RESEARCH PAPER

Asian Journal of Bio Science Vol. 6 Issue 2 (Oct., 2011) : 169-172

Nephroprotective effect of *Solanum nigrum* L. on gentamicin induced toxicity in male albino rats

N.PRIYA AND P. VENKATALAKSHMI

Department of Biochemistry S.T.E.T Women's College, MANNARGUDI (T.N.) INDIA

Email : venkatalakshmisathish@ymail.com

(**Received:** May, 2011; **Accepted :** Aug., 2011)

Solanum nigrum L., is a medicinal herb that has been used as nephroprotective agent in Chinese medicine. In this study, the protective effect of *Solanum nigrum* L., (SN) against gentamicin-induced nephrotoxicity in rats was evaluated. Nephrotoxicity was induced in Wistar rats by intraperitoneal administration of gentamicin 100 mg/kg/day for eight days. Effect of concurrent administration of fresh juice extract of *Solanum nigrum* at a dose of 100 mg/kg/day given by oral route was determined using serum creatinine, AST, ALT, blood urea, ALP, ACP, reduced glutathione, catalase, glutathione peroxidase and protein as indicators of kidney damage. The fresh juice extract of *Solanum nigrum* significantly protected rat kidneys from gentamicin-induced nephrotoxicity by normalizing the alterations in biochemical parameters. Hence, it can be concluded that the extract possesses significant nephroprotective activity.

Key words : Gentamicin, Nephroprotection, Nephrotoxicity, *Solanum nigrum*

Priya, N. and Venkatalakshmi, P. (2011). Nephroprotective effect of *Solanum nigrum* L. on gentamicin induced toxicity in male albino rats. *Asian J. Bio. Sci.*, **6** (2) : 169-172.

INTRODUCTION

The kidneys are organs that filter wastes (such as urea) from the blood and excrete them along with water, as urine. In humans, the kidneys are located in the posterior part of the abdomen. There is one on each side of the spine; the right kidney sits just below the liver, the left below the diaphragm and adjacent to the spleen.The major functions of kidney are excretion of waste products, homeostasis,maintenance of blood pressure, secretion of hormones such as erythropoietin, urodilatin, rennin and 1,25 dihydroxy cholecalciferol.

Nephrotoxicity can be defined as renal disease or dysfunction that arises as a direct or indirect exposure to medicines, and industrial or environmental chemicals. It is well established that toxic nephropathies are not restricted to a single type of renal injury. Some chemicals target one discrete anatomical region of the kidney and may affect only one cell type. Chemical insult to the kidney may result in a spectrum of nephropathies that are indistinguishable from those that do not have a chemical etiology.

Gentamicin is an aminoglycoside antibiotic, used to treat many types of bacterial infections, particularly those caused by gram-negative organisms. Gentamicin is nephrotoxic, which remains a major problem in clinical use.High doses (40 mg/kg or more) are necessary in animals to rapidly induce extended cortical necrosis and overt renal dysfunction. At this stage, a large number of structural, metabolic, and functional alterations are observed in tubular cells and several of these alterations have been claimed to be responsible for cell death or dysfunction. (Moulds *et al.,*2010).

Medicinal plants are nature's gift to mankind and are rich ancient heritage of India. Black nightshade is a fairly common herb or short-lived perennial shrub, found in many wooded areas, as well as disturbed habitats (Jansan van *et al,*. 2007). In India, the berries are casually grown and eaten; but not cultivated for commercial use. The berries are referred to as "fragrant tomato," - manathakkaali in Tamil. In North India, the boiled extracts of leaves and berries are used to alleviate the patient's discomfort in liver-related ailments, including jaundice. The present study was performed to investigate the nephroprotective effect of *Solanum nigrum* on gentamicin induced nephrotoxicity in rats.

RESEARCH METHODOLOGY

Collection of plant material :

The plant material *Solanum nigrum* was collected from Trichy district which was carefully identified with the help of regional tloras.

Animals:

Male albino rats of average body weight(150-200 g) were taken and acclimatized in the laboratory conditions for 7 days and they were randomly grouped into 4 groups of three each. They were purchased from animal house Trichy. They were maintained at room temperature under standard laboratory condition, supplied with commercial pellet diet and an unlimited supply of drinking water.

Chemicals:

Gentamicin was purchased from Nice chemical pvt.Ltd., cochin. All other chemicals and reagents used in this study were procured from Qualigen and Ranbaxy fine chemicals pvt.Ltd., Mumbai. All chemicals were used of analytical grade.

Extraction of plant material:

Aqueous extract was prepared according to the methodology of Indian Pharmacopoeia.The shade dried plant materials were subjected to pulverization to get coarse powder, which was subjected to Soxhlet extraction with distilled water. It was concentrated to dryness in flash evaporator under reduced pressure and controlled temperature (40-50°C). The aqueous extract was put in air tight container, stored in a refrigerator.

Phytochemical analysis:

Phytochemical analysis for major phytoconstituents of the plant extract was undertaken using standard methods.The plant extracts were screened for the presence of biologically active compounds like sugars, aminoacids, proteins, phenols, terpenoids, etc.

Experimental design:

Group I – Rats served as control.

Group II –Rats were administered with gentamicin sulfate (100 mg/kg orally).

Group III –Rats were administered with *Solanum nigrum* extract (100 mg/ kg orally).

Group IV– Rats were administered with gentamicin and aqueous extract(100 mg / kg orally). Biochemical parameters such as urea, creatinine, AST, ALT, catalase, glutathione peroxidase ALP, ACP, protein and reduced glutathione were evaluatedv using standard procedures .

RESULTS AND ANALYSIS

In the present study, the effect of aqueous extract of *Solanum nigrum* on gentamicin induced nephrotoxicity was evaluated through various biochemical parameters and the results are summarized below.

Table 1 shows the results of qualitative phytochemical analysis, which showed the presence of alkaloids, phenolic compounds, tannins, flavonoids, volatile oils and steroids.

Table 1 : Preliminary phytochemical analysis of *Solanum nigrum* L.

Phytochemical compound	Results of qualitative test
Sugars	–
Terpenoids	–
Alkaloids	+
Phenolic compounds	+
Tannins	+
Flavanoids	+
Volatile oil	+
Quinones	–
Steroids	+
Coumarins	–

(+) Positive (-) Negative

Table 2 shows the results of urea, creatinine, AST, ALT, catalase, glutathione peroxidase ALP, ACP, protein and reduced glutathione.GroupII rats showed elevated levels of urea, creatinine, AST, ALT, ALP and ACP and a decrease in the levels of catalase, glutathione peroxidase, protein, reduced glutathione. Treatment with herbal extract brought back the altered parameters to near normal.

Preliminary phytochemical analysis for *Solanum nigrum* indicated the presence of flavonoid, alkaloids, volatile oils and phenols . Phenols are very important plant constituents because of their free radicals scavenging ability due to the presence of hydroxyl group. The phenolic compound may contribute directly to antioxidant action. It is suggested that polyphenolic compounds have inhibitory effects on mutagenesis and carcinogenesis in human beings. Extract of *Solanum nigrum* was found to contain phenolic compounds in significant amount, which attributed to it's antioxidant activity.

The present observation correlates with the previous researches in that there was a significant increase in the blood urea level of gentamicin treated rats. In this study treatment with *Solanum nigrum* extract lowered blood urea levels in gentamicin intoxicated rat. Badary *et al.,*

Table 2 : Levels of various biochemical parameters in experimental and control groups

	Biochemical parameteres									
Groups	Urea mg/dl	Creatinine mg/dl	AST (mmol/mg)	ALT (mmol/mg)	Tissue catalase µg/mg	Tissue glutathion peroxidase mmol/mg	ACP mmol/mg	ALP mmol/mg	Serum protien (mg/dl)	Reduced glutathione (mmol/mg)
Group I	16.2± 0.67	2.12± 0.2	82.3± 0.13	56.5 ± 0.2	101.3±0.8	213.2 ±1.2	19.2 ± 0.5	43.2 ±0.3	6.02±0.12	13.5 ±0.01
Group II	24.3 ± 0.8	3.45±0.11	95.4± 0.59	81.4± 0.91	67.3± 0.3	163.1± 2.6	31.6 ± 0.8	59.6 ± 0.9	4.53±0.01	9.4 ± 0.01
Group III	18.3±0.93	2.26± 0.8	87 ± 0.12	65.6 ± 0.5	85.6± 0.1	177.4±1.3	19.9 ±0.2	44.1 ±0.3	5.75±0.81	11.7 ±0.02
Group IV	19.7± 0.45	2.97± 0.2	90.7± 0.33	71.2± 0.89	98.3± 0.5	192.2± .7	22.5 ±0.1	47.3 ±0.5	5.45±1.06	12.4 ±0.01

Values are X ± S.E (n=3)

(1997) reported that gentamicin intoxication causes kidney injury followed by renal impairment, which is manifested by the decrease in renal blood flow, creatinine clearance as well as increase in blood urea concentration and also up-regulation of antioxidant enzymes in renal cortex although kidneys are histologically normal.

Gentamicin overdose (acute or chronic) is often associated with a wide range of metabolic disorders including serum electrolytes, urea and creatinine derangements. As such, elevations in the serum concentrations of these parameters, particularly, serum urea and creatinine are considered reliable, well documented parameters for investigating drug-induced nephrotoxicity in animals and man (Adelman *et al*., 1981). Creatinine, on the other hand, is mostly derived from endogenous sources by tissue creatine breakdown. The plasma creatinine concentrations in normal individuals are usually affected by a number of factors such as the muscle mass, high protein diet, and catabolic state. Thus, serum urea concentration is often considered a more reliable renal function predictor than serum creatinine. In the present study, results obtained showed that acute nephrotoxicity was reliably established with 35mg /kg/ body weight of intraperitoneal administration of gentamicin.

A significant increase in AST activity was noted in group II when compared to group I. A significant decrease in serum AST level was observed in group III when compared to group II. Also a significant decrease ($p< 0.05$) in serum AST level in group IV was noted when compared to group II .

Gentamicin is a commonly used analgesic and antipyretic drug. The drug is safe at therapeutic levels, but an acute gentamicin overdose can lead to potentially fatal hepatic and renal necrosis in humans and experimental animals (Ajith *et al.,* 2002).An increased level of ALT ($p<0.05$) was found in group II rats when compared with group I. A significant decrease ($p<0.01$) in serum ALT level was noted in group III when compared to group II. Also there was a significant decrease ($p<0.05$) in serum ALT level in group IV when compared to group II. But there was no significant change between group I and group IV. In the present study treatment with *Solanum nigrum* normalized the elevated ALT levels.Serum level of catalase was decreased significantly in group II rats ($p<0.05$) when compared to group I. A significant increase in catalase level was observed in group III and group IV.

Catalase (CAT) is an enzymatic antioxidant widely distributed in all animal tissues, and the highest activity is found in the red cells and liver. CAT decomposes hydrogen peroxide and protects the tissues from highly reactive hydroxyl radicals. Therefore, reduction in the activity of CAT may result in a number of deleterious effects due to the assimilation of superoxide radical and hydrogen peroxide. Glutathione is one of the most abundant tripeptide, nonenzymatic biological antioxidant present in the liver. It removes free radical species such as hydrogen peroxide, superoxide radicals and maintains membrane protein thiols. Also it is substrate for glutathione peroxidase (GPx) (Kumar *et al*., 2001). Decreased level of GSH is associated with an enhanced lipid peroxidation. A significant decrease ($p< 0.05$) in blood glutathione peroxidase level was observed in group II when compared to group I. A significant increase ($p<0.05$) in the levels of tissue acid phosphatase in group II was observed.

Serum ALP was increased significantly in group II when compared to group I. A significant decrease in ALP level was observed in group III and group IV. Elevated level of tissue alkaline phosphatase in indicative of cellular leakage and loss of functional integrity of cell membrane in kidney cells (Heidemann *et al*., 1989). Administration of *Solanum nigrum* extract normalized ACP and ALP levels.

The extract of *Solanum nigrum* possesses strong antioxidant property that is why used in the present study to expect that the action of the toxic free radicals in the course of gentamicin administration, causing oxidative damage to the renal cortex would be antagonized. Reports

about similar ameliorating action of antioxidants upon gentamicin nephrotoxicity is available (Golamreza karimi and Mohammed ramezani, 2005). Agents with antioxidant action could antagonize the depletion of the reduced glutathione. Further studies are essential to find the active principles involved in nephroprotective effect of *Solanum nigrum*.

LITERATURE CITED

Adelman, R. D., Spangler, W. L., Beasom, F., Ishizaki, G., and Conzelam, G. M.(1981). Frusemide enhancement of neltimicin nephrotoxicity in dogs. *J. Antimicrobials & Chemotheraphy,* **7** : 431-435.

Ajith, T. A., Jose, N. and Janardhanan, K. K.(2002). Amelioration of cisplatin induced nephrotoxicity in mice by ethyl acetate extract of a polypore fungus, *Phellinus rimosus. J. Exp.Clin. Cancer Res.,* **2**: 487-491.

Badary, O. A., Nagi, M. N., AI-Sawaf, H. A., AI-Sohaibani, M. A. and AI-Bekairi, A. M.(1997). *Thyymoquinone ameliorates* the nephrotoxicity induced by cisplatin in rodents and potentiates its antitumore activity. *Canadian Journal of Physiology and Pharmacology,* **75**(12) : 1356-1361.

Golamreza karimi and Mohammed ramezani (2005). Cisplastin nephrotoxicity and protection by milk thistle extracts in rats. *Ecam.Advance.Access.,* **26**: 1-4.

Heidemann, H. T., Muller, L., Stepan, G., Hoffman, K. and Ohnhaus, E. E. (1989). Effect of aminophyline on *cisplatin* nephrotoxicity in the rat. *British* j .*Pharmaco.,* **97**(2):313-318.

Jansen van, Rensburg, W.S. *et al.*(2007). African leafy vegetables in South Africa. *Water SA*, **33**(3):317–326.

Kumar, Prasanth, Shashidhara,V., Kumar, S.and Sridhara, M. M. (2001). Cytoprotectives role of *Solanum nigrum* against gentamicin-induced kidney cell (vero cells) damage *in vitro, Fitoterapia.Jun.*,**72**(5) :481-486.

Moulds, Robert and Jeyasingham, Melanie (2010). Gentamicin a great way to start. *Australian Prescriber*, **(33)** :134–135.

**** * ****