown in Fig. (2- C) . Moreover , Fig. (2- D) showed the kidneys of rats injected with cisplatin and received level 2 (10 g / kg diet) *ganoderma lucidum* had no histopathological changes. The kidneys of rats injected with cisplatin and received level 3 (15 g / kg diet) *ganoderma lucidum* showed no histopathological changes as shown in (Fig. 2- E) .

Ganoderma lucidum (Reishi), are rich in vitamins, fiber, and amino acids and low in fat, cholesterol, and calories. These mushrooms contain a large variety of biologically active polysaccharides with immunostimulatory properties, which contribute to their anticancer effects. Furthermore, other bioactive substances, including triterpenes, proteins, lipids , and phenols, have been identified and characterized in medicinal mushrooms , which are responsible for its therapeutic effects (*Sliva , 2004*).

Free radicals are known to play an important role in cisplatin-induced nephrotoxicity. The free radicals and reactive oxygen species induce oxidative stress in kidneys (*Hannemann and Baumann , 1988 ; Uslu and Bonavida , 1996 and Lusania et al., 2000*) .

The depletion of GSH can markedly increase the toxicity of cisplatin, probably due to the augmentation of lipid peroxidation (*Sheena et al ., 2003*). Cisplatin administration, platinum sulphhydryl group complexes formed are taken up by renal cells and stabilized by intracellular GSH for several hours. In case of intracellular GSH depletion, the complexes undergo rapid transformation to reactive metabolites . Thus glutathione depletion results in increased toxicity of cisplatin. Glutathione depletion also results in lipid peroxidation and this seems to be the prime factor that permits lipid peroxidation and impaired antioxidant enzyme activities. These observations support the conclusion that the mechanism of nephrotoxicity in cisplatin-treated rats is related to depletion of antioxidant systems (*Ban et al., 1994 ; Lusania et al., 2000 and Ronald et al., 2010*) .

The decrease in SOD activity after cisplatin administration might be due to the loss of copper and zinc, which are essential for enzyme activity. Cisplatin has been demonstrated to induce the loss of copper and zinc in the kidneys. The decreased SOD activity is insufficient to scavenge the superoxide anion produced during the normal metabolic process. The superoxide anion can cause initiation and progression of lipid peroxidation (*Sharma , 1985 ; Kerim et al., 2009 ; Alireza et al., 2014 ; Fernández-Rojas et al., 2014 and Zhaoli et al., 2014*) .

The activity of CAT and GPX is also found to decrease after cisplatin administration. This resulted in the decreased ability of the kidney to scavenge toxic H₂O₂ and lipid peroxides (*Sheena et al ., 2003*) . While , the restoration of renal SOD, CAT and GPX activities by treatment with *ganoderma lucidum* extract capable of protecting the enzymes (*Sheena et al ., 2003 and Kerim et al., 2009*) . Thus, treatment of nephrotoxicity by the ganoderma (reishi mushroom) might be directly related to its antioxidant activity.

From the results obtained, an increase of the consumption of *ganoderma lucidum* is recommended improve nephrotoxicity , and we encourage foodstuff fortification with *ganoderma lucidum* since it has therapeutic effect against cisplatin that induced nephrotoxicity and inhibit oxidative stress. In addition, nutrition education programs are needed to inform the public about the important role of the *ganoderma lucidum* (reishi mushroom) in a diet. Finally, further studies are needed to examine the effect of *ganoderma lucidum* on other biological and biochemical parameters as well as in the field of food science.

Table (1) :
Effect of Feeding Ganoderma on Feed Intake (FI), Body Weight Gain (BWG) and Feed Efficiency Ratio (FER) of Rats

Groups	FI (g / day)	BWG (g / 28 days)	FER
Negative control	15.04 ± 0.30 ^{a,b}	9.20 ± 1.10 ^{a,b}	0.025 ± 0.04 ^{a,b}
Positive control	10.60 ± 0.28 ^c	-5.80 ± 1.00 ^c	-0.022 ± 0.07 ^c
Ganoderma at 5 g / kg diet	13.40 ± 0.33 ^{b,c}	3.60 ± 1.09 ^b	0.011 ± 1.00 ^b
Ganoderma at 10 g / kg diet	14.80 ± 0.59 ^{a,b}	7.20 ± 1.12 ^b	0.019 ± 1.10 ^b
Ganoderma at 15 g / kg diet	15.40 ± 1.00 ^a	5.00 ± 0.99 ^a	0.014 ± 1.02 ^a

Values were expressed as mean ± SD. Values in the same column sharing the same superscript letters are not statistically significant at P ≤ 0.05.

Table (2) :
Effect of Feeding Ganoderma on Organs Relative Weight of Rats

Groups	Liver (%)	Heart (%)	Kidney (%)
Negative control	3.044 ± 0.83 ^{a,b}	0.258 ± 0.65 ^a	0.538 ± 0.03 ^a
Positive control	3.366 ± 0.83 ^a	0.306 ± 0.65 ^a	0.526 ± 0.02 ^a
Ganoderma at 5 g / kg diet	2.598 ± 0.93 ^{b,c}	0.302 ± 0.65 ^a	0.574 ± 0.07 ^a
Ganoderma at 10 g / kg diet	2.806 ± 0.83 ^{b,c}	0.292 ± 0.65 ^a	0.542 ± 0.10 ^a
Ganoderma at 15 g / kg diet	2.366 ± 1.08 ^c	0.278 ± 0.41 ^a	0.556 ± 0.09 ^a

Values were expressed as mean ± SD. Values in the same column sharing the same superscript letters are not statistically significant at P ≤ 0.05.

Table (3) :
Effect of Feeding Ganoderma on Serum Levels of Urea , Creatinine and Urea Nitrogen of Rats

Groups	Urea (mg/dl)	Creatinine (mg/dl)	Urea Nitrogen (mg/dl)
	Mean ±SD	Mean ±SD	Mean ±SD
Negative control	21.80 ± 2.69 ^b	1.05 ± 0.15 ^a	10.46 ± 1.40 ^a
Positive control	36.66 ± 2.00 ^a	1.46 ± 0.19 ^b	17.53 ± 1.65 ^a
Ganoderma at 5 g / kg diet	30.00 ± 2.93 ^{a,b}	1.39 ± 0.35 ^{a,b}	14.66 ± 0.99 ^{a,b}
Ganoderma at 10 g / kg diet	28.00 ± 1.83 ^b	1.33 ± 0.26 ^a	13.00 ± 1.30 ^b
Ganoderma at 15 g / kg diet	22.33 ± 1.33 ^b	1.29 ± 0.95 ^a	10.90 ± 1.09 ^b

Values were expressed as mean ± SD. Values in the same column sharing the same superscript letters are not statistically significant at P ≤ 0.05.

Table (4) :
Effect of Feeding Ganoderma on Serum Levels of Uric acid and Total protein of Rats

Groups	Uric acid (mg/dl)	Total protein (mg/dl)
Negative control	2.46 ± 0.37 ^c	6.60 ± 0.96 ^b
Positive control	4.43 ± 0.85 ^a	8.43 ± 0.82 ^a
Ganoderma at 5 g / kg diet	3.90 ± 0.32 ^{a,b}	7.13 ± 0.57 ^{a,b}
Ganoderma at 10 g / kg diet	3.36 ± 0.48 ^{a,b,c}	6.63 ± 0.74 ^b
Ganoderma at 15 g / kg diet	3.00 ± 0.14 ^{b,c}	6.36 ± 0.74 ^b

Values were expressed as mean ± SD. Values in the same column sharing the same superscript letters are not statistically significant at P ≤ 0.05.

Table (5) :
Effect of Feeding Ganoderma on Serum Levels of Superoxide Dismutase (SOD) , Catalase (CAT) and Glutathione Peroxidase (GPX) of Rats

Groups	(SOD) (mmol/l)	(CAT) (mg/dl)	(GPX) (mg/dl)
Negative control	94.80 ± 1.03 ^a	729.83 ± 0.96 ^a	35.94 ± 1.98 ^a
Positive control	56.51 ± 1.05 ^d	308.40 ± 0.76 ^d	29.18 ± 1.00 ^b
Ganoderma at 5 g / kg diet	61.63 ± 1.85 ^c	453.20 ± 1.25 ^c	33.41 ± 1.70 ^{a,b}
Ganoderma at 10 g / kg diet	76.41 ± 1.25 ^b	461.50 ± 1.00 ^b	34.88 ± 1.10 ^{a,b}
Ganoderma at 15 g / kg diet	92.42 ± 1.87 ^a	726 ± 1.87 ^a	35.41 ± 1.09 ^a

Values were expressed as mean ± SD. Values in the same column sharing the same superscript letters are not statistically significant at P ≤ 0.05.

Table 6 :
Effect of Feeding Ganoderma on Serum Levels of Glutathione (GSH) and Malondialdehyde (MDA) of Rats

Groups	(GSH) (nmol/mg)	(MDA) (mg/dl)
Negative control	9.15 ± 0.57 ^a	18.00 ± 1.59 ^b
Positive control	4.79 ± 0.77 ^c	25.81 ± 2.00 ^a
Ganoderma at 5 g / kg diet	5.76 ± 1.03 ^{b,c}	21.92 ± 1.84 ^{a,b}
Ganoderma at 10 g / kg diet	7.52 ± 0.60 ^{a,b}	20.63 ± 1.87 ^b
Ganoderma at 15 g / kg diet	8.49 ± 0.84 ^a	18.71 ± 1.35 ^b

Values were expressed as mean ± SD. Values in the same column sharing the same superscript letters are not statistically significant at P ≤ 0.05.

Histopathological Examination :

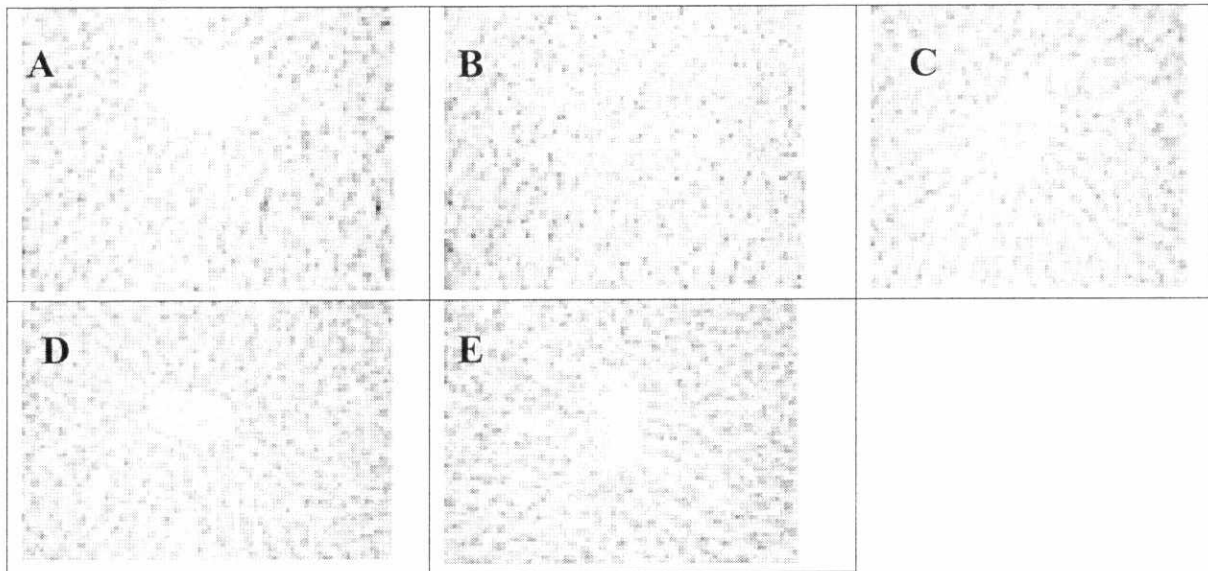


Fig. 1: Histopathological changes detected in the liver of (A) negative control, (B) positive control, (C) 5 g / kg diet of *Ganoderma lucidum* , (D) 10 g / kg diet of *Ganoderma lucidum* , (E) 15 g / kg diet of *Ganoderma lucidum* (H and E X 400) .

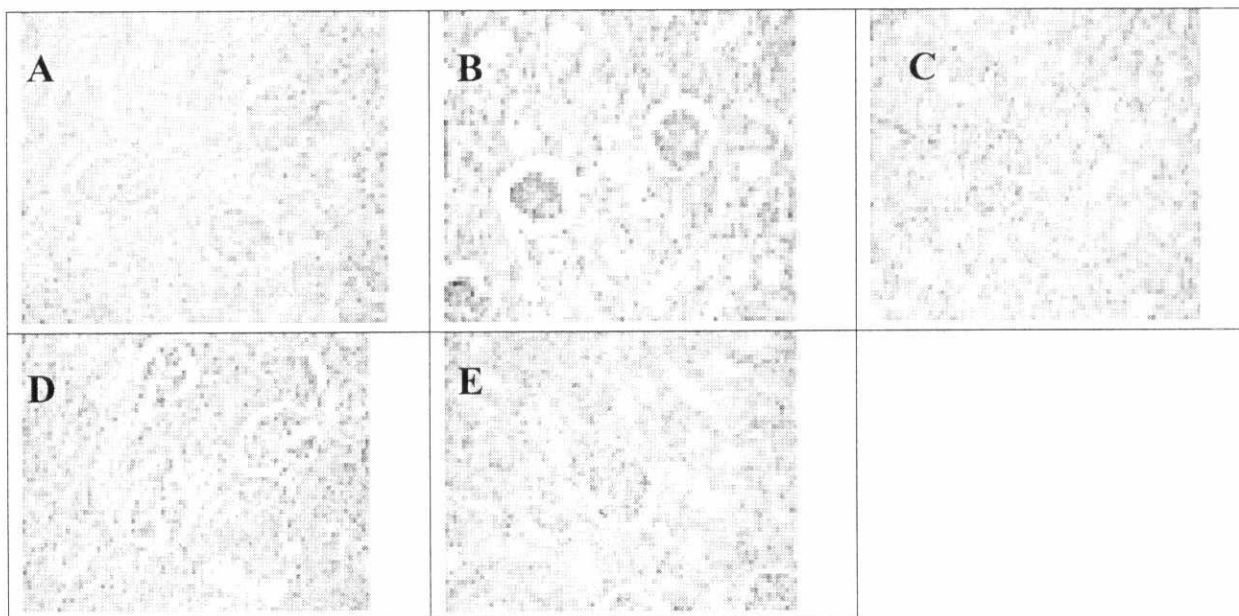


Fig. 2: Histopathological changes detected in the kidneys of (A) negative control, (B) positive control, (C) 5 g / kg diet of *Ganoderma lucidum* , (D) 10 g / kg diet of *Ganoderma lucidum* , (E) 15 g / kg diet of *Ganoderma lucidum* (H and E X 400) .

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كفاءة الجانوديرما (*Ganoderma lucidum*) ضد التسمم الكلوي المحدث بواسطة السيسبلاتين في ذكور الفئران البالغة .

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الملخص العربي

تهدف هذه الدراسة الى معرفه تاثير نبات الجانوديرما على تسمم الكلوي الناتج عن السيسبلاتين وذلك في ذكور الفئران البالغة. وتم استخدام خمس مجموعات من الفئران كل مجموعته مكونه من تسع فئران وتم تغذيه المجموعه الاولى على الغذاء المثالي (المجموعه الضابطه السالبة)؛ بينما المجموعات من (2-5) تم حقنهم انتربروتوني بالسيسبلاتين بجرعه (5 ملجم / كجم من وزن الجسم) وذلك لاحداث تسمم كلوي في الفئران؛ وقد تم تغذيه المجموعه (2) على الغذاء المثالي كجموعه ضابطه موجبه ، بينما باقى المجموعات تم تغذيتهم على نظام الغذاء المثالي المضاف اليه نبات الجانوديرما بنسبه 5 ، 10 ، 15 جم / كجم الطعام ، على التوالي. وقد اظهرت النتائج ان المجموعه الضابطه الموجبه اظهرت زياده كبيره في مستويات مصل الكرياتينين واليوريا وحمض اليوريك واليوريا النيتروجين والبروتين الكلي وكذلك (Malondialdehyde) وقد اظهرت النتائج انخفاض كبير في مستويات مصل لكل من (Catalase (CAT) , Superoxide Dismutase (SOD) , Glutathione Peroxidase (GPX) and Glutathione (GSH) وذلك عند مقارنة بالمجموعه الضابطه السالبة. بينما باضافه النسب المختلفه من الجانوديرما فقد اظهرت النتائج انخفاض كبير في مستويات مصل الكرياتينين واليوريا وحمض اليوريك، واليوريا والنيتروجين والبروتين الكلي و كذلك (MOD) ، وايضا اظهرت زياده ملحوظه في مستويات المصل لكلا من (GPX) , (CAT) , (SOD) (GSH) عند المقارنة بالمجموعه الضابطه الموجبه . ومن النتائج الحاليه يمكن استنتاج ان التغذيه بنبات الجانوديرما له تاثير علاجي ضد احداث التسمم الكلوي الذى تسبب بواسطه الحقن بالسيسبلاتين كما انها تمنع تكوين مضادات الاكسده. وبذلك نوصى باستخدام الجانوديرما وذلك لعلاج حالات تسمم الكلى.

الكلمات الرئيسية: ذكور الفئران ، سيسبلاتين، التسمم الكلوي ، الفطر ريشي، جانوديرما، وظائف الكلى، مضادات الاكسده.