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ENDOSULFAN CAUSES HYPERCHOLESTEREMIC IN MICE AND ITS BIOREMEDIATION THROUGH CURCUMA LONGA

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ABSTRACT

The wide use of agrochemicals in agricultural practice has caused severe health hazards to humans while their side effects have damaged the environment also. Endosulfan is an organochlorine insecticide effective against a wide range of pests of cereals, coffee, cotton, fruits, oilseeds, potato, tea and vegetables. Moreover, it is easily absorbed by the stomach, lungs and skin and exposure through any route can be hazardous. In the present study, Endosulfan was administered orally at the dose of 3.0 mg/Kg body weight per day to Swiss albino mice for 4 weeks. Upon 4 weeks Endosulfan pretreated mice group, *Curcuma longa (rhizome extract)* at the dose of 200 mg/Kg b.w per day was orally administered for 4 weeks to these groups to observe the ameliorative effect. Mice were sacrificed at each interval and their blood were collected for biochemical assay especially lipid profile. The lipid profile study showed inclination in the cholesterol level, LDL, and triglycerides level while declination in HDL level after endosulfan exposure but, upon *curcuma longa* treatment to the endosulfan treated group showed significant declination in the cholesterol level, LDL, and triglycerides level while inclination in cholesterol HDL level. Thus, from the above study it can be concluded that although the entrance of these hazardous pesticide into our body cannot be stopped but by the use of these medicinal plant extracts as potent antidote can solve the problem at much extent.

KEYWORDS: Amelioration; *Curcuma Longa*; Endosulfan; Hypercholesteremic.

INTRODUCTION

Pests are responsible for the loss of one third of worlds agriculture production every year. In India approximately, agricultural products of more than 60 billion annually are destroyed by

pests. Every year this problem is increased by the appearance of new pests and diseases.[1] Pesticides are group of chemicals mainly designed for the destruction of pests but besides killing pests it also affects the heath of non-target organisms. Only a small percentage (0.3%) of applied pesticides goes into the target pest while 99.7% go somewhere else into the environment.[2] Endosulfan is an organochlorine insecticide effective against a wide range of pests of cereals, coffee, cotton, fruits, oilseeds, potato, tea and vegetables. Moreover, it is easily absorbed by the stomach, lungs and skin and exposure through any route can be hazardous. Commercially produced endosulfan consists of two isomers α endosulfan and β endosulfan. Both these forms have been proved to be genotoxic to human gonads.[3,4]

Due to the high persistence and bioaccumulation potential, the Stockholm Convention has classified endosulfan as environmental hazards and banned the use of many of them. Pesticide safety is classified by the World Health Organization (WHO) according to the results of LD_{50} tests, which document the amount of a chemical required to kill 50% of a population of laboratory animals. Under this system, endosulfan is currently classified as Class II – moderately hazardous to human health. However, the United States' Environmental Protection Agency (EPA) rates endosulfan as Category Ib - *highly hazardous*. LD_{50} data for endosulfan are equivocal, with some published results indicating that the chemical should be in the WHO's Class Ib, according to the organization's own criteria.[5]

Evidence of the threats to human health posed by endosulfan is abundant, and the chemical has been banned outright or severely restricted in a number of countries as a result. Independent of LD_{50} results, these threats warrant the immediate upgrading of endosulfan to WHO Class I b.[6]

The active constituent of turmeric is known as curcumin. It has been shown to have a wide range of therapeutic actions. First, it protects against free radical damage because it is a strong antioxidant. Second, it reduces inflammation by lowering histamine levels and possibly by increasing production of natural cortisone by the adrenal glands.[7] Curcumin is also reported to have antibacterial,[8] antiamoebic[9] and anti-HIV[10] activities. Curcumin also shows antioxidant activity.[11-14] It also shows antitumor,[15-17] and anticarcinogenic[18-20] activities. Hence, the present work aims to study the ameliorative effect against Endosulfan induced toxicity in Swiss albino mice.

MATERIALS AND METHODS

Animals

Thirty Swiss albino mice (Mus musculus) were reared in the animal house. 12 weeks old mice weighed 30±2 grams were selected for experiments. The mice were kept in the polypropylene cages with paddy husk at room temperature 28±2ºC and humidity 50±5% in a controlled light (12 hrs light and 12 hrs dark).

Test chemicals

Pesticide endosulfan, manufactured by Excel India Pvt. Ltd., Mumbai with EC 35% was utilized for the experiment. The pesticide was prepared to 3.0 mg/Kg b.w, which was administered orally to mice for 4 weeks. Commercially available kit for chemical analyses like Serum Cholesterol, HDL, LDL and Triglyceride were used of crest coral clinical system.

Calculation of LD50 and Maximum permissible dose (MPD) of curcuma longa (Turmeric) aqueous rhizome extract

For calculating the LD50 value of Curcuma longa for mice by standard method was reported by Balachandran and Govindrajan (2005), as 200 mg/kg b.w as LD50. At 200 mg/Kg & 400 mg/Kg b.w. although there were no death reports and no side effect were seen at 200 mg/kg b.w. So, 200 mg/Kg b.w. was selected as Maximum Permissible Dose (MPD) for the experiment.

Experimental design

In the present study 30 mice (20 Endosulfan treated and 10 as control mice) were taken and divided into groups - control, Endosulfan treated and turmeric treated. The endosulfan at the rate of 3.0mg /kg body weight daily was administered orally for 4 weeks. To this endosulfan treated group turmeric at the rate of 200mg / kg body weight per day was administered for 4 weeks. After the completion of the experiment blood samples were collected by orbital sinus puncture method and then serum was extracted.

Statistical analysis

Results are presented as mean ± S.D and total variation present in a set of data was analyzed through one-way analysis of variance (ANOVA). Difference among means has been analyzed by applying Dunnet's 't' test at 99.9% ($p< 0.001$) confidence level.

RESULTS

The lipid profile tests total cholesterol levels, LDL levels and triglycerides levels show inclination in the levels while HDL cholesterol decreased levels in the Endosulfan treated group in comparison to control group was observed but, after turmeric treatment cholesterol levels, LDL and triglycerides levels show decreased in the levels while there was significant increase in the HDL cholesterol levels denotes the ameliorative effects (Figures 1-4).

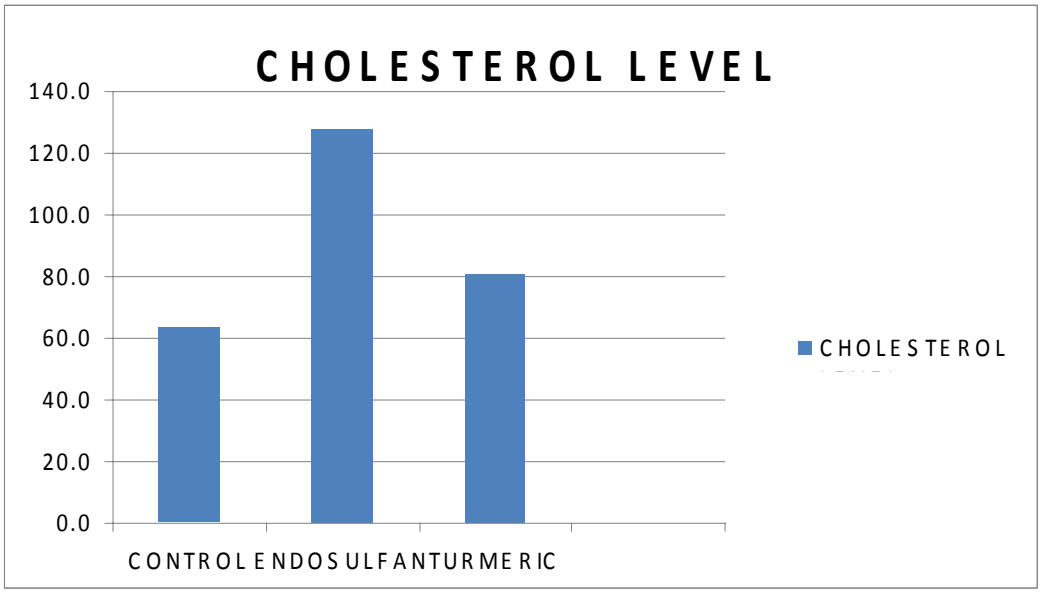

Figure 1: Effect of curcuma longa on edosulfan treated group showing cholesterol levels (n=10, value is mean ± S.D).

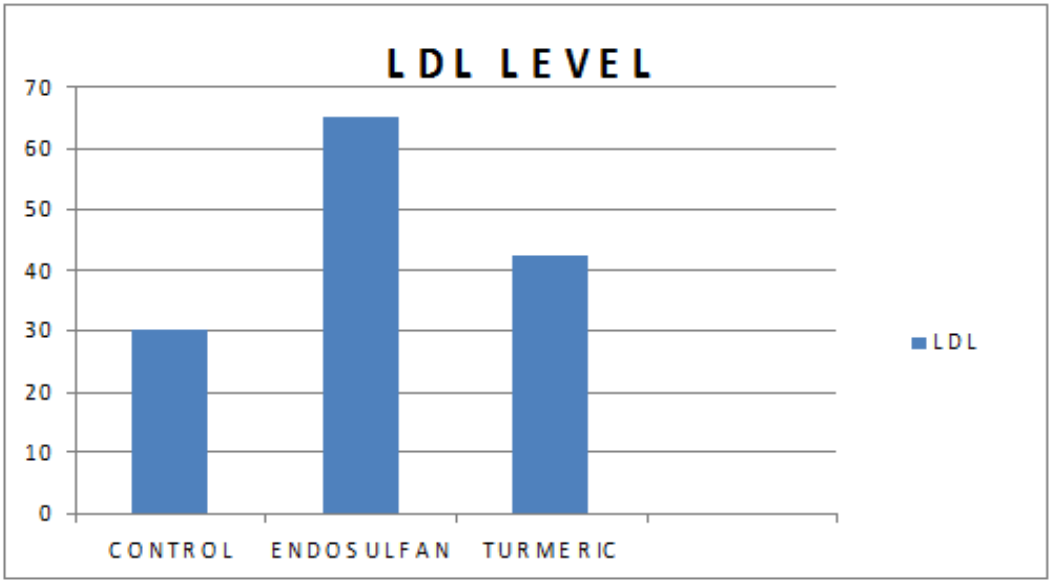

Figure 2: Effect of curcuma longa on edosulfan treated group showing LDL (Low dendisty Lipoprotein) levels (n=10, value is mean ± S.D).

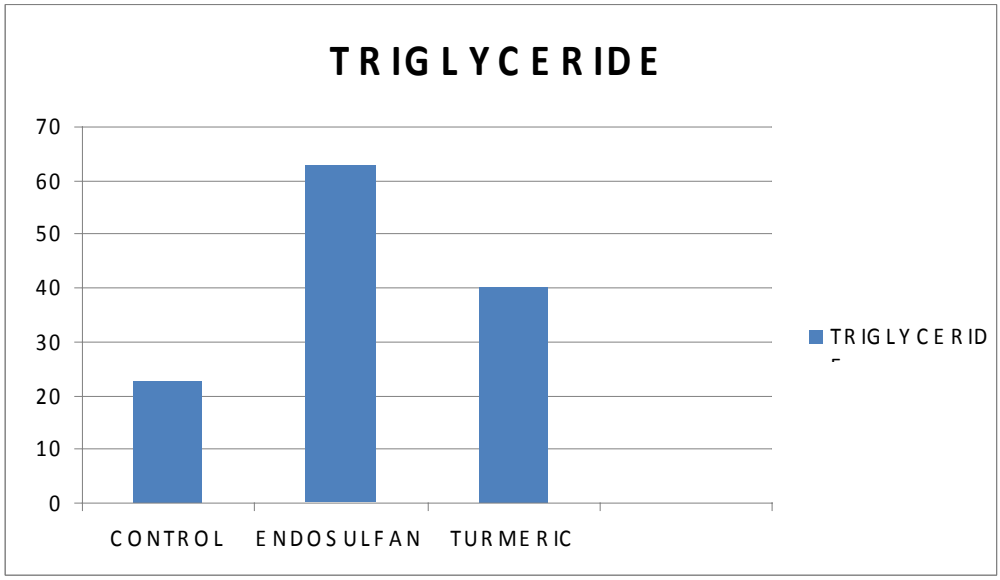

Figure 3: Effect of curcuma longa on edosulfan treated group showing Triglyceride levels (n=10, value is mean ± S.D).

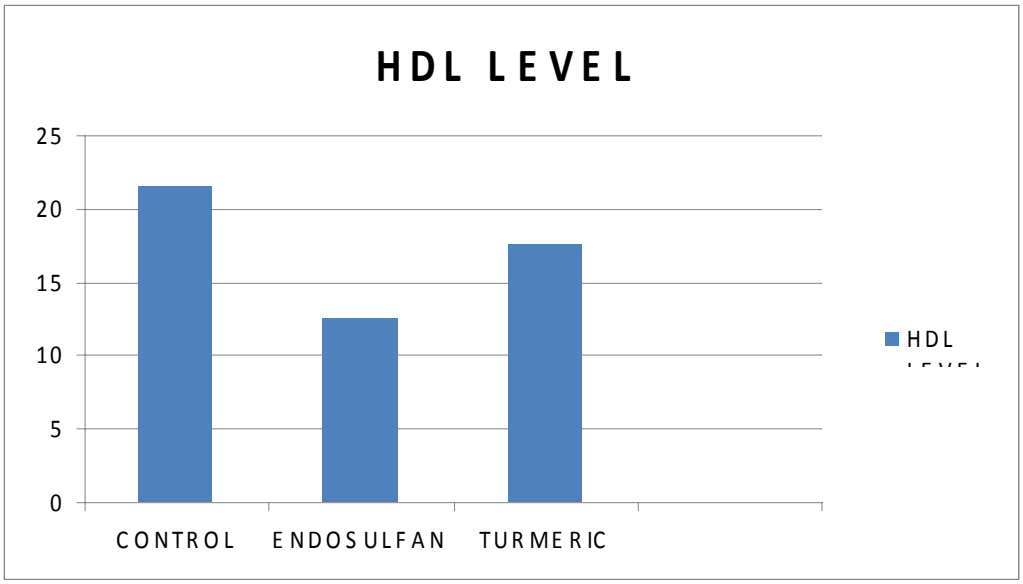

Figure 4: Effect of curcuma longa on edosulfan treated group showing HDL (High Density Lipoprotein) levels (n=10, value is mean ± S.D).

DISCUSSION

Lipids are one of the important sources of energy, carriers of fat-soluble vitamins, components of bile salts and precursors for the synthesis of steroid hormones. Lipids are mainly synthesized in liver. Biochemical characteristics of blood are the important indicator of status of internal environment of an organism. Most of the pesticides act as metabolic depressors and generally affect the activity of biologically active molecules such as proteins,

carbohydrates and lipids.[21] A number of studies have been carried out regarding the biochemical alterations in blood induced by pesticides in general.[22-26]

In the present study, the hypercholesteremic in mice exposed to endosulfan can reasonably explained on the basis of hypothesis that endosulfan induces oxidative stress in the cells especially in hepatocytes. Liver is the main site of detoxification so it requires more energy for detoxification. To meet additional energy demands liver cells starts biosynthesizing of different classes of lipids. This leads to the elevation in total cholesterol, LDL cholesterol, and triglyceride level in blood serum of endosulfan induced mice. Hence, it can be speculated that inclination in lipid profile is one of the compensatory mechanism of mice to adopt to pesticides like endosulfan. The inclination in serum lipid content resulting in hypercholesteremic is certainly due to stress induced by pesticide poisoning for longer periods. The test animals in the present study were observed to be restless throughout the exposure period. They were in constant fast movements aided by muscular action. Lots of extra energy was required to minimize the stress induced by endosulfan. The observed hypercholesteremic during present investigation may be also due to impairment in the membrane organization and damage to liver. In a similar study,[27] have reported that increased level of serum cholesterol in *Oreochromis niloticus* exposed to phenol may be due to impairment in the membrane organization induced by the acclimatization in acidic water or water contaminated with phenol in order to get the positive survival value under the imposed stress. Endosulfan, are also known to induce oxidative tissue damage resulting from the release of ROS and free radicals play an important role in the pathogenesis of inflammation.[28] Endosulfan also acts as a xenoestrogen binding with the lipid membranes and causing severe damage to them due to lipid peroxidation. The lipid peroxidation in turn causes depletion of lipid from the membranes making the blood lipid rich, more viscous and enhancing the chance cardiovascular disease. Thus, there are multiple possible pathways that might lead to selective alteration in rates of synthesis or metabolism of some classes of serum lipids. Lipid profile abnormalities play a significant role in atherosclerosis and cardiovascular disease. The findings of the present investigation indicate that exposure to endosulfan alters the metabolism of cholesterol and thus increases the risk of cardiovascular disease and atherosclerosis.

But the medicinal plants have potent ameliorative effect in controlling the hypercholesteremic effect. Turmeric in the recent times has proven its efficacy as a good

antioxidant in traditional medicine group. Curcumin (diferuloylmethane), the main yellow bioactive component of turmeric has been shown to have a wide spectrum of biological actions. These include its anti-inflammatory, antioxidant, anticarcinogenic, antimutagenic, anticoagulant, antidiabetic, antibacterial, antifungal, antiprotozoal, antiviral, antifibrotic, antivenom, antiulcer, hypotensive and hypocholesteremic activities. Its anticancer effect is mainly mediated through induction of apoptosis (Ammon 1992). In the present study, turmeric maintains both estrogen and progesterone level in mice as it normalises the hormonal imbalance. Since its antioxidant activities are well established hence it plays the vital role to combat the toxicity.[25] However, the other studies have established the protective effect of turmeric on Endosulfan induced toxicity.[26]

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CONCLUSION

Endosulfan causes deleterious effect on the lipid profile functions in the Swiss albino mice, but after the treatment of *curcuma longa* there was significant control in the lipid profile levels. Thus, *curcuma longa* possesses anti- hypercholesteremic activity normalizing the physiology of the body and maintaining the cellular integrity and normal functioning of the system.

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