Nephroprotective Effect Of Camellia sinensis L. On Lead Acetate Induced Male Albino Rats

S.Ramya and G.Prasanna*

Department of Biochemistry, Sengamala Thayaar Educational Trust Women's College, Sundarakkottai, Mannargudi, Tiruvarur dt, Tamilnadu, India.

*Corres. author : prasannakeertana@yahoo.in

Abstract: Protective effect of *Camellia Sinensis* L. leaf extract on lead acetate Induced nephrotoxicity in albino wistar rats were investigated by analyzing various biochemical parameters. Lead acetate induced kidney damage was well manifested by significant increase in renal parameters like urea, uric acid creatinine and serum electrolytes sodium, potassium,chloride, calcium, phosphorous and TBARS and decrease the levels of haemoglobin and protein. The oral administration of aqueous extract of *camellia sinensis* along with lead acetate reversed these altered parameters to normal level which indicating the nephroprotective efficacy of *camellia sinensis* against lead acetate induced kidney injury. From this , we concluded the phytochemical constituents such as flavonoids are responsible for the nephroprotective activity of *camellia sinensis*. Further extensive studies are required for its potential uses in clinical practice.
Key Words: *Camellia sinensis, Lead acetate*, Nephrotoxicity,Nephroprotectivity.

Introduction

Lead is being a ubiquitous environmental contaminant due to its significant role in modern industry. However both occupational and environmental exposures remain a serious problem in many developing and industrializing countries. In the recent past, lead toxicity has emerged as an important global problem with public health consequences.

The important sources of lead exposure include gasoline additives, lead based paints, ceramic glazes, drinking water system, cosmetics, battery and plastic recycling Industry. In India, the main source of lead pollution is through automobile exhaust because of use of unleaded (Royal commission in Environment pollution IX report). In developed countries like UK, the Royal commission in Environment pollution has banned the use of leaded gasoline.Toxicity of a chemical may be defined as the capability to cause injury in aliving organism. Toxicity is uncommon, results from inhalation of large amount of lead due to occupational exposure among industrial workers. The clinical symptoms are characterized by metallic taste, abdominal vomiting, diarrhea, anemia, oliguria, collapse and coma.

Lead may be absorbed through the skin, gastrointestinal tract or lungs and distributed to three major compartments-blood, soft tissue and bone. Blood lead is in equilibrium with lead in soft tissue.The soft tissues that take up lead are liver, kidneys, brain and muscle. Lead is not metabolized in the body but it may be conjugated with glutathione and excreted primarily in the urine. Lead is a multi-targeted toxicant affecting gastro intestinal tract, hematopoietic system, cardiovascular system, central and peripheral nervous system, kidneys, immune system and reproductive system.

Lead can damage all tissues, particularly the kidneys and the immune system. Recent evidence suggested that the kidney might also be one of the major organ for chronic lead toxicity. Lead may exert toxic effect on several organ system but those in the kidney are the most insidious.Nephrotoxicity results because kidney is the main route of elimination of lead [1].

Effect of lead on renal system is characterized by dysfunction of proximal renal tubules manifested by glycosuria, generalized amino aciduria, hyperphosphaturia, hyperphosphataemia and rickets are noted in acute lead poisoning. Long-term exposure to lead is known to cause irreversible functional and morphological changes, which include interstitial, tubular atrophy, and ultra structural changes in renal tubule mitochondria [2]. Chronic lead toxicity is caused by the change of renal function parameters.

Lead induced oxidative stress contributes to the pathogenesis of lead toxicity for disturbing the delicate prooxidant / antioxidant balance that exists within mammalian cells. Lead exposure cause generation of ROS and alteration of antioxidant defense in animals and occupationally exposed workers.

Medicine are largely based upon therapeutic principles due to a common belief that herbal products are less toxic without side effects and due to the lesser cost, people affected with disease are increasingly seeking traditional medicinal practitioners for treatment. However all such claims made by traditional medical experts are without scientific proof.On the basis of these, we analysed the nephroprotecter activity of camellia sinensis on lead acetate induced toxicity in rats.

Camellia sinesis, Green tea (family: Theaceae) is made from unfermented leaves and reportedly contains the highest concentration of powerful antioxidant called polyphenols. Green tea has been consumed throughout the ages in India, China, Japan and Thailand. In traditional Chinese and Indian medicinal practitioners use green tea as a stimulant, diuretic,astringent and to improve heart health[3]. Other traditional uses of green tea include treating flatulence (gas), regulation of body temperature, blood sugar,promoting digestion and improving mental processes.

Camellia sinensis leaves contain carotene,riboflavin, nicotinic acid, pantothenic acid and ascorbic acid. Caffeine and tannin are among the more active constituents. Ascorbic acid present in the fresh leaf is destroyed in making black tea. Malic and oxalic acid occur along with kaempferol, quercitrin, theophylline, theobromine,xanthine,hypoxanthine,adenine,gums,dextrins and inositol. Certain constituents, especially catechin, epigallocatechin, and epigallocatechin gallate are said to have antitoxidative properties.

Materials And Methods

Animal

Healthy young male rats (140gm- 160gm) were purchased from animal house. The group of rats were kept separately in individual stainless steel hoppers. The test animals should be characterized by strain, source, sex, weight and age.

Chemicals

Lead acetate and all other chemical used in the experiments were of analytical grade. The biochemical reagents used for the assays were purchased from Sri Anchana diagnostics, Tiruchirappalli.

Preparation of aqueous extract of *Camellia sinensis*

Camellia sinensis were purchased from Tiruchirappalli.10g of *camellia sinensis* was grounded to fine powder using mortar and pestle and was then stirred vigorously in 60ml of warm distilled water for 20 minutes. The aqueous extract was obtained from 10 gm of plant material was used for this study.

Group-1: Control Rats

Group-2: Rat induced with lead acetate(200mg/kg body weight)

Group-3: Rats induced with lead acetate (200mg/kg bodyweight) and orally treated with *Camellia sinensis* (100 mg/kg bodyweight)

Group-4: Rat orally treated with *Camellia sinensis* (100 mg/kg bodyweight)

At the end of experiment 21days rats were sacrificed by cervical decapitation.Blood was collected and centrifuged for serum separation. For plasma, blood was collected with anticoagulant and centrifuged (2000Xg

for 20min) to separate plasma. The tissues were dissected out, weighed and washing use of ice cold saline solution. Tissues were mixed and homogenized (10%w/v) in Tris-HCI buffer and phosphate buffer (0.1M; pH 7.4) and centrifuged at 3000xg of 20minutes at 4°C. The resulting supernatant was used for biochemical assays like estimation of haemoglobin[4], Protein[5],Albumin[6], Globulin,Urea[7], Uric acid[8], Serum creatinine[9] using jaffe's (1986)colour reaction, Sodium and potassium, chloride[10],Phosphorus[11], Calcium [12], TBARS[13], andSOD[14].

Results And Discussion

Lead (pb) is a highly toxic metal with no known physiological benefit and is a ubiquitous pollutant in the ecosystem as a result of its natural occurrence and its industrial use. In order to determine the effect of lead toxicity on kidneys, different biochemical parameters and was compared with lead exposed, control and *camellia sinensis* treated groups. The results were represented in tables. The *Camellia sinensis* had the ability to decrease the nephrotoxic effect of lead by increasing the activity of antioxidant (SOD).

Liver is an organ for the synthesis of a number of nutrients and also for the metabolism of carbohydrates, fats and proteins. Treatment with lead affects the normal function of the liver, leading to decreased metabolism of essential nutrients and accumulation of toxic intermediates. This adversely affects the normal function of the liver, leading to decreased metabolism of essential nutrients and accumulation of toxic intermediates. This adversely affects the liver and other tissues resulting in decreased body weight.

Lead causes various biochemical alterations and thus influences the body weight.There was a significant decrease in the body weight in lead induced group when compared with normal control group(Table 1). This reduction in the body weight might be due to the adverse effect of lead intoxication on the liver. Chronic administration of lead causes fibrosis and consequent accumulation of collagen in the liver[15].

Lead toxicity facilitates conversion of Hb into met-Hb. During Hb oxidation in the presence of lead, H_2O_2 is generated, which may induce lipid peroxidation in the erythrocyte cell membrane. As a result lead might induce generation of ROS by interacting with oxy-Hb, leading to peroxidative damage of erythrocyte membrane. Significant reduction in the level of Hb(-54.6%) might account for oxidative damage of erythrocytes in lead induced groups.

Lead binds to plasmatic protein, where it causes alteration in high number of enzymes. It perturbs protein synthesis in hepatocytes.. The observed decrease in protein content (-36.24%) of plasma of rats treated with lead might be due to decrease in hepatic DNA and RNA[16].

Administration of *Camellia sinensis* to lead treated groups showed a significant increase in haemoglobin (+72%) and protein (+33.59%) when compared lead induced group (group II). It was well established that *camellia sinensis* was potent inhibitor of oxidative damage(Table 1). This was evident from the significant normalization of Hb in *camellia sinensis* treated lead induced group (group III).

Chronic exposure to lead resulted in electrolyte retention, which might account for the elevated level of electrolytes sodium (+17.93%), potassium (73.26%), chloride (+13.80%), calcium (+10.93%) and phosphorus (+24.76%). Treatment with *camellia sinensis* normalized the level of electrolytes viz, sodium (-7.60%), potassium (-22.28%), chloride (-7.32%), calcium (-8.45%) and phosphorus (-16.24%) in group III(Table 2)..

The mechanism of lead induced renal damage includes increased oxidative stress[17], increase oxygen free radicals production seems to be induced by the interaction of lead with mitochondrial structures[18] which accounts for the elevation of renal parameters like urea (+82.53%) and creatinine (+73%). Lead exposure is associated to increase production of superoxide anion[19] and lipid peroxidation [20].

In our study we have observed that plasma TBARS, an index of lipid peroxidation, was markedly increased in rats exposed to lead, thus suggesting increased renal oxidative stress. A similar data had been previously reported[21]. In addition, plasma total antioxidant capacity was markedly decreased in these animals(Table 3). The decreasing activity of endogenous plasma SOD and SOD in tissues might be due to its consumption to neutralize the increased oxygen free radicals production probably due to the ultra structural damage in mitochondrial systems.

Our results suggests that *Camellia sinensis* prevent the formation of radicals and reduced the oxidstive stress, thereby resist the extent of lipid peroxidation in tissues, which may be the basis for the increased activity of antioxidants on the administration of *Camellia sinensis* on group III.

Table 1: Changes in the body weight and blood parameters

Groups	Body wt	Haemoglobin	Protein	Albumin	Globulin	A/G
Group I	173±3.5	13.77±0.40	6.075±0.30	3.6±0.30	2.45±0.05	1.35±0.14
Group II	147±2.44	6.25±0.38 (-54.6%)	3.87±0.28 (-36.24%)	2.5±0.17 (-30.5%)	1.35±0.12 (-44.89%)	1.8±0.14 (+33.33%)
Group III	169±4.97	10.75±0.25 (+72%)	5.17±0.71 (+33.59%)	3.2±0.42 (+28%)	2.0±0.25 (+48.14%)	1.5±0.04 (-16%)
Group IV	171±2.99	11.87±0.35 (+89.92%)	6.4±0.35 (+65.37%)	3.8±0.18 (+52%)	2.5±0.22 (+85.18%)	1.41±0.17 (-21.66%)

Values are mean ± SEM (n=6) and expressed as in %

Table 2 : Changes in the level of serum electrolytes

Parameters	Sodium	Potassium	Chloride	Calcium	Phosphorus
Group I	145±1.41	5.05±0.6	105±5.88	9.6±0.38	5.33±0.36
Group II	171±2.56 (+17.93%)	8.75±0.68 (+73.26%)	119.5±4.20 (+13.80%)	10.65±0.24 (+10.93%)	6.65±0.38 (+24.76%)
Group III	158±2.16 (-7.60%)	6.80±0.33 (-22.28%)	110.75±5.79 (-7.32%)	9.75±0.31 (-8.45%)	5.57±0.49 (-16.24%)
Group IV	151±5.44 (-11.69%)	4.72±0.16 (-30.58%)	100.25±5.43 (-9.48%)	10.1±0.47 (-5.16%)	5.22±0.26 (-5.16%)

Values are mean ± SEM (n=6) and expressed as in %

Table 3 : Changes in the level of renal parameters

Groups	Uric acid	Urea	Creatinine	TBARS	SOD-Plasma	SOD-tissue
Group I	2.6±0.38	15.75±0.96	0.52±0.10	74.45 ± 2.99	9.05±0.75	12.0±0.35
Group II	3.7±0.16 (+42.30%	28.75±4.11 (+82.53%)	0.9±0.13 (+73%)	414.5±24.48 (+455.25%)	4.8±0.19 (-46.96%)	8.3±0.30 (-30.83%)
Group III	3±0.27 (-18.91%	19.5±2.5 (-32.17%)	0.6±0.07 (-33.33%)	92.75±3.30 (+77.62%)	7.3±0.28 (+52.08%)	10±0.54 (+20.48%)
Group IV	2.5±0.38 (-32.43%	17.5±2.88 (-39.13%)	0.53±0.06 (-41.1%)	70.5±1.29 (+23.98%)	10.1±0.25 (+ 110.4%)	13.2±0.59 (+59.03%)

Values are mean ± SEM (n=6) and expressed as in %

Conclusion

The main damaging role of exposure to lead may be on the cellular membrane. The change in liver function and also the change in the shape and structure of haemoglobin molecule, which is the main component of RBCs, may damage organs such as kidney, liver and other critical organs. The present study indicated that the protective effect of *Camellia sinensis* might be due to its potent antioxidant and free radical scavenging activity.

From these observation, it was concluded that the lead was found to be toxic and it produced nephrotoxicity in albino rats. The present study was proved the nephroprotective action of *Camellia sinensis* against lead induced renal toxicity and it is a need to be evaluated for future study.

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