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The Effect Of Pesticide Residues On The Morphology Of Liver Of Rats.

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ABSTRACT

The study of the effect of pesticide residues on the liver of rats was undertaken using thirty Wistar rats, which were randomly separated into three groups, (A,B and C) of ten rats each. The first group (A) was the control group and was fed on normal rat chow. The second group (B) was fed on diet that was stored with pesticide for seven weeks while the third group (C) was fed on diet that was stored with pesticide for fourteen weeks. The feeding experiment lasted for fourteen weeks. The result showed that the liver was affected in rats fed experimental diets. The liver of the test groups, showed various accumulations of degenerative fatty vacuoles and some areas of necrosis, which are more pronounced in group B that group C animals. This shows that the liver was affected due to the pesticide residues present in test diet.

Key Words: Pesticide Residues; Permethrin; Morphology, Liver.

Pesticides have been shown to be toxic to a wide range of organisms (Newman, 1978). These injurious actions of pesticides could have been highly specific for undesirable target organisms and non-injurious to desirable non-target organisms (Metcalf, 1975; Pumford & Halmes, 1997). However, most of the pesticides used in our environment are not highly selective but are generally toxic to non-target species (Seth, 1996). The application of pesticides most often are predicated by selecting quantities, concentration and manner of usage that will minimize the exposure to non-target organisms (Casarette & Doul, 1975).

Pesticide residues have been shown to be present in Nigeria foods and drinks and in the environment (Kwanashie, 1990, Seth, 1996). These residues have been shown to induce liver and other tumours in animals and possibly in man (Kwanashie, 1990; Iyaniwura, 1996). The presence of these pesticide residues in Nigerian foods and drinks may account for the prevalence of liver and other gastrointestinal cancers in the population (Kwanashie, 1990, Seth, 1996). The reason, is that some pesticides residues that contaminate Nigerian foods and drinks according to Kwanashie, (1990), have the liver as their primary target organ of attack and followed by the intestine.

The liver being a very important organ of metabolism and detoxification of poisonous substances in the body, any derangement may affect the metabolic activities of the liver, which may lead to many disease conditions in the body. The present study is aimed at investigating the effect of pesticide residues on the morphology of the liver of Albino rats.

MATERIALS AND METHODS

The pesticide used for tis study was the Coopex® grains storage powder containing Permethrin as active ingredient at the concentration of 0.5%w/v and at the rate of 0.5kg per tone. The Coopex® powder was properly mixed with rat pellets made by Pfizer Animals Feeds Plc, Kaduna at the above rate and stored between 7 and 17 weeks.

Animals used for this study was thirty male Albino (Wistar) rats of average weight of 140gm and age of 10 weeks and were grouped as A,B and C of 10 rat each. The animals in group A were used as the primary control group. The second group (B) and the third group (C) were used as the test groups and as such were fed with the experimental diets. The animals in group B were fed with the experimental diet after 7 weeks of storage while animals in group C were fed with the experimental diet after 14 weeks of storage. The control group (A) was fed with the normal rat pellets. All the animals were allowed drinking water *ad libitum*. The feeding period lasted for 14 weeks.

At the end of the 14th week of feeding for groups B and C respectively, the animals were sacrificed and a mid-line incision made in the ventral body wall. The liver of the animals were excised rinsed in normal saline and weighed and then fixed in 10% neutral formalin. The tissues were processed using the Histokinette tissue processor. The tissues were embedded in paraffin, sectioned and stained using Haematoxylin and Eosin (H and E) method and Periodic Acid Schiff (PAS) method according to Drury and Wallington, (1973).

RESULTS

The results showed that the experimental diets had effect on the mean weight of the liver of Albino rats as in table I. The mean weights of the liver were 19.88 $\pm$ 2.5g; 12.21 $\pm$ 2.54g and 14.19 $\pm$ 1.92g for groups A, B and C respectively, of which the level of difference was significant between the control group (A) and experimental groups B and C ($p<0.05$). The difference was not significant between the experimental groups B and C ($p<0.05$).

Microscopic examination of the liver show the liver normal cord arrangement of cells from the control group (A) as shown in Figure 1 and 2. Animals in group B, showed fatty vacuoles in some liver cells as in Figure 3 while, some in addition contained area of degeneration of cells (necrosis) as shown in Figure 4. The group C animals also showed fatty infiltrations in form of fat vacuoles in some liver cells as in Figure 5 while Figure 6 showed enlarged hydropic liver cells of animals in group C.

DISCUSSION

The results from the liver of the experimental groups (B and C) show degenerative fatty deposits in the form of fatty vacuoles. It has been shown that some cytotoxic agents like cyclohexim inhibit protein synthesis thereby producing fatty liver while others like orotic acid produce fatty liver by interfering with egress of lipid from cells (Zimmerman, 1982). Sometimes, damages to the plasma membrane may contribute to the accumulation of fats in the cells in that in gross peroxide accumulation, membrane damage results (Range, *et. Al, 1999).*

Some of the cytotoxic agents in the pesticide residues may polymerize and denature biological proteins like enzymes and membrane proteins and lipids. Membrane damage increases permeability and cell leakage often results which poses a serious danger to lysosomes (Duve, 1970). The degenerative fatty changes in the liver may be due to the presence of cytotoxic agents in the diets like the pesticide residues which are more in group B diets due to the short period of storage than group C diets which have longer period of storage.

Also manifested was necrosis of the liver cells and tissues in the test groups. Zimmerman (1982) showed that some toxic agents lead to injury to the plasma membrane, which permits intrahepatic accumulation of calcium ions. The high concentration of calcium ions, in-turn enhances plasma membrane injury permitting even higher intracellular content of the ion, which leads to necrosis (Scales, 1993). It has also been shown that the inability to synthesize proteins that have been destroyed by the toxic agents may conceivably contribute to necrogenesis (Grundmann, 1980). Grundmann (1980), has shown that in all cases of liver toxicity, the nature of the cytotoxic agent is less influential on the causation of liver injuries than the personal and individual susceptibility (Guyton and Hill, 1996).

The presence of pesticide residues in foods and drinks of Nigerian has been demonstrated and the liver has been shown to be their target organ of attack followed by the intestine (Kwanashie, 1990; Zimmerman, 1980). It has been shown that the longer the storage time, the lower the effect of these pesticide residues.

Therefore, effort should be directed towards improved agricultural extension services and educational campaigns that will help local farmers to apply pesticides correctly and thereby reduce the incidence of residues in foods (Kwahashie, 1990, Seth, 1996). In addition, campaign should be mounted against local businessmen who buy and store foodstuffs only to bring them to the market for consumption prior to the time allowed for the residual effects to reach tolerable level for the purpose of maximizing profit.

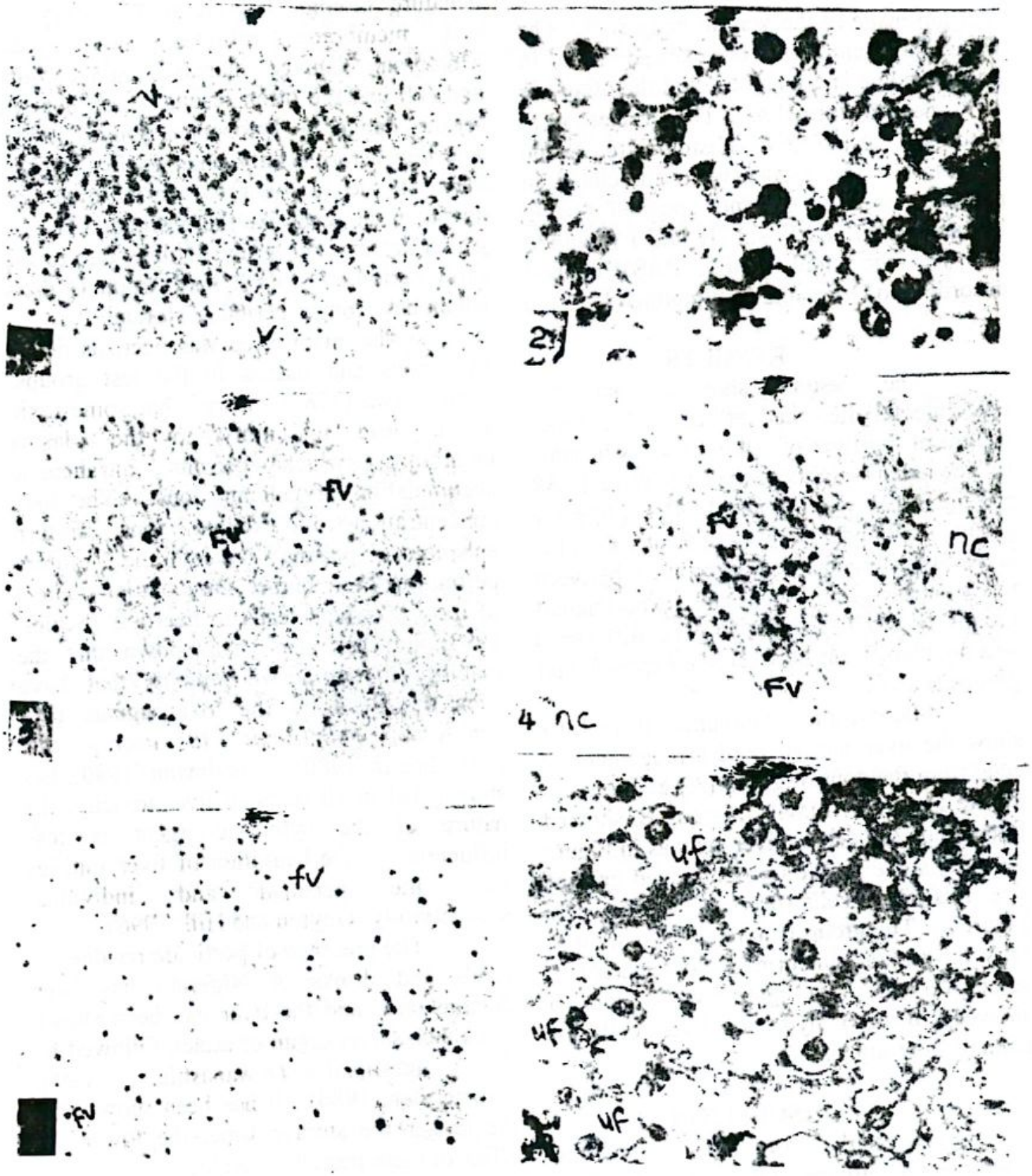

Fig. 1: Normal liver architecture with cords radiating from the central vein (v), group A. H and E. x 100.

Fig. 2: Liver from Control group (A), showing normal liver cells with PAS positive glycogen,Storage. PAS x 250.

Fig 3: Liver from group B showing fat vacuoles and some liver cells (FV). H and E x 100.

Fig 4: Liver from group B, showing fat vacuoles in some liver cells with area of necrosis (NC) H and E x 100.

Fig. 5: Liver from group C, showing fatvacuoles in some liver cells (fv). H and E x 100.

Fig. 6: Liver from group C, showing enlarged hydropic liver ceUs representing a stage before cell degeneration. p AS x 250.

Table 1: The effect of pesticide residues on the weight (gms) of the liver of Albino Rats.

Rat No.	Group A	Group B	Group C
1	20.2	10.2	12.6
2	21.5	11.3	13.5
3	19.8	8.6	16.6
4	22.5	10.5	15.6
5	23.6	12.6	14.8
6	20.1	14.5	11.9
7	20.3	16.2	10.8
8	18.5	13.1	14.7
9	15.6	15.3	16.1
10	16.4	9.8	25.3
Total	**198.5**	**122.1**	**141.9**
Mean	**19.85**	**12.21**	**14.19**
S.D	**±2.5**	**±2.54**	**±1.92**
Range	**(15-24)**	**(8-16)**	**(12.17)**

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