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TOXIC EFFECT OF TRANSFLUTHRIN BASED LIQUID MOSQUITO REPELLENT ON THE LIVER ENZYMES IN *Rattus norvegicus* (BERKENHOUT)

Shekhar Biswas[1], Vishwakant[1], Anand Pratap Singh[1], Prem Sagar[2]

[1]Department of Zoology, Agra College, Agra Affiliated to Dr. Bhimrao Ambedkar University, Agra, Uttar Pradesh, India

[2]Department of Zoology, Government PG College, Jalesar, Affiliated to RMPSU Aligarah, Uttar Pradesh, India

Email : Shekharbiswas442@gmail.com

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Abstract

One of the major and ongoing sources of indoor air pollution in homes is the use of liquid mosquito repellent. Major insecticides found in mosquito repellents include transfluthrin, allethrin, cypermethrin, deltamethrin, etc., all of these falls into the pyrethroid group. A significant increment is shown in the level of Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST) and Alkaline Phosphatase (ALP) in *Rattus norvegicus* (Berkenhout) after 7, 15, 30, 45 and 60 days exposure to liquid mosquito repellent in comparison to control group. The current research demonstrates how liquid mosquito repellent has toxic effects on various liver enzymes. This repellent's active ingredient is deadly and harmful to both humans as well as environment too.

Keywords: Repellent, Transfluthrin, Pyrethroid

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Introduction

Since indoor pollution has a greater impact than outdoor pollution, it is a severe issue. People spend more than 90% of their time in their homes or offices without being aware of the kind of toxins that are present. Mosquito repellents, paints, smoking, fragrances, furniture polish, glues, air fresheners and many more household goods are a few of the significant sources of indoor air pollution. These are the so-called volatile organic compounds, which primarily come from chemicals and solvents. One of the major and ongoing causes of indoor air pollution in houses is the usage of insect repellents. The environment is polluted by both liquid and solid insect repellents. When the liquid form is present, the airborne dangerous compounds it contains combine with it and spread over the entire space. You can lessen your chance of contracting malaria and other infectious diseases by using mosquito repellents such coils, vaporizers, mats and creams. Because they interfere with mosquitoes ability to smell, they successfully deter mosquitoes from landing on people to feed. We are using pyrethroid and related derivatives as the main active ingredients in our mosquito repellents. The pyrethrum plant, Chrysanthemum cinerariifolium, produces dried and crushed flowerheads that are used to make the oldest known insecticides, known as pyrethroid (Siddique *et al.*, 2015). Based on their chemical makeup and harmful effects, pyrethroids have been classified into Type I and Type II classes. In contrast to Type II pyrethroids, Type I pyrethroids do not contain a cyano group (Akthar *et al.*2012). It primarily affects the sodium channel, which is exposed for an extended period of time. This causes protracted sodium current to flow, which results in the nervous system being overexcited (Narahashi *et al.*, 1992). The central and peripheral nervous systems of insects can be paralysed by these highly lipophilic esters (Abdrabouh 2021). A fast-acting, low persistency pyrethroid insecticide is transfluthrin, chemical formula $C_{15}H_{12}C_{l2}F_4O_2$. Inconsistent usage of transfluthrin can result in poisoning symptoms such jitteriness, anxiety, tremors, convulsions, skin allergies, sneezing, runny nose and irritation. An efficient preventative and treatment for sanitary and storage pests, transfluthrin is a pyrethroid insecticide with a broad range of action that acts by touch, inhalation, and repellent due to its significant lethal potential. A single or repeated exposure to insect repellents may have some short-term or long-term negative health effects. Humans would develop all lungs-related ailments like cough, cold, wheezing, asthma, etc. if repellents are regularly used. These lung-related illnesses are all a result of repellent side effects. It results in headaches, irritability, brain damage, memory loss, and breathing issues. Although poor use of repellents frequently results in allergic reactions and skin irritation, the average person is still unaware of how indoor air pollution affects people. The albino rat was chosen for the current investigation because it is easy to handle in a lab setting and shares many physiological traits with humans.

Materials and Methods

For the present study, the common liquid mosquito repellent of A Brand will be used. It contains transfluthrin (1.6 % w/w) as the main active ingredient. Healthy and adult albino rats, Rattus norvegicus (Berkenhout) was taken for the present study. The rats were divided into control group and treated groups, further control group and treated groups was divided into 5 sub-groups having 10 rats each. For six hours each day for 7, 15, 30, 45, and 60 days respectively, albino rats were exposed to liquid mosquito repellent vapours all over their bodies. Control Group (A) consists of a total of 10 rats while

Treated group consists of a total of 50 rats with 5 sub-groups (B, C, D, E and F) with 10 rats in each group. The rats of the control group and treated groups will be dissected out on the 7th, 15th, 30th, 45th and 60th days respectively. For the purpose of separating the serum for the assessment of liver enzymes among all the groups, the blood samples were taken directly from the ventricles of dissected albino rats using a cardiac puncture. Alkaline Phosphatase (ALP) was estimated by the method of King and King's (1954) while the estimation of Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) was done by the method of Reitman and Frankel's (1957). The acquired data were used to calculate the mean and standard error of the mean, and the significance level was established using the 't' test.

Results

The current study indicates the use of transfluthrin based liquid mosquito repellent in treated albino rat's shows elevation among the liver enzymes as compared to control rats. The present findings indicates the significant and highly significant increased level of Alkaline Phosphatase (ALP), Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) after 7, 15, 30, 45 and 60 days respectively.

Discussion

In many parts of the country, it is now regular practice to use insect repellents. Between mats, coils, and sticks, liquid insect repellent is the most convenient to use. Because of their widespread overnight use, people of all ages and both sexes are inevitably exposed to them (Srivastava et al., 2005). Due to their efficiency and inexpensive cost, pyrethroid-based mosquito repellents are widely utilized. Studies in a variety of animals utilizing a wide range of dosages and administration times have linked pyrethroids to oxidative damage, as seen by abnormal markers (Singh et al., 2021). Liver is the largest gland of the body which plays a major role in metabolism, synthesis and secretion of bile, glycogenesis, gluconeogenesis, glycogenolysis, deamination and urea formation, synthesis of plasma proteins, blood purification, yolk synthesis, detoxification, etc., any damage to liver will hinder in all these functions. In the present study there is a significant increment in level of Alkaline Phosphatase (ALP), Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) have been observed in liver, they have been commonly associated with liver dysfunction or damage. Aminotransferases (ALT & AST) play a major role in metabolism of non-essential amino acids. ALT present in the hepatocytes is a cytosolic enzyme and concerned with intracellular metabolism. AST also present mainly in liver, skeletal muscles, RBCs and related to mitochondrial damage (Nafiu et al., 2020). In addition to its hydrolase and transphosphorylase activities, ALP is a membrane-bound enzyme that is ubiquitous across all cellular membranes. ALP is most abundant in the bone marrow, the intestinal mucosa, the liver, and the biliary tract epithelium. In the event of hepatic cell injury and bile duct obstruction due to hepatocyte growth, serum ALP activity rises (Ahmad et al., 2011). It plays a vital role in metabolism and biosynthesis of macromolecules and present mainly in liver. The elevation in liver enzymes activities can be attributed to production of free radicals due transfluthrin inhalation that cause oxidative stress which results in hepatocytes necrosis leading to leakage of this enzyme into blood stream. Similar to present findings Akhtar et al., 2012 reported the significant increased activity in ALP, AST and ALT after prallethrin induced serum biochemical changes in wistar rats. In support of current findings Divakar et al. (2015) noticed the increased activity of ALT and AST in swiss albino mice after the toxicity caused by allethrin and the protective role of piperine and curcumin to decrease the effect. Parmar et al. (2019) also reported rise in ALP, AST, and ALT after repeated toxicity of Beta-Cyfluthrin in wistar rats. The study of Karim et al. (2020) noticed the elevation of liver enzymes after the health complications caused by mosquito coil smoke inhalation in mouse model. In support of present findings Sharma and Bansal (2022) reported significant increase in ALP, AST and ALT levels in the biochemical parameters after Malathion toxicity.

Table – I Effect of Transfluthrin Based Liquid Mosquito Repellent on Alkaline Phosphatase (U/L) in *Rattus norvegicus* (Berkenhout) after 7, 15, 30, 45 and 60 days Exposure.

S.No.	No. of days	No. of rats	Range Mean ± S.Em.	
			Control	Treated
1	7 Days	10	87.64–92.89 (90.07 ± 0.48)	99.87–104.81 (102.02 ± 0.48) ↑**
2	15 Days	10	87.64–92.89 (90.07 ± 0.48)	110.24 – 116.87 (114.11 ± 0.58) ↑***
3	30 Days	10	87.64–92.89 (90.07 ± 0.48)	119.44 – 126.81 (123.62 ± 0.62) ↑***
4	45 Days	10	87.64–92.89 (90.07 ± 0.48)	127.63 – 132.44 (130.09 ± 0.48) ↑***
5	60 Days	10	87.64–92.89 (90.07 ± 0.48)	133.01 – 139.45 (135.45 ± 0.66) ↑***

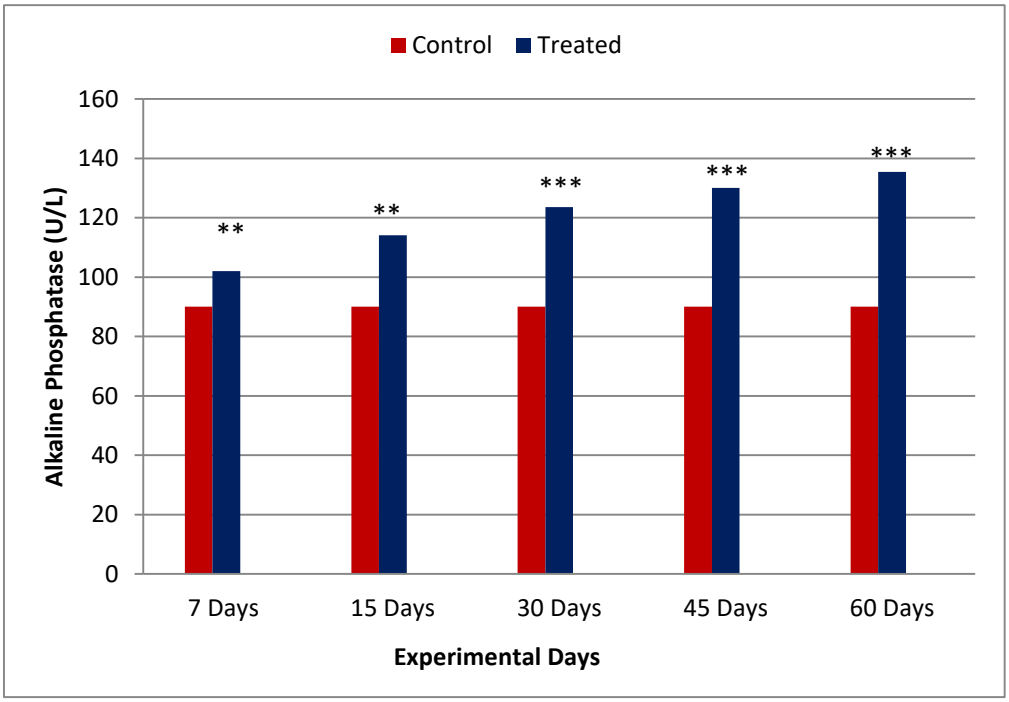

Fig- 1- Effect of Transfluthrin Based Liquid Mosquito Repellent on Alkaline Phosphatase (U/L) in *Rattus norvegicus* (Berkenhout) after 7, 15, 30, 45 and 60 days Exposure

Table – II- Effect of Transfluthrin Based Liquid Mosquito Repellent on Alanine Aminotransferase (U/L) in *Rattus norvegicus* (Berkenhout) after 7, 15, 30, 45 and 60 days Exposure

S.No.	No. of Days	No. of Rats	Range Mean ± S.Em.	
			Control	Treated
1	7 Days	10	21.84–33.81 (27.04 ± 1.15)	38.78 – 43.11 (40.67 ± 0.48) ↑**
2	15 Days	10	21.84–33.81 (27.04 ± 1.15)	42.59 – 47.51 (44.66 ± 0.47) ↑***
3	30 Days	10	21.84–33.81 (27.04 ± 1.15)	47.24 – 52.05 (49.68 ± 0.51) ↑***
4	45 Days	10	21.84–33.81 (27.04 ± 1.15)	50.29 – 54.93 (52.80 ± 0.45) ↑***
5	60 Days	10	21.84–33.81 (27.04 ± 1.15)	53.44 – 56.49 (54.86 ± 0.31) ↑***

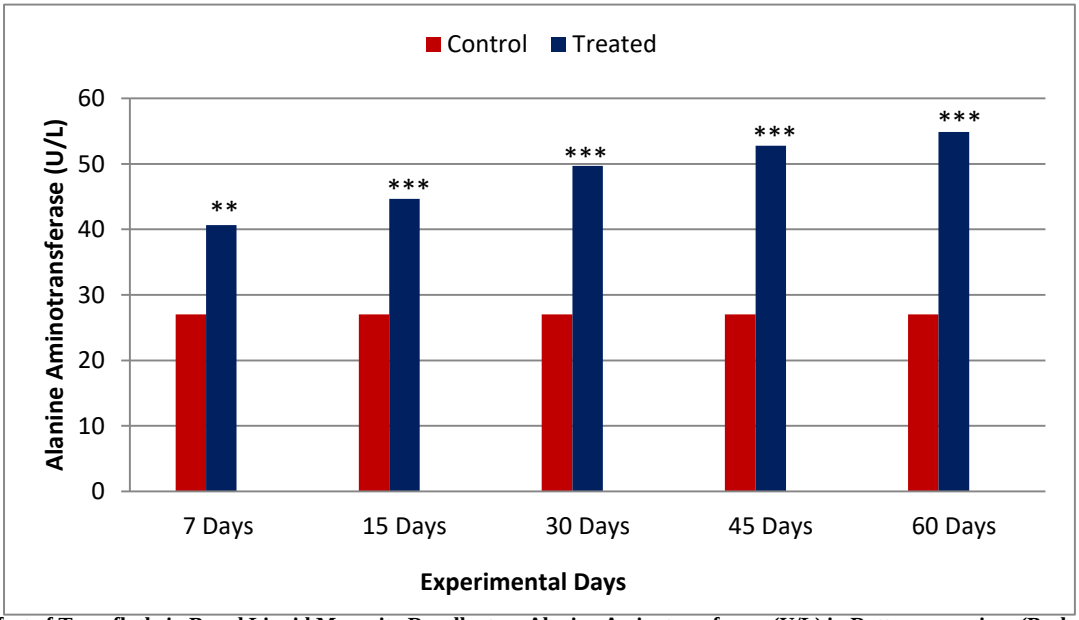

Fig- 2 Effect of Transfluthrin Based Liquid Mosquito Repellent on Alanine Aminotransferase (U/L) in Rattus norvegicus (Berkenhout) after 7, 15, 30, 45 and 60 days Exposure

Table – III Effect of Transfluthrin Based Liquid Mosquito Repellent on Aspartate Aminotransferase (U/L) in *Rattus norvegicus* (Berkenhout) after 7, 15, 30, 45 and 60 days Exposure

S.No.	No. of Days	No. of Rats	Range Mean ± S.Em.	
			Control	Treated
1	7 Days	10	22.41 - 26.56 (24.61 ± 0.46)	35.87 – 39.81 (37.97 ± 0.43) ↑**
2	15 Days	10	22.41 - 26.56 (24.61 ± 0.46)	39.53 – 47.02 (43.93 ± 0.79) ↑***
3	30 Days	10	22.41 - 26.56 (24.61 ± 0.46)	48.63 – 52.33 (50.68 ± 0.40) ↑***
4	45 Days	10	22.41 - 26.56 (24.61 ± 0.46)	52.69 – 58.29 (54.49 ± 0.56) ↑***
5	60 Days	10	22.41 - 26.56 (24.61 ± 0.46)	55.51 – 61.02 (58.27 ± 0.54) ↑***

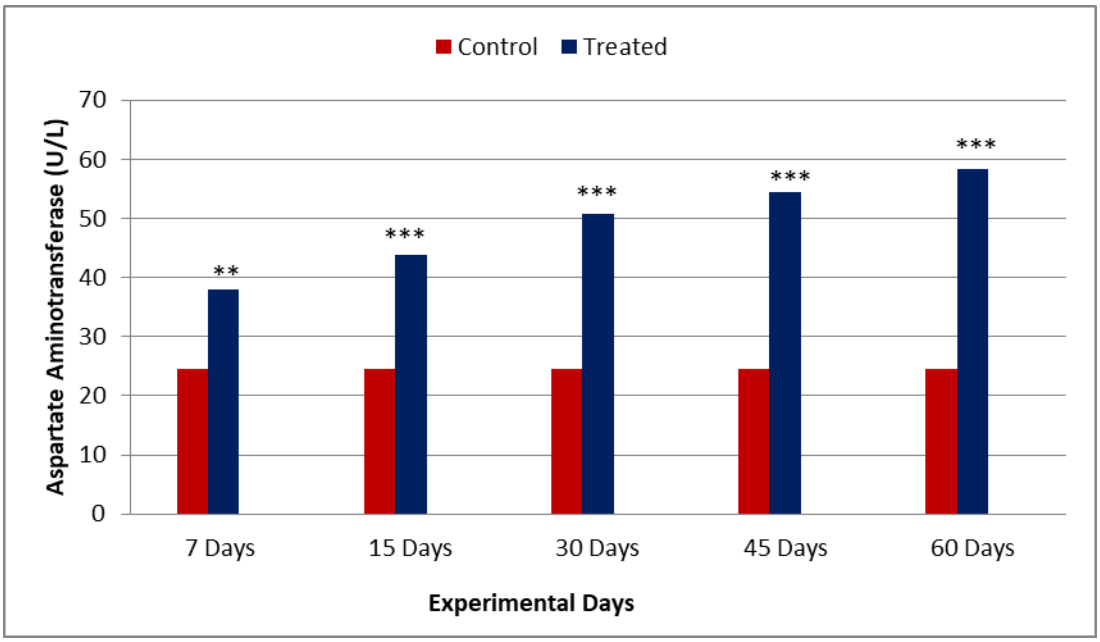

Fig- 3- Effect of Transfluthrin Based Liquid Mosquito Repellent on Aspartate Aminotransferase (U/L) in *Rattus norvegicus* (Berkenhout) after 7, 15, 30, 45 and 60 days Exposure

Conclusion

Mosquitoes are vectors for many lethal diseases including malaria, dengue, etc. Humans are using many different types of methods to avoid these vectors. One of the commonly used methods is liquid mosquito repellent. Mosquito repellent not only kill the mosquitoes but also harms the human being. So, we can say that mosquito repellent is a good friend and a bad evil. The proposed research work will help people to aware about the indoor air pollution caused by liquid mosquito repellent and the findings of the proposed research work can be extrapolated to the higher mammals including humans. The proposed research work would provide a baseline data for further researchers and scientists involved in such kind of study.

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References

Srivastava, A., M. K. Srivastava and R. B. Raizada (2005) Ninety-Day Toxicity and One-Generation Reproduction Study in Rats Exposed to Allethrin-Based Liquid Mosquito Repellent. *J. Toxicol. Sci.*, **31**(1) :1-7.

Ahmad, L., A. Khan and M. Z. Khan (2011) Cypermethrin Induced Biochemical and Hepato-Renal Pathological Changes in Rabbits. Int. J. Agric. Biol., 13(6) : 865-872.

Nafiu, S. A., M. Zakariyya, Z. Y. Hassan and M. K. Ahmad (2020) Toxicological Effect of Inhaled Mosquito Incense Sticks Smoke on the Histology and Biochemical Responses in Experimental Rats. Fudma, J. Sci., 4(4) : 391-400.

Singh, H., R. K. Diwan, R. Singh, P. Manik, A. Rani and S. Ahmad (2021) Experimental Validation of Vitamin C's Defensive Function Against the Biochemical Changes Triggered by a Pyrethroid-Based Mosquito Coil (PBMC) on Testis of Albino Rats. Int. J. Mosquit. Res., 8(1) :01-05.

Sharma, C. D. and G. Bansal (2022) Malathion Alters Biochemical Parameters of Liver in Albino Rats. Ind. J. Experimen. Biol., 60 :438-441.

Karim, R., D. K. Ghose, F. Rahman, T. Hossain, R. Rahman, A. Rahman and R. Islam (2020) Evidence of Health Complications Caused by Mosquito Coil Smoke Inhalation in Mouse Model. J. Adv. Biotechnol. Exp. Ther., 3(2) :122-127.

Akhtar, A., A. A. Deshmukh , C. G. Raut , A. P. Somkuwar and S. S. Bhagat (2012) Prallethrin Induced Serum Biochemical Changes in Wistar Rats. Pest. Biochem. Physiol., 102 :160-168.

Divakar, D., D. Sasmal, A. Kumar, A. Kumar and N. Sharma (2015) Prophylactic Role of Piperine and Curcumin in Allethrin Altered Hematological and Biochemical Parameters in Swiss Albino Mice. Pharmacol., 6(8) :396-412.

Parmar, H. C., J. K. Raval, J. M. Patel, P. D. Vihol, I. H. Kalyani and M. C. Prasad (2019) Haemato-Biochemical Study: Induced Beta Cyfluthrin Repeated Toxicity with Reversal on Wistar Rats. Int. J. Curr. Microbiol. App. Sci., 8(3): 100-111.

Abdrabouh, A.E. (2021) Susceptibility of Young and Adult Rat Kidneys to Impacts of Mosquito Coil Fumes. Egypt. J. Bas. Appl. Sci., 8(1) :1-11.

Narahashi, T., J. M. Frey, K. S. Ginsburg and M. L. Roy (1992) Sodium and GABA-Activated Channels as the Targets of Pyrethroids and Cyclodienes. Toxicol. Lett., 64 :429-436.

Siddiqui, N., S. Nazir and R. Jabeen (2015) Mosquito Coil Smoke Inhalation Effects on Interstitium of Kidney of Albino Rats. PJMHS, 9(2):672-675.

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