

Therapeutic Effect of Gum Arabic on some Biochemical Parameters in Nephrotoxic Albino rats

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Abstract

The aim of the current study is to evaluate some biochemical parameters in rats treated with gentamicin to induce nephrotoxicity . The experimental study was conducted using 42 healthy adult male rat weighing 250-300 grams . The results showed a significant increase ($P \leq 0.05$) in the levels of urea and creatinine in the blood serum, an increase in the activity of liver enzymes AST, ALT, ALP and a significant decrease in the concentration of albumin in adult male rats injected with gentamicin (80 mg / kg IP daily for 10 Days) to induce nephrotoxicity compared to control group. The results showed a significant increase ($P \leq 0.05$) in the concentration of urea and creatinine in the blood serum and a significant increase ($P \leq 0.05$) in the activity of liver enzymes AST, ALT, ALP, and albumin concentration in (untreated induced nephrotoxicity) compared with (control group). The results showed a significant decrease ($P \leq 0.05$) in the levels of urea and creatinine in the blood serum and a significant decrease ($P \leq 0.05$) in the activity of liver enzymes AST, ALT, ALP, kidney weight and a significant increase ($P \leq 0.05$) in albumin concentration, from the induced nephrotoxicity group treated with (15% w / v / day) Gum Arabic compared to the untreated nephrotoxic group, but the values In all treated groups were less than the control group. The present study concluded that the induced nephrotoxicity group treated with Gum Arabic showed improvement in some biochemical and hematological parameters associated mainly with nephrotoxicity .

Keywords: Gum Arabic, Biochemical, Hematological, nephrotoxic, Albino rat

Introduction

The kidneys are the major organ” that the human” body” needs”to realize and perform various ”essential ”functions” inclusive extracellular fluid control, homeostasis ,detoxification and toxic metabolite excretion⁽¹⁾ . It has important and essential role in excretion of many drugs and chemicals, So the failure of kidney to remove there materials may lead to retention of these compounds which may accumulate gradually to toxic levels ⁽²⁾. Gentamicin can cause the nephrotoxicity and ototoxicity and for this reason ,that can restrict its use in severely ⁽³⁾ . Nephrotoxicity is a

specific disease that affects the kidneys occuring as a result of the accumulation of toxic metabolic discharge in the kidneys due to drugs and other toxic factors, in percentage”20%”of nephrotoxicity ”is caused and occurs due to drugs ;”this” percentage increases in the ”elderly ”due”to the”increased”life”span ⁽⁴⁾ . The main mechanism of gentamicin in inducing nephrotoxicity is continous production of mitochondrial reactive oxygen species (ROS) which leads to a decrease in key endogenous antioxidant enzymes. Elevated levels of ROS are capable to cause injury to numerous cellular molecules, inclusive lipids, nucleic acids, and proteins, thus impairing function of the cell and leading to its death

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ROS generation is capable of causing cell death by necrosis or apoptosis ⁽⁶⁾. Gum”Arabic”also known”as Gum Acacia, (GA) is known as an edible, water-soluble, dietary fibrous heteropolysaccharide,it is

obtained from the dried gummy exudate of the branches and stems of *Acacia seyal* or *Acacia senegal* trees ⁽⁷⁾. GA "possesses" biological effects including nephro-protective activity. It has several characteristics such as being antibacterial, antiviral, anti-inflammatory and antioxidant ⁽⁸⁾. Gum Arabic is antioxidant because it contains four antioxidant elements; copper, iron, manganese and zinc. Also it has positive effect on the antioxidant enzyme expression ⁽⁹⁾. AG's protective effects are likely linked to its antioxidant and anti-inflammatory and cytoprotective properties ⁽¹⁰⁾. It is known that it is very rich in antioxidant, which were reported to have antioxidants and reduced effect of lipid peroxidation ⁽¹¹⁾. The current study aims at evaluating the possibility of the therapeutic effect of Gum Arabic in concentration (15%w/v) on induced nephrotoxic by gentamicin in male albino rats. The study also aims at identifying the ideal concentration of treatment for the nephrotoxic by investigating Creatinine, Urea, ALT, AST, ALP, Albumin.

Methodology

The experimental study was conducted during the period from February 2020 to March 2020, and the experiment was conducted using 42 healthy adult male rat (*Rattus norvegicus*) weighing 250-300 grams. The animals were integrated with wooden shelves, under natural light (12 hours) and (12 hours) in the dark. The animals were placed in cages at laboratory temperature (23-25 °C). Food and water were introduced daily, and kept for a week before the acclimatization experiment began. Adult Male rat divided into two groups as following:

1. Control group: 18 rat will be kept without treatment and given 2mL /kg, normal saline.

2. Nephrotoxicity group: twenty male rat were induced nephrotoxicity in dose 80 mg/kg/body weight IP for 10 days. After ten days of the experiment, 12 male rat from induced nephrotoxicity.

Measurements include Estimation of kidney function (serum Urea and Creatinine). Estimation of liver function: ALT (Serum Alanine aminotransferase), AST: (Serum Aspartate aminotransferase), Serum Alkaline phosphate activity ALP, Albumin.

Results

Table 1. : Effect of Gentamicin on levels of serum Urea and Creatinine in induced nephrotoxicity in male rat

groups	Urea Mg/dl (Mean±SE)	Creatinine Mg/dl (Mean±SE)
Control group	B 36.5± 1.23	B 0.35± 0.009
Nephrotoxicity group	A 99.66± 1.20	A 2.05± 0.208
Sig. (2-tailed)	3.834	0.464

The different Capital letters refer to significant change ($P \leq 0.05$) between groups

The result in table (1) shows a significant increase ($P \leq 0.05$) in concentrations of Urea and Creatinine in serum of male rats treated with Gentamicin (80 mg/kg IP daily for 10 days) to induced nephrotoxicity in male rats compared with control group.

Table 2 : Effect of Gentamicin on Serum AST, ALT, ALP and ALB Levels in induced nephrotoxicity group of the male rat:

Groups	AST U/ml	ALT U/ml	ALP U/ml	ALB g/dl
Control group	B 139.66±7.59	B 50.83±3.84	B 155.5±10.95	A 3.95±0.187
Nephrotoxicity group	A 319.66±13.02	A 99.83±3.02	A 388.3±9.94	B 2.53±0.197
Sig. (2-tailed)	33.94	10.89	32.97	0.607

The different Capital letters refer to significant change ($P \leq 0.05$) between groups

Table (2) shows a significant elevated ($P \leq 0.05$) in liver enzymes AST, ALT and ALP activity in serum of induced nephrotoxicity group by gentamicin (80 mg/kg IP daily for 10 days) in male rats compared with control group .whereas, the results in same table, indicated that there was a significant decrease ($P \leq 0.05$) in ALB concentration in induced nephrotoxicity group compared with control group.

Table 3. : Therapeutic Effect of the Gum Arabic on levels of Serum Urea and Creatinine of the induced Nephrotoxicity in Male rats:

Groups (n=6)	Parameters (Mean \pm SE)	
	Urea Mg/dl	Creatinine Mg/dl
Control group	B 34.33 \pm 1.20	B 0.36 \pm 0.00
Nephrotoxicity group	A 130.33 \pm 18.94	A 2.60 \pm 0.15
Gum Arabic only (15%)	B 37.67 \pm 0.88	B 0.38 \pm 0.006
Gum Arabic (15%)+Nphrotoxicity	B 37.67 \pm 0.66	B 0.44 \pm 0.00
Gum Arabic (7.5%)+Nphrotoxicity	B 40.33 \pm 2.84	B 0.49 \pm 0.04
LSD	27.09	0.225

The different Capital letters refer to significant change ($P \leq 0.05$) between groups.

In Table 3 , the statistical analysis for kidney functions, creatinine and urea (Mg/dl) showed significant increase ($p \leq 0.05$) in the levels of serum

Urea and Creatinine in induced nephrotoxicity group compared with control group and There were significant decrease ($p \leq 0.05$) in the concentration of serum Urea and creatinine of the nephrotoxicity groups treated with Gum Arabic compared with nephrotoxicity group .

Table 4. : Effect of treatment with Gum Arabic on serum AST ,ALT , ALP and ALB concentration in induced nephrotoxicity group of the male rats.

Groups (n= 6)	Parameters (Mean±SE)			
	AST U/ml	ALT U/ml	ALP U/ml	ALB g/dl
Control group	C 138.66±5.60	C 49.33±2.40	D 151.66±4.05	A 3.93±0.26
Nephrotoxicity group	A 320.66±11.46	A 114.66±8.68	A 397.00±7.76	B 2.45±0.10
Gum Arabic only (15%)	C 139.00±1.73	C 52.00±2.51	DC 158.33±2.72	A 3.86±0.20
Gum Arabic (15%)+ Nphrotoxicity	B 178.00±2.64	C 58.00±0.57	C 168.66±0.33	A 3.76±0.16
Gum Arabic (7.5%)+ Nphrotoxicity	B 193.00±3.46	B 84.66±3.48	B 186.66±6.83	A 3.63±0.08
LSD	19.161	14.092	16.136	0.555

The different Capital letters refer to significant change ($P \leq 0.05$) between groups.

In the table 4 : The AST activity showed significant increase ($p \leq 0.05$) in nephrotoxicity group compared with control group . Result showed that there is highly significant decrease ($p \leq 0.05$) in the levels of AST activity of the nephrotoxicity groups treated with Gum Arabic in comparison with nephrotoxicity group but no significant difference ($p \geq 0.05$) when compare between the two groups .

Discussion

Gentamicin (GM) is one of the aminoglycoside antibiotics frequently used in the treatment of serious infections with aerobic gram-negative and gram-positive bacteria , The most evidenced series side-effects of gentamicin are nephrotoxicity and ototoxicity ⁽¹²⁾,Gentamicin can cause renal damage and dysfunction which marked by increase of serum urea and creatinine levels⁽¹³⁾ . The current study showed increase in the

level of the urea and creatinine become higher, This may be due to disturbed in transport functions of the epithelial cells of the collecting tubules and diffuse impairment in the functions of proximal convoluted tubules ⁽¹⁴⁾. Increased creatinine and urea levels in the blood serum are due to the inability of nephrons to put them with urine because of the damage that occurred in the convoluted tubules, which caused a defect in The efficiency of the nephron in ridding the body of wastes of cellular metabolism, as the kidneys ability to excrete Urea and creatinine are valuable biomarkers in assessing kidney performance and Gentamicin contributes in ROS levels Increased, such as hydroxyl radical and superoxide ⁽¹⁵⁾ . It was found that Gum Arabic protects rats against gentamicin-induced nephrotoxicity, likely in part, by inhibiting the product of oxygen-free radicals which causing lipid peroxidation ⁽¹⁶⁾ Gum Arabic may act to protection tubular epithelial cells of the renal cortex from free radical oxygen-mediated damage and inhibited the formation of oxidised product, this is supported by the fact that Gum Arabic has elevated

affinity to the free radical ¹⁷⁾ it has an additional beneficial effect on kidney function, which is related to its anti-inflammatory and antioxidative effects ⁽¹⁸⁾ . properties of antioxidant in the Gum Arabic may be due to the its ingredeint flavonoids and another polyphenolics, and it has been reported that these plant components possess lipid-antioxidant and antioxidant activities ⁽¹⁹⁾ . Data in table 2 show a significant rise ($P \leq 0.05$) in "serum of "ALT",ALP",AST levels"and"significant decrease in Albumin concentration of induced nephrotoxicity group by gentamicin, (80 mg/ kg IP daily for 10 days),GNT was also seen to catalyze hepatotoxicity secondary to ototoxicity and nephrotoxicity. It causes hepatic injury via enhancing the productin of free radicals that invade and destroyed hepatocytes ⁽²⁰⁾ . ALT and AST are two enzymes that are the most accurate indicators of necrosis or hepatocellular damage. Their levels in a number of hepatic diseases are show elevated .of the two enzymes, ALT is believed to be more diagnosis to hepatic injurys because it is primarily found in cytosole in the liver and elsewhere in low concentrations⁽²¹⁾ , High concentrations for these enzymes are outcomes of destruction of hepatocytes and increased cellular permeability ⁽²²⁾ Observed reduction in activity of all enzymes may indicate normal metabolism as well as improving liver function. In this line, liver enzyme activities are indicators of hepato-toxicity and liver function ⁽²³⁾ . The present study, shows reductions in albumin concentration may be attributed to impaired hepatocyte synthesis ,as a result of oxidative stress and hepatitis, along with increased protein breakdown and kidney loss ⁽²⁴⁾ , In this study ,its reported that animals which sever from nephrotoxicity which is caused by gentamicin when given Gum Arabic for purpose of treatment for 4 weeks , Table (4) notes significant decrease in serum AST,ALT,ALP, of male rat and this agree with ⁽²⁵⁾ who reported that the gum Arabic has a protective effect on the liver through reducing the blood level of liver enzymes; aspartate transaminase (AST), alanine transaminase (ALT), and alkaline phosphatase (ALP) and through decreasing the oxidative stress.

Present study, revealed that the Gum Arabic significantly decreased the activity of liver enzymes and may play a protective role against liver dysfunctions in rats ⁽²⁶⁾ , In mice and rats, GA has been act as protecting agent against hepatic and renal toxicities⁽²⁷⁾ ,The protective effects of Arabic gum are likely to be

related to its anti-oxidant and anti-inflammatory and cytoprotective properties⁽²⁸⁾ .

Conclusions

The study concluded that administration of Gum Arabic to rats via drinking water for 4 weeks decreased the side effects of Gentamicin-induced nephrotoxicity by inhibiting free radical , and enhancing renal and hepatic functions .

Ethical Clearance : Taken from University of Kufa ethical committee

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Conflict of Interest : Nil

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