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EFFECTS OF SUB-LETHAL EXPOSURE OF LAMBDA-CYHALOTHRIN ON BIRTH OUTCOME OF FEMALE WISTAR RATS

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ABSTRACT

Lambda-Cyhalothrin (LCT) is widely used pyrethroid pesticide for pests control in agriculture, home, health and so on. The aim of this study was to investigate toxicity of sub-lethal doses of Lambda-Cyhalothrin on birth outcome of pregnant female wistar rats (Rattus novergicus). Animals were randomly assigned into four equal groups. Group 1 (control) received normal feed and water. Animals in group 2 to 4 were treated with three concentrations of lambda-cyhalothrin 0.2%, 0.4% and 0.8% respectively through feed and drinking water *ad libitum* from gestation day 1 through to weaning. The results on litter size indicates a significant dose dependent decrease ($p<0.05$) across treated groups. Total litter birth weight significantly decreased ($p<0.05$) in a dose dependent manner compared with control. A significant ($p<0.05$) stillbirth was recorded among treatment groups when compared with that of control. Also, postnatal survival showed a significant ($p<0.05$) dose dependent lower number of pups survival between parturition and weaning. These results demonstrated that lambda-cyhalothrin has toxic effects on birth outcome in treated rats.

KEYWORDS: Lambda-Cyhalothrin, Birth outcome, Female Wistar rats.

INTRODUCTION

Pesticides are agrochemicals used in agricultural sector for pests control, improvement and maintenance of non-agricultural areas like public urban green areas, sport fields, public health protection practices for pests control, for example, humans from vector-borne disease, like schistosomiasis, malaria, dengue fever among others (Hoffman, *et al.*, 2000; Johnston, 2001).

Pesticides have been associated with health and environmental hazards (WHO, 1990; Hayes, *et al.*, 2006; Sanborn, *et al.*, 2007; Alewu, and Nosiri, 2011 and Goulson, 2014). Health hazards that have been associated with pesticides include, reproductive and developmental, endocrine disruption, gastrointestinal, neurological, carcinogenic, respiratory, dermatological, hematological, hepathological etc. (Bretveld, *et al.*, 2006; Bassil, *et al.*, 2007; Bjorling-Poulsen, *et al.*, 2008; Osman, 2011 and Mnif, *et al.*, 2011). Pesticides residues can be found in water, fruits, food, animal feeds, vegetables, human and animal breast milk and it is a great concern for prenatal exposure and health hazards in offspring (Pirsaheb, *et al.*, 2015). Animals and humans are most sensitive to the toxicity of pesticides in the embryonic and early postnatal periods of life, exposure of pesticides in utero or early childhold period paves way in the pathogenesis of many diseases such as coronary heart disease, cancer, obesity among others (Goldman, *et al.*, 2004; Zoeller, 2010). Lambda-cyhalothrin a pyrethroid pesticide is one of the pesticides widely used. Lambda-cyhalothrin (trade name Attacke) is a potent synthetic type II pyrethroid pesticide. It is a stomach, contact and residual pesticide that acts as a neurotoxic interfering in the conductance of nerve membranes by prolonging the sodium channel current (Clark, 1997). Based on the health hazards associated with pesticides exposure in the present literature, this study aimed to assess the toxicity of lambda cyhalothrin on birth outcome of pregnant female Wistar rats.

MATERIALS AND METHODS

This research was ethically approved by the appropriate authority and the guide line of National Research Council (NRC, 2011) were followed for care and maintenance of animals.

Animals

Mature Healthy female and male Wistar rats (*Rattus norvergicus)*, thirty six (24 female and 12 male) in number weighing between 160-185g were used. They were procured from the Animal House of the Department

of physiology, University of Port Harcourt, River State Nigeria.

After three weeks of acclimatization before the commencement of the treatment at normal room temperature. The female rats were randomly divided into four groups, group 1 served as control group while 2 to 4 groups were the treatment groups and were paired 2 female per 1 male for fertilization to occur which was confirmed by a vagina smear test carried out each morning, confirmation of spermatozoa was considered day 1 of gestation.

The animals were housed in labeled plastic cages covered with wire gauze under standardized animal conditions, fed with pelleted food (Vita feeds) twice daily with each rat consuming estimated feed weight of 30g per day and drinking water *ad libitum.*

Lambda cyhalothrin Preparation
Three concentrations 0.2%, 0.4% and 0.8% of sublethal solutions were prepared by diluting the commercially available Lambda Cyhalothrin liquid in distilled water (DW).

Lambda Cyhalothrin administration
The solutions were administered to the female Wistar rats only through feed by mixing 15ml of different prepared concentration of lambda cyhalothrin accordingly to 15g of feed twice a day throughout the period of gestation and 21 days after parturition. The first day of administration was considered day 1 of treatment.

Data collection
The animals were monitored throughout the treatment period and observations recorded. Birth outcome such as litter size, birth weight, stillbirth and postnatal survival were recorded.

Statistical analysis
Data obtained was expressed as Mean ± Standard Deviation and analyzed using the SPSS package 20.0. One-way Analysis of Variance (ANOVA) was used. Values at $p<0.05$ was regarded as significant in comparison with appropriate controls.

RESULTS

Birth outcome study
The results of lambda cyhalothrin treated rats recorded a significant dose dependent decrease litter size compared with control group. Also a significant dose dependent decrease total litter birth weight was observed across treatment groups. Stillbirth recorded significant in treated rats. Postnatal survival between parturition and weaning in lambda cyhalothrin treated rats was significant in a dose dependent manner when compared with control group.

Table 1: Birth outcomes of female Wistar rats after treatment with different doses of Lambda-cyhalothrin.

Groups	Litter size survival	Birth weight	Stillbirth	Postnatal
Control (0.0%)	7.5 ± 0.43	7.07 ± 0.201	0.30 ± 0.210	9.00 ± 0.40
Treatment 1 (0.2%)	6.8 ± 0.49	6.63 ± 0.360	0.83 ± 0.307	2.80 ± 0.87
Treatment 2 (0.4%)	6.5 ± 0.22	6.23 ± 0.300	1.00 ± 0.260	1.17 ± 0.47
Treatment 3 (0.8%)	6.3 ± 0.33	6.07 ± 0.240	1.30 ± 0.490	1.30 ± 0.49

Values are expressed as means ± SD; n = 6 for each treatment group.

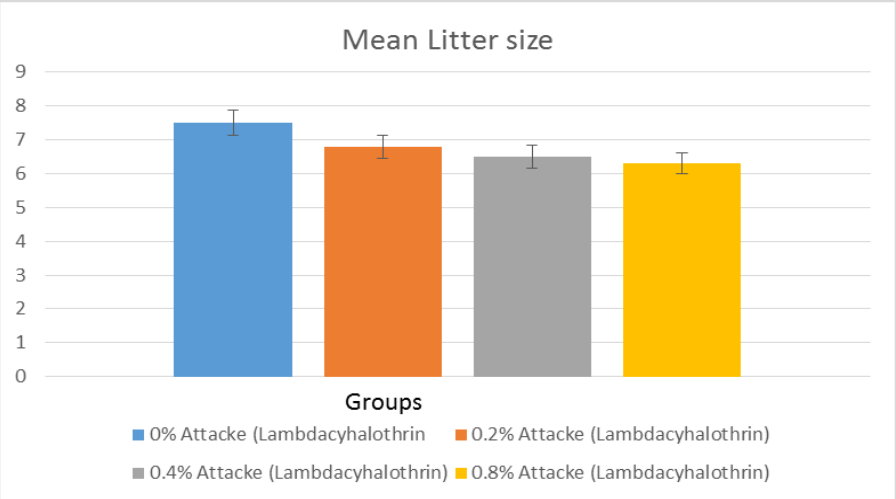

Figure 1: Effect of lambda cyhalothrin on litter size.

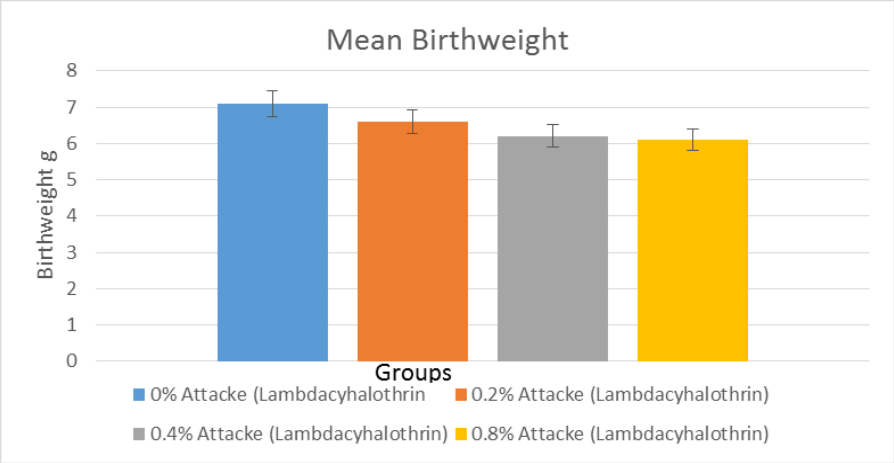

Figure 2: Effect of lambda cyhalothrin on birth weight.

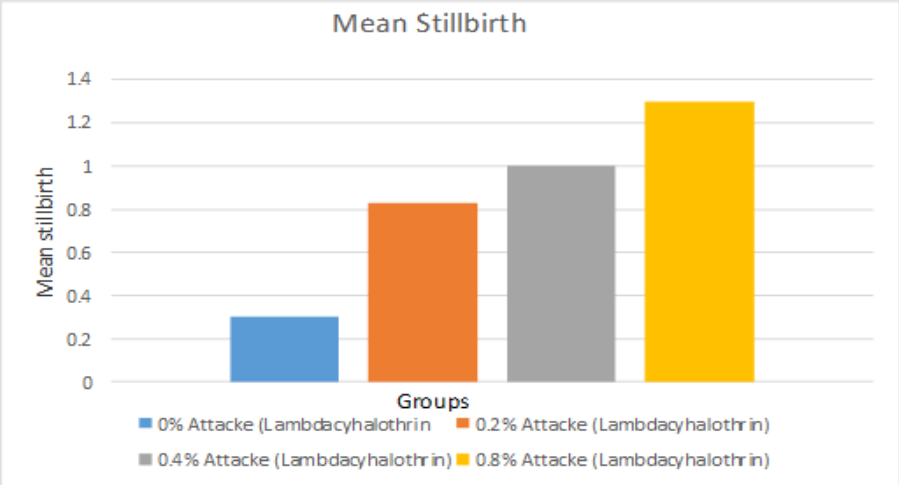

Figure 3: Effect of lambda cyhalothrin on Stillbirth.

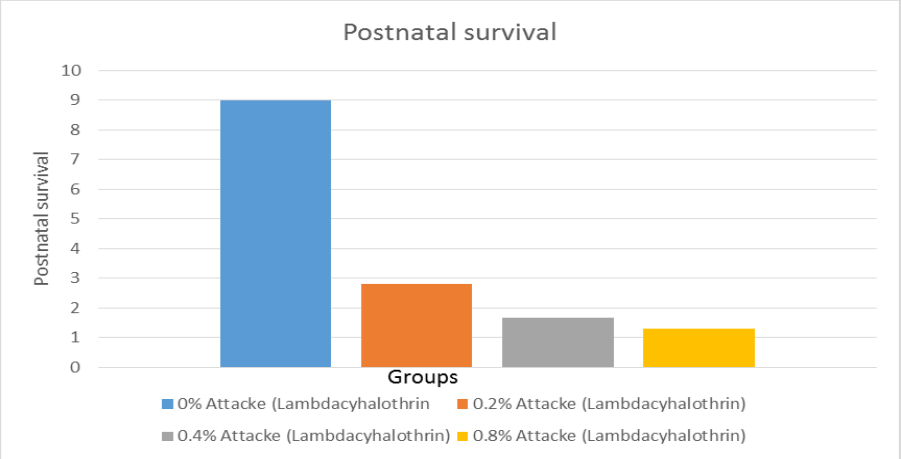

Figure 4: Effect of lambda cyhalothrin on postnatal survival.

DISCUSSION

In the present study lambda cyhalothrin at different concentration 0.2%, 0.4% and 0.8% affected the birth outcome of treated pregnant female Wistar rats. There was a significant decreased litter size across lambda cyhalothrin treated rats. Also, a significant dose dependent low birth weight observed in litters of lambda cyhalothrin treated rats. Stillbirth was recorded significant in the treated rats compared to control. Postnatal survival between parturition and weaning recorded significant decrease dose dependent in lambda cyhalothrin treated rats. All the above mentioned observations is often associated with pesticide toxicity. The result of this study is therefore in line with Sinha, *et al.*, (2006) and Ding, *et al.*, (2015) who reported

pyrethroid pesticides and birth outcomes. They reported prenatal exposure to pyrethroids toxicity with reduced total litter weight. The result on stillbirth is consistent with Farahat, *et al*., 2016 that reported earlier delivery in pregnant mothers exposed to pesticides, Eskenazi, *et al.*, (2004) studied 448 pregnant women who had shortened gestations age delivery, Wang, *et al.*, (2012) also reported 187 newborn with reduced gestational age. Farahal, *et al.*, 2016 also reported low birth weight in pesticide exposed infants.

The result of this study did not agree with WHO, (1989) report where treatment of low doses of cypermethrin up to 500 mg/kg body weight on female rats, mice and rabbits had no adverse effects on body weight and some reproductive parameters. In agreement with the present study, WHO, (1989) discovered in a multigeneration study in rats treated with cypermethrin at a dose of 500mg/kg in diet exhibited decrease in litter size and total litter weight. Consistent with the present study Shukla and Taneja, 2002 and Ullah, *et al*., 2006 reported that cypermethrin treatment in mammals induced embryonic resorption, pre and post implantation sites, number of viable fetuses and weight gain in fetuses. In line with the result of this study Farag, *et al*., 2007 study on cypermethrin treated female rats with treated males in a dose of 10 mg/kg/day for 4 weeks, 5 days in a week reported increased number of dead pups. Joshi, *et al*., 2011 reported cypermethrin treatment with 100 mg/kg in pregnant female rats from 6th to 17th day of gestation induced marked adverse effects in fetuses which is in agreement with this study.

CONCLUSION

It was confirmed from the study that lambda cyhalothrin has deleterious effects on birth outcome of the treated female rats in a dose-dependent manner. It can be suggested that pregnant humans and animals be protected from Lambda cyhalothrin exposure because of its high detrimental effects in the embryonic and early stage of life. Further studies with lambda cyhalothrin are necessary to verify their birth outcome toxicity in humans because of accidental and professional exposure.

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