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Effect of smoke from mosquito coil on serum aspartate transaminase, alanine transaminase and alkaline phosphatase activities in male albino rats

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A B S T R A C T

The effects of smoke from mosquito coil on serum alkaline phosphatase (ALP), alanine transaminase (ALT) and aspartate transaminase (AST) activities were investigated in male albino rats using spectrophotometric methods. The animals were grouped into four: A, B, C and D. The animals in group A (Control) were not exposed to the smoke from the mosquito coil while those in groups B, C and D were exposed to the smoke for six, ten and fourteen hours respectively for two weeks. Decrease in physical activities, food and water intake was observed in the animals in groups B, C and D. Blood samples were collected on the fifteenth day following the last day of exposure period. The serum AST activities (µ/l) of the animals in groups A, B, C and D were 31.00±1.40, 36.00±1.10, 47.00±1.80 and 60.00±2.30 respectively with the corresponding values of serum ALT activities (µ/l) as 56.00±1.50, 60.00±2.10, 69.00±2.00 and 81.00±2.20. The serum ALP activities (µ/l) recorded 78.00±2.20, 90.00±2.30, 101.00±1.40 and 119.00±2.40 for the animals in groups A, B, C and D respectively. There were duration-dependent significant (P>0.05) elevations of serum AST, ALT and ALP activities.

Introduction

The fight against mosquitoes has led to the production of many insecticides. These insecticides are in different formulations usually applied with the intention of reducing, if not checking, the devastating effects of insects (Hassar, 1990).

Mosquito coils are slow burning devices that emit smoke containing insecticides and are used in close proximity for protection against mosquitoes to prevent malaria (Garba *et al*., 2007a). Many people, especially the poor and rural dwellers, use mosquito coils because of its low cost and effectiveness in killing mosquitoes. The most common active ingredients of mosquito coils are various pyrethroids that are effective against many genera of mosquitoes including *aedis*, anopheles and mansonia (Krieger *et al*., 2003).

Besides these advantages, the smoke from burning mosquito coils has some undesirable effects to the biological system. It also produces toxic effects in non- target species and the toxic response depends on the dose of the smoke in relation to the size of the victim. The frequency of exposure to mosquito coils plays a role on the degree of damage caused by the smoke (Johnson, 1997).

Enzymes are proteins that catalyse specific biochemical reactions (Crook, 2006). These enzymes almost always function intracellularly and have no physiologic use in the plasma. In healthy individuals, the levels of these enzymes are fairly constant, and represent a steady state in which the rate of release from damaged cells into the plasma is balanced by an equal rate of its removal from the plasma. The presence of elevated activity in plasma indicates tissue damage that is accompanied by increased release of intracellular enzymes (Pamela *et al*., 2005; Crook, 2006).

The toxicity that results from exposure to smokes from burning mosquito coils may be attributed to the metabolic transformation of the smoke in the liver. In most cases, the damage in biological components results from toxic metabolites (some of which can be potent mutagens) produced during metabolism of the smoke from burning mosquito coils (Cosida, 1993).

There has been a growing concern among the public regarding the routine and prolonged use of mosquito coils (Anvita *et al*., 2006). This work was designed to determine the effect of smokes from burning mosquito coils on the activities of serum alkaline phosphatase (ALP), alanine transaminase (ALT) and aspartate transaminase (AST) in albino rats.

Materials and Methods

Materials

The mosquito coils were bought from Kpirikpiri Market in Abakaliki, Ebonyi State and the male albino rats from the animal house of Department of Veterinary Medicine, University of Nigeria, Nsukka.

Methods

Exposure of the animals to the smoke from mosquito coil

The 24 male albino rats were separated into four different cages with uniform structure and openings (100cm (Length) x 60cm (Width) x 70cm (Height), one third of the upper part of the cage was covered with wire gauze for aeration). Each of these cages (labeled A, B, C and D) contained six rats. Group A (Control) was not exposed to the smoke of the coil. Groups B, C and D were exposed to the smoke from burning mosquito coil for six, ten and fourteen hours respectively each day for two weeks.

Collection of blood samples

Blood samples were collected from the animals through heart puncture on the fifteenth day following the completion of the 14-day exposure period.

Determination of enzyme activities

The methods of Talib and Khurana (1999) were used.

Data Analysis

All the tested parameters were subjected to statistical analysis using T-test. Differences between means were regarded significant at $P<0.05$ (Oyeka, 1996).

Result and Discussion

The control group was found to be more agile than the exposed groups. Taiwo *et al.* (2008) reported depression and muscle tremor as physical symptoms of exposure to mosquito coil smoke. Voithione *et al.* (1996) also reported that the animals exposed to pyrethroid compounds (transfluthrin) showed signs of tiredness and mental confusion; abnormal electroencephalogram being evident of excess production of acetylcholine.

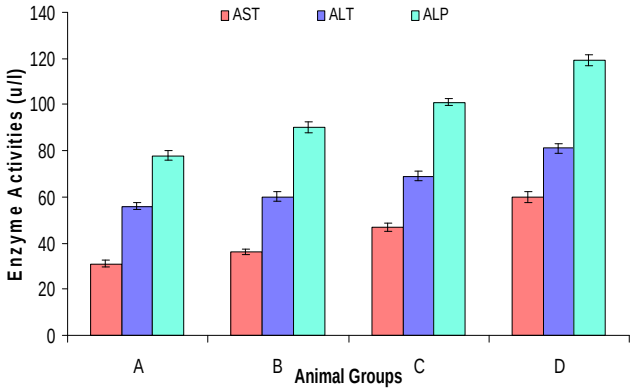

Fig.1 Serum enzyme activities

A = Those not exposed to the smoke of the coil (Control)
B = Those exposed to the smoke for six hours
C = Those exposed to the smoke for ten hours
D = Those exposed to the smoke for fourteen hours

There was a duration-dependent significant (P>0.05) increase in AST activities in the sera of the exposed groups. Tomei *et al.* (1998) reported similar increase in AST activities in the sera of the workers exposed to similar insecticides having pyrethroid compounds as active ingredient. Garba *et al.* (2007b) reported a high serum AST activity as a result of exposure to mosquito coil smoke.

The ALT activities in sera of the exposed animals increased significantly (P>0.05) and duration-dependently (Fig. 1). Thomson *et al.* (1997) reported an increase in ALT and amylase activities in rats given intramuscular injection of cyfluthrin, a pyrethroid. Another report by Banzedon *et al.* (1986) revealed an increase in ALT activities in the sera of insecticidal workers exposed to pyrethroid compounds. In contrast, Chizefin *et al.* (1992) reported that there was no significant increase in ALT activities in the sera of insecticidal workers (adults) exposed to pyrethroid compounds. This result might be as a result of exposure duration because the report has it that the workers were on shift schedule, working after intervals of two days. As a result of the day's intervals, there might be enough time for the liver to detoxify the pyrethroid compounds since this compound is relatively easily hydrolysable.

There was also a significant (P>0.05) duration-dependent increase in ALP activities in the sera of the exposed animals (Fig. 1). Tomei *et al.* (1998) using the insecticide – carbamates, phosphate esters and pyrethroids observed that there was a significant increase in ALP activities of the exposed workers. Srivastava *et al.* (1991) reported a significant increase in serum ALP activity, which they traced to hepatic damage after exposure to the classes of pesticides. Generally, Abubakar and Hassan (2007) reported significant elevations in serum ALT, ALP and AST activities due to exposure to different brands of mosquito coil smokes for fourteen days.

The significant elevation in the activities of these liver marker enzymes in the serum is an indication of hepatotoxic effect of smokes from mosquito coils, which increases according to exposure duration. It is advisable to avoid frequent exposure to mosquito coils.

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