Study On The Influence Of Benzene Hexa Chloride (Hexa Chloro Cyclo Hexane) In Certain Endocrine Glands Of Gerbil

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***Abstract*— in the present research, the pesticide BHC was administered to endocrine glands in Gerbil (Antelope Rat), the experimental animals by two doses one after another. On histological analysis of endocrine gland and other tissues showed that except pancreas all tissues were affected severely with the toxic effect of BHC. Degeneration of cells, vacuolations, space formations shrinkage and splitting of cells, separation of cells, lesions etc were noticed through out the study.**

***Index Terms*— Benzene Hexa Chloride, Antelope rat, endocrine glands**

I. Introduction

It is well known that chemicals cause various types of damages and necrotic effects on the different organs of animals. Various chemicals and heavy metals that caused serious damages to animals were reported by Baycumi *et al. (*1981) and Puttannaiah and Seshadri (1983). The toxicity of various pesticides is of general importance because of their wide use in agriculture. While these pesticides destroy insects they may have a direct or indirect action on various body systems of animals, including the endocrine system inhabiting the area.

Changes induced by organo-chlorine derivatives on male reproductive organs of rats were reported by Dikshith and Datta (1972) and Starr and Clifford (1972). The pesticide may enter the animal either directly or indirectly as an environment pollutant. Reports do indicate that herbicide like diuron, linuron, fenuron cause functional disturbances of haemopoietic system in animals during their short and long term exposure (Wanger, 1983). Sub lethal levels of DDT were shown to cause increase in adrenal cortical tissue of Bobwhite quails which resulted in increased secretion of corticosteroids which in turn affects reproduction (Lehman *et al*., 1974). A delicate homeostatic balance exists within in the avian endocrine system which may be disturbed by feeding sub lethal levels of pesticides. This adverse effect on the endocrine system may cause reproductive failures which go unnoticed until the population is greatly reduced (Vibhawadha *et al*., 1991).

Only very little work has been reported to investigate the effects of pesticides in the endocrine glands of Antelope Rats, Gerbils. The present work embodies observation on the toxicity studies of Benzane hexachloride on four endocrine glands ie, pitutory, thyroid, Adrenal and Pancreas of South Indian Gerbil, *Tatera Indica Cuvieri.*

II. Material And Methods

About 15 male adult healthy gerbils of almost same size weighing 150-200gm caught from the coastal belt of Trivandrum city and were housed in metallic wire netted cages in a room at a temperature 30-32^{o}C and on a 12 hour light:12 hour dark schedule. They were fed with bits of tapioca on every third day, with water given *ad libitum.* After a week of acclimatization they were divided into three groups of five each. Group I served as normal gerbils, group II control gerbils and group III experimental gerbils. Group I were given the normal diet the Tapioca bits ad libitum group II were fed only with 200gms tapioca powder per animal and group III were fed with toxic dose of BHC in 200gms of tapioca powder per animal.

250mg per kilo body weight of BHC (Commercial grade) with 200gm of tapioca powder uniformly mixed together to produce a toxic dose BHC contained food. 200gms of tapioca powder was given to each control animal. Like wise toxic dose of BHC contained food was given separately to each experimental antelope rat. Control animals consumed the 200gms of tapioca powder with in two to three days. But the experimental animals consumed the toxic dose of the control food and BHC+Food completely with in seven days. The second dose of the control food and BHC+Food were given to control animal and experimental animal respectively on the seventh day when both groups had completed their 1st doses. The experimental animal completely consumed the 2nd dose of BHC food only on the 14th day. Their activity pattern was observed during the experimental period .the experiment was repeated for confirmation.

One set of normal gerbil, control gerbil and experimental gerbil were killed by decapitation on the seventh day when they completed the 1st dose of food. The endocrine glands-pitutory, thyroid, adrenal and pancreas were dissected out from this sets and fixed in aqous bouins fluid. The other sets of animal normal, control and experimental were killed by decapitation on 14th day, 12hours after the complete

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consumption of 2nd dose of BHC+Food by experimental animals. The endocrine glands-pitutory, thyroid, adrenal and pancreas were dissected out and fixed in aquous bouins fluid. Paraffin blocks were prepared with fixed tissues and cut at 6μ thickness, stained with haematoxylin and eosin, clearly observed and studied under microscope. Haematoxylin–Eosin staining method was used to stain the fixed thin paraffin sections. This slide section is used for further study under microscope.

III. Results

Both normal and control gerbils did not exhibit any notable change in behavior. They were active and the healthy in appearance. But the experimental animal showed a dull and unhealthy nature. The body weight gradually decreased day by day and on reaching the 14th day there started muscular shivering and became unconscious (Table-1, 2, 3). When compared to normal and control gerbils, histopathological changes were noticed in BHC treated animals both in the endocrine glands tissues.

Normal and control gerbils did not show notable histopathological changes in pitutory glands. The pitutory gland of BHC treated animals showed remarkable changes in the 7th day. The cells of these glands became constricted. The cells of the peripheral part separated to each other. The adenohypophyseal and neuro hypophyseal parts of pitutory glands are deformed. On 14 days of treatment there developed vacuoles inside the cells. There appeared binucleate stage due to the breakage of adjacent cells constriction and shrinkage of cells made spaces and clefts in the various parts of the gland. Certain cells broken in to bits, aggregations of haematoxylin and eosin staining granules were present here and there. It is clear that the pesticide BHC caused damage to the pitutory gland (Plate I &II).

The normal and control antelope rats showed nature of the gland. The thyroid glands of BHC treated animals were damaged. Cells constricted and separated on the 7th day analysis. Due to the formation of vacuoles inside the thyroid follicles the section of the 14th day treated BHC fed animals appeared in the form of a loose net. Cleft formations were many when compared to pitutory gland on the 14th day analysis. Separated cells and splitted cells were found due to decaying of thyroid gland (Plate I &II).

The adrenal glands of experimental gerbils only showed histopathological changes. On the seventh day of BHC treatment, the cortex was damaged, clumps of nuclei and space formation observed. In medulla region also shrinkage of cells, damaged chromaffin cells and space formation were noted. The experimental gerbils that consumed the 2nd dose of BHC on the 14th day, zona fasciculate of the cortex were ruptured and their nuclei were pycnotic and vacuolation developed. Some of the cells of this region were binucleated and space formation noticed. In medulla region due to shrinkage of cells spaces formed and ruptured chromaffin cells in compact mass. Chromaffin cells were hypertroped and their nuclei were pycnotic. Due to splitting big venules were formed in medulla. BHC damaged the adrenal gland of gerbil (Plate I &II).

On examination, the histology of the pancreas of normal, control and experimental antelope rats found to be normal after consuming completely the first and 2nd doses of food ie after the 7th day as well as after the 14th day. The cells of the alveolar tissues as wells the islets of langerhans were not disturbed. It was noticed that the pesticide BHC had only very little toxicity effect in the pancreas of gerbil (Plate I &II).

IV. Discussion

In the present experiment histopathological changes in pitutory, thyroid and adrenal gland were noticed clearly in BHC treated experimental gerbils. But the pancreas of the three groups of gerbils showed normal structure.

The pesticide, BHC affected the pitutory gland of antelope rat and showed many changes including constrictions, shrinkage, breakage of cells vacuolar and space formations. Similar observations are noted by few workers. The values reported in the literature of WHO (1985) indicates that mice and rats are more sensitive to the insecticides. Oral administration of Cypermethrin produced a dose dependent toxicity in Rats, Cypermethrin degenerated the glands and other tissues in varying degree on microscopic observations (Ahamed *et al*., 1989). Here also the pesticide BHC damaged the pitutory gland.

In the experimental animals, like pitutory gland the thyroid also affected seriously by the pesticide. Separations of cells, splitting of cells, vacuolar and cleft formation were also noticed here. The gland appeared as loose broken net under microscope.Nazarethrabells *et al*., (1975) noted that certain doses of DDT in animals create the structural aberrations. He reported the pesticide induced increasing frequency of chromatid lesions in workers occupationally exposed to DDT. Considering his view deletion in the form of fragments of cells was one of the most common abnormalities of glands due to influence of pesticides. The toxic effect of BHC also damaged the thyroid gland of gerbil.

In the present study, the adrenal gland showed serious histopathological changes. Pycnotic nuclei, vacuolation, binucleated cells, space formations, venule formation were noticed after BHC treatment. Similar observations are done few workers in adrenal glands of rat.Shtenberg and Rybacova (1968) reported an increase in size and mitotic activity of the cells of zone glomerulosa, enlargement of cells with two nuclei in the fascicular zone induced by carbaryl in rats. Hasan *et al*., (1977) observed degranulation and hypertrophy of adrenal cortex and medulary cells after exposure to 60 coirradiation. Hypertrophy due to BHC is reported here. Dikshith *et al* (1980) reported small as well as big vacuoles in the adrenal glands of male rats treated with carbon tetrachloride (CCL_4) and noticed necrotic cells. Roy chowdhury *et al* (1984) described significant morphological changes in the adrenal glands of rats due to low dose of lead acetate but with higher dose the chromaffin cells of adrenal medulla also atrophy. Singh *et al* (1984) reported the tendency for individualization of cells of adrenal glands after exposure to aldrin.

The pancreas is not affected by the pesticide. In our present study no sharp deviation in the structure of pancreas were noticed in the normal, control and experimental gerbils up to 7th and 14th day of treatment of BHC .Notable works in the action of pesticide on pancreas were not noticed.

However our present study reveals that the pancreas resisted the toxic action of BHC.

It is assumed that the degeneration of most of the endocrine glands of Antelope Rat may be due to the metabolic blocking of the pesticide and also its serious lethal actions in glands. The stable nature of the pancreas both in the direction of chemical actions and arrangements of cells may resist the action of BHC.The stability of pancreas may due to its dual function in the body, the exocrine and endocrine functions. It can be concluded that BHC causes damage to the endocrine glands of gerbil except pancreas.

V. Acknowledgment

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Table 1. Effect of BHC on Activeness of Gerbils

Day spent	Normal	Control	Experimental
7	Very active	Very active	Less active
10	Very active	Active	Dull
14	Very active	Active	Semi conscious

Decrease of activeness in experimental gerbils noticed

Table 2. Effect of BHC in connection to food consumption (gm) of Antelope Rates

Number of days	Food consumption-control	Food consumption-Experimental
1	22.0±0.82	10.3 ±0.77
4	128.3 ±5.89	107.0± 4.02
7	Fully consumed-again food given	Food consumed completely-next dose given
10	140.7± 6.82	121.38 ±3.88
14	Fully consumed-food completed	Second dose of food -completed

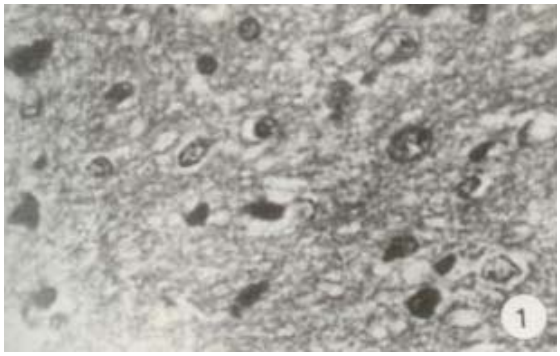
Food consumption rate is slow in experimental Antelope rats

Table 3. Effect of BHC on body weight (gm) of Antelope Rates

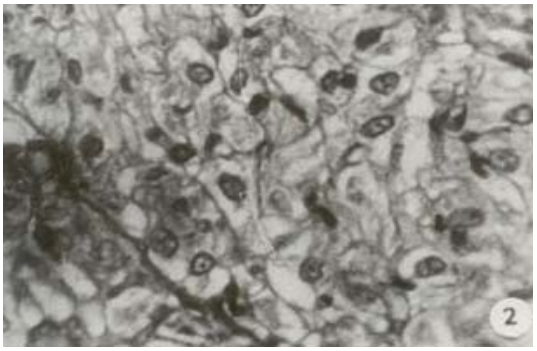
Number of days	Body weight normal	Body weight control	Body weight-experimental
1	151.33± 0.98	149.90 ±1.02	156.83± 2.11
7	150.97 ±0.88	147.99 ±2.33	149.27 ±3.22
14	150.99 ±1.26	142.58 ±2.17	140.01± 2.02

Body weight of experimental animals found to be decreased in higher rate when compared to normal and control antelope rats.

PLATE –I



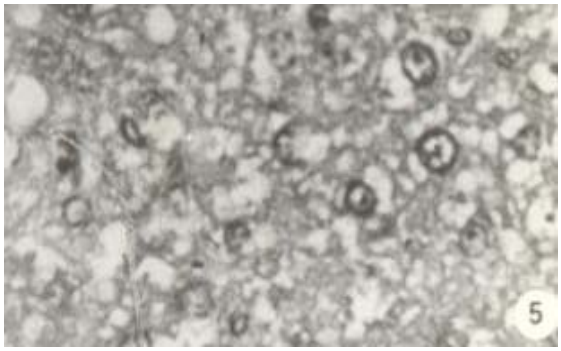
Section of pitutory gland of Experimental gerbil



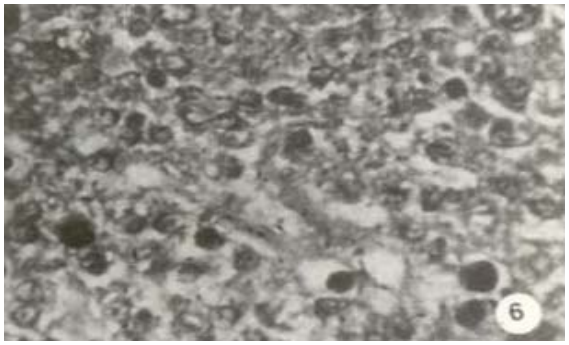
Section of thyroid gland of Experimental gerbil

Section of adrenal gland of Experimental gerbil

Section of pancreas of Experimental gerbil



Section of liver of Experimental gerbil



Section of testis of Experimental gerbil

Section of kidney of Experimental gerbil

Section of muscle tissue of Experimental gerbil

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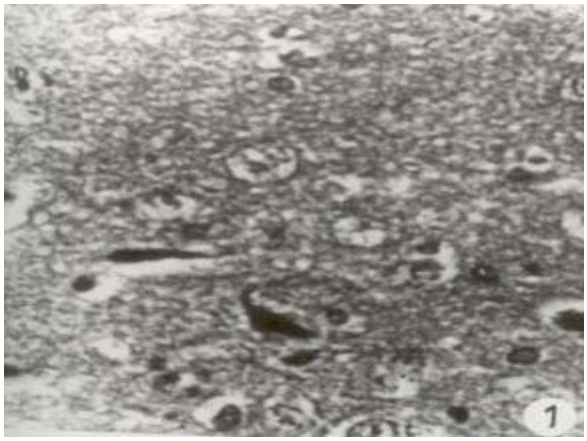
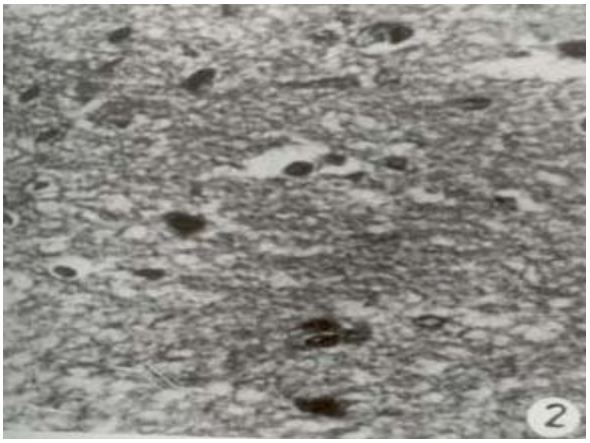
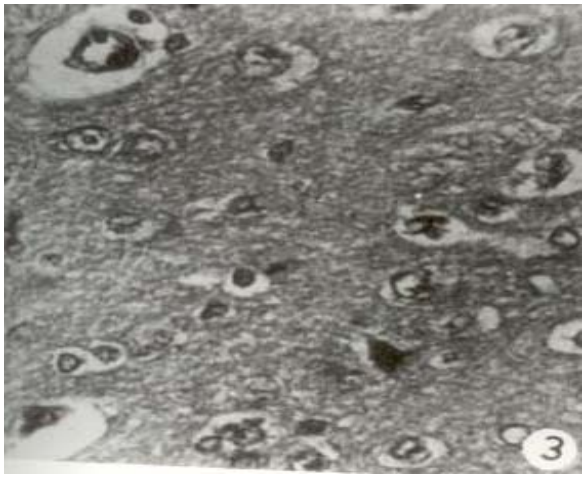
PLATE –II



Section of pitutory gland of normal gerbil

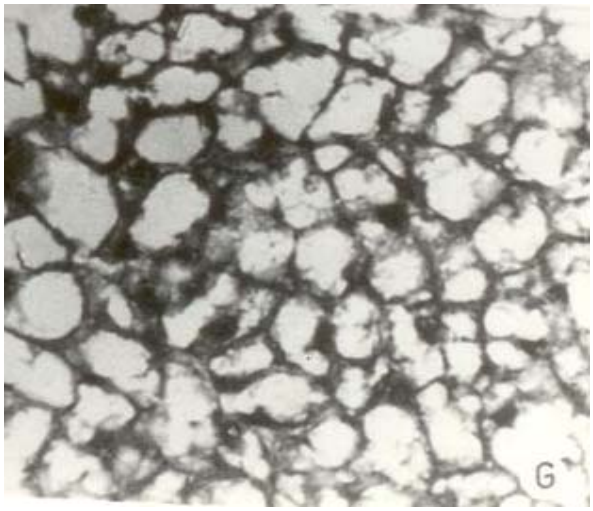


Section of pitutory gland of control gerbil



Section of pitutory gland of experimental gerbil after 14 days of BHC +food treatment.

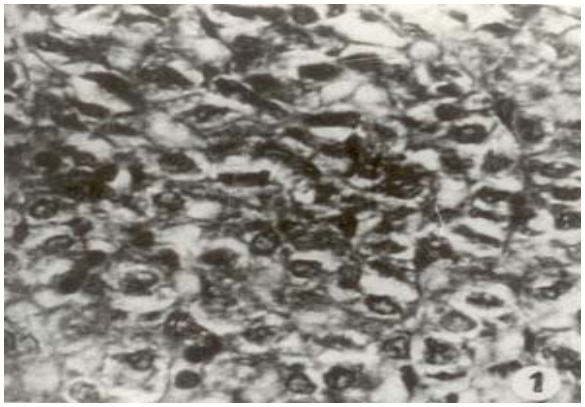
Section of thyroid gland of normal gerbil



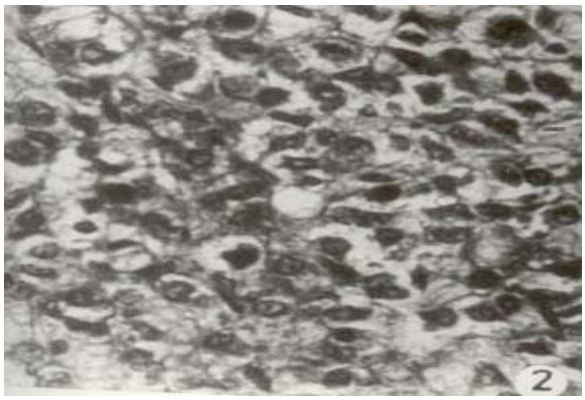
Section of thyroid gland of control gerbil

Section of pitutory gland of experimental gerbil after 14 days of BHC +food treatment.

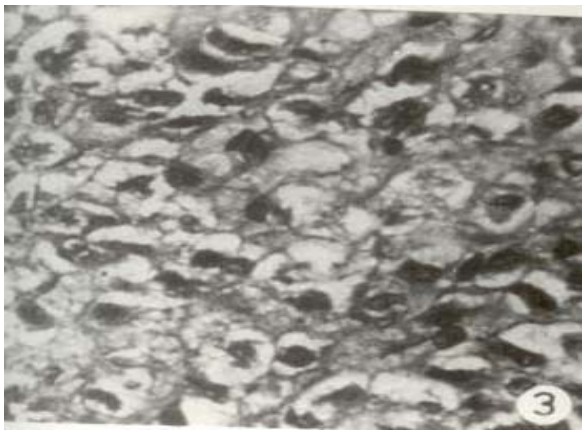
Plate III



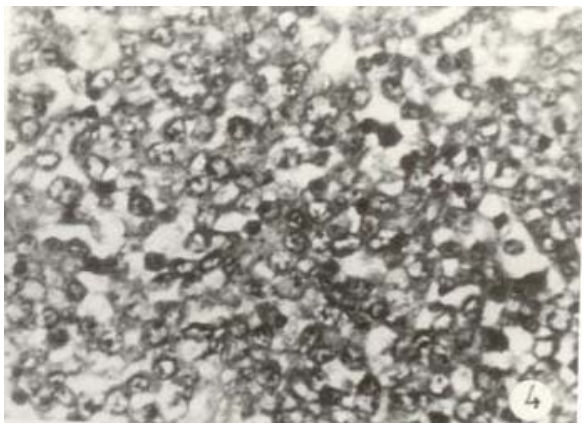
Section of adrenal gland of normal gerbil



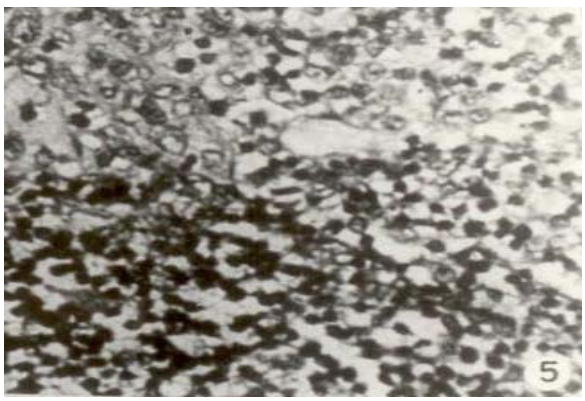
Section of pitutory gland of control gerbil



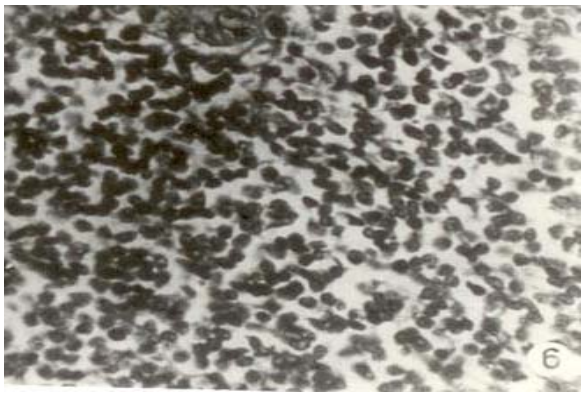
Section of pitutory gland of experimental gerbil after 14 days of BHC +food treatment



Section of pancreas of normal gerbil



Section of pancreas of control gerbil



Section of pancreas of experimental gerbil after 14 days of BHC +food treatment