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EFFECT OF EXPOSURE AND WITHDRAWAL OF PYRETHROID AND HERBAL BASED MOSQUITO VAPORIZER FUMES ON BODY WEIGHT OF MALE ALBINO RATS

Morphology

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ABSTRACT

Introduction- Growth of rats occurred at two stages-In first stage, all parts of animal (head, body, limbs and tail) grow, resulting till maturity. In second stage, there is increase in body weight which is not accompanied with tail or limb length. It is thought that increase in body weight during second stage is due to increase in body fat. Average birth weight of albino rats is 5-6 gram. An adult male rat weight is 300-450 gram. Life span of rat is 2-3 years. Pyrethrum is the oldest and most widely used botanical insecticide. A great importance of pyrethroid is to control the mosquito borne diseases. They are well absorbed orally and via inhalation, but poorly absorbed through skin. Many safe alternate measures that could be used to avoid toxicity of pyrethroid based insecticides and to control the growth of mosquitoes. These days herbal repellents are frequently used. They are derived exclusively from herbal extracts and natural oils. They are easily biodegradable and leave no residues in the environment. **Material & Method-**A total of 26 healthy male albino rats of the age between 1-2 months, weighing between 120-180 grams were obtained from the animal house of Indian Institute of Toxicology and Research, Lucknow. The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 statistical Analysis Software. The values were represented in Number (%) and Mean±SD. **Observation & Result-** Exposure of pyrethroid as well as herbal vaporizers were associated with decreased food and water intake. Pyrethroid exposure caused significant loss of body weight when compared to control. Loss in body weight was more in pyrethroid exposure as compared to herbal exposed group. Significant improvement of body weight was more in group IIB (herbal withdrawal group) than group IB (pyrethroid withdrawal group). Our study recommended to aviod pyrethroid based mosquito vaporizers as much as possible, in our routine life.

KEYWORDS

Pyrethroid, Herbal, Vaporizers, Toxicity, Body weight

INTRODUCTION

Mosquitoes are one of major vector of human diseases like-Malaria, Dengue, Yellow fever, Haemorrhagic fever etc. In 1996 WHO reported the worldwide annual consumption of mosquito repellants to be approximately 29 billion pieces **(Sharma,2001)**. The most common ingredient in these repellants were various form of pyrethrin. These days herbal based mosquito repellants are also available in the form of coil, fumes, aerosol and mat. They are derived by herbal extracts and natural oils **(Kamble 2012)**.

MATERIALS AND METHODS

The present study was conducted in Department of Anatomy with collaboration of Department of Pharmacology, King George's Medical University, UP, Lucknow. Ethical clearance was obtained from Animal Institutional Ethical Committee, King George's Medical University.

A total of 26 healthy male albino rats of the age between 1-2 months, weighing between 120-180 grams were obtained from Animal House of Indian Institute of Toxicology and Research, Lucknow. After procurement of rats, they were allowed to acclimatize for 2 weeks and were fed freely on standard pellet diet 5 gm/rat/day purchased from Hindustan Lever Limited. The composition of pellet was corresponded to nutritional standards recommended by U.S. National Research Council. Environmental condition was maintained with proper aeration and good source of light (12 hours light- 12 hours dark) and a temperature variation of 24°C + 3°C was maintained.

Rats were kept in proper hygiene and care was delivered in accordance with the guidelines given by CPCSEA.

Exclusion Criteria:

1. Female Rats
2. Diseased Rats

Study Design:

Animals were divided into 3 groups-

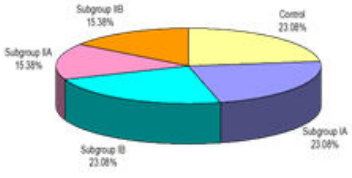
1) Group 0 (Control)- 6 rats with no exposure.
2) Experimental Group I- 12 rats, exposed with fumes of chemical based mosquito vaporizer 8 hours /day for 12 weeks. (Good Knight Mosquito vaporizer containing Transfluthrin-0.88% w/w)

This group again subdivided into 2 subgroups IA and IB. The purpose of it was to observe reversal effect in 6 rats of subgroup-IB that were kept for additional 4 weeks without any exposure under normal condition like control group.

3) Experimental Group II- 8 rats exposed with herbal based mosquito vaporizer 8 hours/ day for 12 weeks. (Mosrelief mosquito vaporizer containing azadirachta 6%, Nimba 6%, Eucalyptus 6%, Cymbopogan 6% etc)

This group also subdivided into 2 subgroups- IIA and IIB. Subgroup IIB, contained 4 rats to see reversal changes after stopping exposure for 4 additional weeks, under normal condition like control group.

FIGURE-1 DISTRIBUTION OF STUDY POPULATION



Weight Measurement:

Weight of each rat was measured with the help of electronic weighing machine at the time of procurement which was considered as Baseline Group II was found to be least (Fig-2).

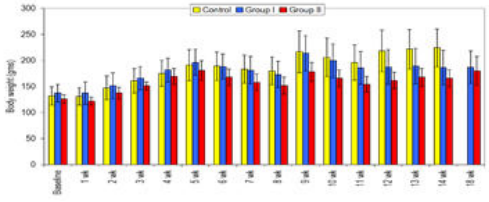
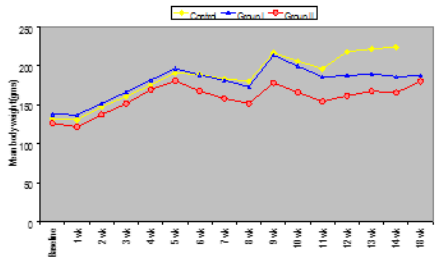


Figure-2 Intergroup Comparison Of Weight At Different Time Intervals

At all time intervals of observation i.e. from baseline to 14 weeks body weight of rats of control group was found to be higher than that of rats of Group II, which were significantly found at 10th to 14th weeks (Fig-3)



Upto 7 week and at 9 weeks, body weight of rats of either Subgroup IA or Subgroup IB was maximum and of either Subgroup IIA or Subgroup IIB was minimum, but these differences were not found significant ($p \geq 0.05$)

At 8th week, 10th week and thereafter 11-14 weeks, body weight of animals of control group was found to be maximum followed by herbal exposed withdrawal group (IIB) and minimum of Pyrethroid exposed group (IA) (Figure-4).

Differences in body weight among the subgroups were found to be statistically significant at 12 weeks ($p=0.048$) and 14th week ($p=0.033$). (Figure-3 and 4).

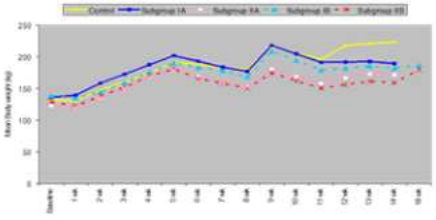


Figure-4 Comparison Of Change In Weight At Different Time Intervals At Subgroup Level (tukey Hsd) weight.

Then each rat was measured at the end of each week. First two weeks were for acclimatization, then upto 14th week for exposure and at the end of 18th week was withdrawal period.

Mode Of Exposure:

Rats of Group I and II were kept in a room of dimensions 9.5 feet x 9 feet x 9 feet having proper cross ventilation. Rats were exposed to whole body inhalation to respective vaporizer fumes for 8 hours 9 AM to 5PM).

Statistical Analysis:

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 statistical Analysis Software. The values were represented in Number (%) and Mean±SD. The comparison of body weight between groups and subgroups was done by Tukey HSD method.

OBSERVATION AND RESULT:

At baseline mean body weight of animals of Group I (137.67± 17.04 gms) was found to be highest than that of control (132.17± 17.34 gms and group II (126.25± 8.31 gms) was found to be least but these differences were statistically insignificant ($p=0.267$) (Table-1).

From 6th to 14th week of exposure, the body weight of animals of control group were highest followed by Group I while Ggroup

Table-1Comparison of Body weight (BW) at different time intervals at Group level

DISCUSSION:

The present study revealed a significant effect on gross anatomical parameter i.e. body weight. Body weight reveals the overall state of metabolism of an individual. Weekly observation of body weight helped us to monitor the growth and development of rats**.**

Decrement of body weight was more in exposure group I followed by group II which was highly significant especially during later weeks of exposure period. The decrease in weight was found to be time dependent and was also associated with decrease in food and water intake. The result was in concordance with earlier studies who also reported a decrease in body weight following exposure to different type of pyrethroid formulation. **Akunna et al (2013a)** and **Liu & Sun (1988)** demonstrated significant decrease in body weight following exposure to allethrin based mosquito coil. Loss in body weight in exposed rats is consistent with earlier report of reduction in body weight following lambda-cyhalothrin (a synthetic pyrethroid) exposure **(Fetoui et al., 2012)**. The observed decrease in body weights of rats in this study may be due to diminished food consumption caused by anorexia, due to stress generated by smoke or decreased utilization of food. The decrease in body weight may also be due to the role of pyrethroid in pituitary which could have led to reduction in growth hormone and hence decreased in body weight **(Elbetieha et al., 2001).** Other factors may lead to decrease in weight gain in exposed group-like organ directed toxicities, oxidative damage, change of colony and anxiety to strange environment **(Gentry-Nielsen et al., 2004).**

On the other hand, animals of control (group 0) had a significant increase in body weight. It means that they were still in their active growth phase during the study, which was consistent with the study of **Saalu et al (2008).** On cessation of exposure for 4 weeks, we found there was an increase in body weight of withdrawal groups i.e. group IB and IIB, but they did not reach the control level suggesting that it might require some more duration to recover. **Al-Hamdani and Narasinhachary (2011)** stated that body weight of mice treated with various doses of cypermethrin had significant reduction. While after six weeks of cessation of cypermethrin, body weight of mice was improved but did not reach control level.

In present study, improvement of weight was more in herbal withdrawal group (IIB) than pyrethroid withdrawal group (IB). It might be due to the appetite enhancing role of certain herbs.

Limitation Of Study:

Rate of individual components of aerosol inhaled by animals were not monitored in absence of inhalation chamber.

CONCLUSION:

Our present study was an attempt to delineate the effect of fumes of transfluthrin and herbal based mosquito vaporizer exposure on morphology of albino rats. Study also included the withdrawal of exposure to see the spontaneous reversibility of changes after one month of discontinuation of exposure.

Pyrethroid vaporizer fumes induced lethargy, depression, rough and scanty fur during 12-14th weeks of exposure. Exposure was associated with decreased food and water intake as well as significant loss of body weight.

Effects seen after 4 weeks of withdrawal of exposures-- Significant improvement in appearance, morphology and body weight in group IIB than group IB.

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Conflicts Of Interest:

None

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