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ORIGINAL ARTICLE

Effect of Beta-Cyfluthrin on Total Cholesterol Level in Wild *Drosophila* Fed on Normal and High Caloric Diet

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ABSTRACT

For decades, the use of insecticides has been the most important form of crop protection to prevent or control pests, diseases, weeds, and other plant pathogens, reduce or eliminate yield losses, and maintain high product quality. It has been a critical approach. Conservation of agroecosystems is therefore critical and necessary to establish effective safety controls and to avoid pollution, resistanc and adverse effects of conventional pesticides on non-target organisms. The present study is designed to estimate total cholesterol level in Drosophila after beta cyfluthrin intoxication during high and normal caloric diet conditions.

Key words: *Drosophila, Cholesterol, Beta-cyfluthrin, normal and high caloric diet*

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INTRODUCTION

Insects are the most powerful enemies of man as they are carrier of many harmful microbial diseases to human population. The most popular way to control these insects is by the use of synthesized chemicals. In last few decades, man has developed many ingenious methods in their attempts to control wide variety of insects that constantly threatened the supply of food as well as posing a threat to health. The chemicals, the insecticides belong to various categories such as organophosphates, organochlorines, carbamates and cyclodienes. Synthetic forms of natural pyrethrin are called pyrethroids. Natural insecticides are obtained from plants as well as animals. However, the natural pyrethrins are obtained from the flower heads of Chrysanthemum cinerariaefolium. Due to unstability, the natural pyrethroids are replaced by synthetic pyrethroids. However, the synthetic pyrethroids are categorized as type Ist and type IInd. These are stable and revealed low mammalian toxicity due to rapid metabolism via ester hydrolysis and hydroxylation. Allethrin was the first synthetic pyrethroid in the series of pyrethroids. Type II pyrethroid have much greater inherent toxicity other than type 1' and also less side effects.

Pyrethroids are axonic poison, bind at sodium channal of nerve cell, prolong their opening cause possible death. There are six biologically active chemicals in pyrethrins that are responsible for knockdown properties of insecticides. They are divided into two groups on the basis of their biochemical action and on behavioural indicies of toxicity as pyrethrins I and pyrethrins II. The use of pyrethroids is increasing day by day and the insects try to resist against these insecticides. This development of resistance accounts for changes in physiology and biochemistry of the body. Due to development of resistance against insecticides, rapid efforts have been made to synthesize new insecticides, to prevent the resistance problem. On a biochemical level, beta-cyfluthrin has a complex mode of action and affects normal nerve function in several ways. It includes alterations in nerve membrane causing abnormal sodium and potassium flows.

The effect of Beta-cyfluthrin will be observed on vinegar flies as they (*Drosophila melanogaster*) are considered to be the best on account of short life span of about 10-14 days. However, the small fly completes whole metamorphosis in 10 days at 25°C, has abundance of genetic variability, four pairs of chromosomes, is reared in the laboratory easily. There are 2500 species of *Drosophila*, which are present all over the world. In eukaryotes the maize and *Drosophila* are used as models because their genetic aspects are clearly understood.

MATERIALS AND METHODS

The wild form of *Drosophila* (Meign) used in the present study were obtained from the Department of biotechnology, Indian Institute of Technology, Kanpur and further maintained and reared in *Drosophila* culture section, Toxicology Laboratory, Department of Zoology, School of Life Sciences, Dr. B.R. Ambedkar University, Agra. The pure culture of wild form of *Drosophila melanogaster* was reared in glass culture vials of 100 ml capacity which was plugged with sterilized cotton. The wild form of *Drosophila melanogaster* was maintained under laboratory conditions and was placed in B.O.D. incubator set at a temperature 25°C and relative humidity 50%. Specified food would be given to these test insects.

Beta cyfluthrin (Buldoc 025 SC) a synthetic pyrethroid obtained from Bayer India Limited New Delhi, was selected for the present study to estimate the biochemical response of wild *Drosophila melanogaster* after treatment.

To assess the sublethal effect of experimental compound on the total lipid and total cholesterol in larvae, pupae and adults of wild vinegar flies and were divided into two groups, treated and untreated. Each group consisted of four culture vials were marked as

(i) UT ♀ × UT ♂

(ii) T ♀ × T ♂

(iii) T ♀ × UT ♂

(iv) UT ♀ × T ♂

The treated vials were given the 1/10th concentration of calculated LC_{50}.

The control set included UT♀ × UT♂, which was run separately for each of the treated set. These culture vials were kept inside B.O.D. at 25°C and 50% relative humidity. The total cholesterol was estimated by the method of Zlatkis *et al.* (1953). The data was statistically analyzed by Ky plot version 3.0 computer software

RESULTS AND DISCUSSION

In normal diet condition, the value of total cholesterol content ranges from 50-56 with mean 54.40±0.33 mg/dl in control set, while 65-74 with mean 69.50±0.67 mg/dl in both treated set; 59-68 with mean 65.33±0.75 mg/dl in male treated set and 55-64 with mean 59.50±0.50 mg/dl in female treated set. The changes in total cholesterol content are significant in treated sets as compared to control set (Table-1, Fig. 1). In high caloric diet condition, the value of total cholesterol content ranges from 57-66 with mean 64.50±0.50 mg/dl in control set, while 69-77 with mean 74.44±0.33 mg/dl in both treated set; 66-75 with mean 69.60±0.45 mg/dl in male treated set and 63-70 with mean 67.20±0.42 mg/dl in female treated set. The changes in total cholesterol content are significant in treated sets as compared to control set (Table-2, Fig. 1).

Table 1: Total cholesterol content (mg/dl) in wild *Drosophila melanogaster* in normal diet conditions under stress of beta cyfluthrin

S.No.	Sets	Number of sets	Normal diet		Significance level
			Range	Mean + S.E.	
1.	UT♀ x UT♂ (Control)	3	50-56	54.40+0.33	
2.	T ♀x T♂ (Both treated)	3	65-74	69.50+0.67	P<0.001
3.	UT ♀x T♂ (Male treated)	3	59-68	65.33+0.75	P<0.01
4.	T ♀x UT♂ (Female treated)	3	55-64	59.50+0.50	P<0.05

T- Treated, UT- Untreated, ♀- Female, ♂- Male

Table 2: Total cholesterol content (mg/dl) in wild *Drosophila melanogaster* in high caloric diet conditions under stress of beta cyfluthrin

S.No.	Sets	Number of sets	Normal diet		Significance level
			Range	Mean + S.E.	
1.	UT♀ x UT♂ (Control)	3	57-66	64.50+0.50	
2.	T ♀x T♂ (Both treated)	3	69-77	74.44+0.33	P<0.01
3.	UT ♀x T♂ (Male treated)	3	66-75	69.60+0.45	P<0.05
4.	T ♀x UT♂ (Female treated)	3	63-70	67.20+0.42	P<0.05

T- Treated, UT- Untreated, ♀- Female, ♂- Male

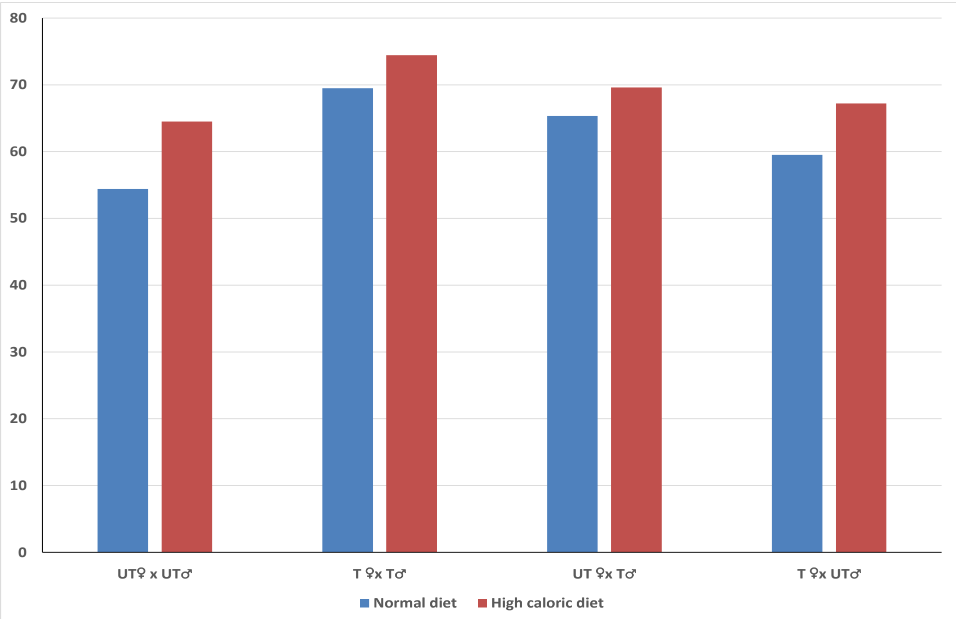

Fig. 1: Total cholesterol content (mg/dl) in wild *Drosophila melanogaster* in normal and high caloric diet conditions under stress of beta cyfluthrin

Palli and Locke (1988) considered fat bodies to be responsible for such an enhancement in the lipids and cholesterol. Probably similar reason may be assigned for lipid elevation in developing stages of *Drosophila melanogaster* as fat bodies perform two functions, one, synthesis of larval proteins 1 and 2 as is revealed in 3rd instar larvae of *Drosophila melanogaster* (Sato and Robert, 1983) and two, storage of lipids which dissolves and retains the xenobiotic substances as much possible (Saxena and Srivastava 2002) and that this retained xenobiotic substance is in true sense responsible for elevation in the level of lipids to counteract the entry of the experimental compound in question. (Saxena and Srivastava, 2002).

The greater increase in cholesterol in low caloric both treated forms may probably be due to entry of the experimental compound from two 2 onnel sites, first through the external barrier, the integument and the second ingestion, by the way of alimentary canal. This probably accounts for more stress, hence more increase in lipids and cholesterol has been observed. The present findings are in affirmation to Creus *et al*. (1983) who earlier reported that glucose utilization increases during the stress condition, some of the glucose is used in anaerobic respiration, resulting in glycerol formation, which in turn is utilized for lipid as well as cholesterol biosynthesis. Probably similar explanation may be sought for lipids and cholesterol elevation under the stress of Beta-cyfluthrin in the present investigation. Similar findings were given by Lozinsky et al. (2013) revealed toxicity in *Drosophila melanogaster* under stress conditions of s-nitroglutathione based on pupation delay and oxidative stress; Colinet et al. (2013) showed that sugar in diet of Drosophila melanogaster affect the flies cold tolerance; Kubrak et al. (2014) reported hormonal regulation of signaling and metabolism in *Drosophila melanogaster*; and Rovenko *et al.* (2015) stated that level of sucrose in diet either high or low causes some metabolic effect alongwoith stress in *Drosophila melanogaster*.

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