



AMELIORATING EFFECTS OF GARLIC OIL AGAINST MOSQUITO COIL SMOKE INDUCED HISTOPATHOLOGICAL CHANGES IN RAT KIDNEY

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ABSTRACT

Present study was undertaken to evaluate the effect of garlic oil against mosquito coil smoke induced histopathological changes in kidney of the albino rat. Rats were exposed to one mosquito coil smoke (Baygon brand) for 8 hours (10 AM to 6 PM) daily for 28 days, Histopathological study reveals a remarkable damage to kidney tissue after inhalation of mosquito coil smoke. After supplementation of garlic oil (0.1 ml/100 g. b.wt) histopathological alterations have been mitigated in comparison to mosquito coil smoke exposed rats.

KEYWORDS: Mosquito coil, Kidney, albino rat, Garlic oil



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INTRODUCTION

Mosquito coils are widely used as mosquito repellent and are slow burning device which emit smoke containing one or more insecticides¹. The most common active ingredients of mosquito coils are various pyrethrins accounting for about 0.3 – 0.4% of the coils mass². They are effective against many genera of mosquitoes including aedes, anopheles, and mansonias³. The irritants released from the mosquito coil smoke such as aldehydes, sulphates and polycyclic aromatic hydrocarbons⁴. When a mosquito coil is burned, the insecticides evaporate with smoke, which prevents the mosquito entering the room. Kidney performs elimination of foreign substance, regulation of water and maintenance of concentration of many components in extracellular fluid. Inhalation of mosquito coil smoke may effect the functions of the kidney. Antioxidants are substances or nutrients in our foods which can prevent or slow the oxidative damage in our body. They acts as free radicals scavengers and hence prevents and repair damage done by these radicals. Garlic which is used as an antioxidant can safely interact with free radicals and terminate the chain reaction before vital molecules are damaged.

MATERIALS AND METHODS

Adult and healthy wistar albino rats (110-160g) of both the sexes were kept in polypropylene cages and maintained at standard laboratory conditions of temperature $21\pm 0.5^{\circ}\text{C}$ and relative humidity $60\pm 5\%$ with a photoperiod 12 hours/day. The experimental protocol was in accordance with guidelines approved by the institutional ethics committee. The rats were feed on commercial food pellets (Golden feeds, New Delhi) and water *ad libitum*. Experimental animals were acclimated for one week prior to the experiment.

Test article

The Baygon brand mosquito coils manufactured by Bharat box factory Ltd., Samba (J & K) was used for experiment which contains pyrethroids (d-trans allethrins) 0.10

w/w and other ingredients 99.9% w/w. It is measured 12 cm diameter, 85 cm length and 14.0 g weight.

Antioxidant

Garlic Pearls soft gelatine Capsules (Ranbaxy's Global Consumer Health care) were used as antioxidant. Garlic oil was given orally (0.1 ml/100 g. b.wt.) to each rat per day for four weeks.

Present experiment was conducted in partially ventilated rooms (26 m³). The rats were grouped into three sets, control set I and Experimental sets (II, III), contain five rats each. The rats of control set (without mosquito coil smoke) and experimental sets were kept in a partially ventilated room separately. Experimental set II was exposed to one mosquito coil smoke for 8 hours (10 AM to 6 PM) per day for four weeks. Experimental set III was exposed to one mosquito coil smoke with supplementation of garlic oil (0.1 ml/100g. b.wt) for 8 hours (10 AM to 6 PM) per day for four weeks.

Tissue Collection

The control and experimental rats were anesthetized and dissected carefully. Kidney were taken out to assess the total kidney weight and histopathological study.

Histopathological Study

The small pieces of kidney tissue of control and experimental rats were fixed in 10% formalin and dehydrated through a series of ethanol solution. The tissue were embedded in paraffin wax. The section of 5 μ (micron) thickness were cut and stained with haematoxyline and eosin. Sections were examined under light microscope for histopathological study.

RESULTS

Histopathological examination of the kidney tissue in control rats showed an outer, granular appearing cortex and an inner striated appearing medulla and composed of huge number of nephron. Each nephron consists of a renal corpuscle and renal

tubules, the glomerulus, surrounded by Bowman's capsule. The parietal layer between two layers of the capsule is the urinary space. One proximal convoluted tubule is lined by columnar epithelium cells having numerous closely packed cilia. The distal convoluted tubule is lined by cuboidal cells with cilia in their epithelial lining (Plate – 1a & b).

Histopathological Changes

After inhalation of mosquito coil smoke, histopathological observations showed

marked symptoms of renal tissue impairment. The glomerulus are degenerated and renal tubules lost their characteristics appearance indicate tubular degeneration and intertubular spaces are infiltrated by inflammatory leucocytic cells. Glomerulonephritis and tubular necrosis are seen at some places (Plate II a & b). After supplementation of garlic oil, histopathological alterations like glomerular degeneration and glomerulonephritis are almost disappear. Tubular degeneration is mostly recovered and leucocytic infiltration is seen at some places (Plate III a & b).

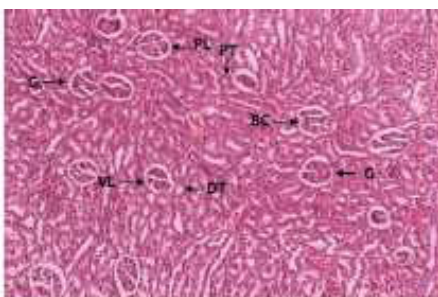


Plate- I



Plate- II

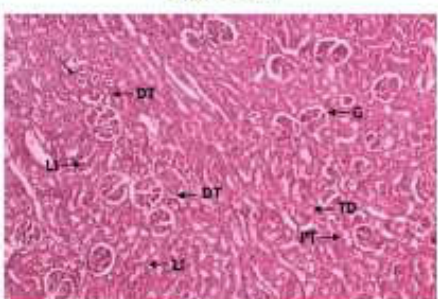


Plate- III

Plate-I : Photomicrograph of kidney section of control rats (x100)

Plate-II: Photomicrograph of kidney section of albino rat after 28 days exposure to mosquito-coil smoke (x100)

Plate-III: Photomicrograph of kidney section of albino rat after 28 days exposure to mosquito coil smoke with supplementation of garlic (x100)

BC	-	Bowman's capsule	PL	-	Parietal layer
DT	-	Distal convoluted tubule	PT	-	Proximal convoluted tubule
G	-	Glomerulus	TD	-	Tubular degeneration
GD	-	Glomerular degeneration	TN	-	Tubular necrosis
GN	-	Glomerular nephritis	VL	-	Visceral layer
LI	-	Leucocyte infiltration			

DISCUSSION

Histopathological assessment of kidney tissue of mosquito coil smoke inhaled rats shows glomerular degeneration, tubular degeneration, tubular glomerulonephritis, leucocytic infiltration, tubular necrosis and urinary space. These alterations in the kidney tissue is the indication of inflammatory responses caused by irritants released by mosquito coil smoke. The toxicity of mosquito coil smoke is caused by its combustion products such as heavy metals, allethrins and wide range organic vapour⁵. These particles can reach the lower respiratory tract. Its acute exposure produce mainly mucosal irritation of eye and long term exposure to mosquito coil smoke induce asthma leads to the production of histopathological changes in lung, Liver and Kidney of rodents⁶. Mosquito coil smoke and pyrethroids are the potent inhibition of mitochondria complex and oxygen consumption hence, they inhibit the production of ATP in mitochondrial of cells, leads to alterations of Na⁺/K⁺ pump kinetics⁷. Histopathological changes in the kidney of rats reflect the failure of membrane ion pump, because of lack of cellular ATP allowing the cell to accumulate fluid⁸. Accumulation of phospholipids, fatty acids and cholesterol within the cell due to inability of mitochondria to utilize them for ATP production results in

fatty degeneration of parenchymal cells which is responsible for tubular degeneration and tubular necrosis in rat kidney after exposure to pyrethroids⁹. Pyrethroids generate from the mosquito coil smoke causes tubular degeneration, leucocytic infiltration, tubular necrosis and glomerular degeneration in the kidney of rats^{9,10}. Garlic oil which is used as antioxidant protect the cellular structure against peroxidation. It proven successful in protecting different organs against oxidative and inflammatory injuries in rats¹¹. The high antioxidant potential of garlic may be a result of its high content of sulfur compounds such as allin, ajoene, vinyldithins and several allyl sulphides that have shown considerable activity¹². Garlic provides protection against free radicals damage in the body through antioxidant activities¹³. The mechanism of the antioxidant activity of garlic, such as trapping damaging free radicals, when allicin decomposes it forms 2-propenesulfenic acid and it binds to free radicals¹⁴. The component of garlic may partly be explained by its secondary effect on possible increase in renal reabsorption by basic electrolytes like sodium and potassium¹⁵. Raw garlic combat the oxidative stress through modulatory effect on ROS¹⁶ and ameliorates nephro toxicity in rats¹⁷.

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