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EFFECT OF UPPERCOTT EXPOSURE ON THE LIVER OF FEMALE ALBINO WISTAR RATS

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ABSTRACT
Improving technology has led to more dependence on agricultural pesticides and herbicides in the fight against pests. These pesticides have been shown to have harmful effects on man and other species. In this study, the hepatic effect of exposure to cypermethrin and dimethoate mixture (uppercott) was investigated in female albino wistar rats. Thirty (30) female wistar albino rats were distributed into five (5) groups of six (6) animals each. Groups 1 and 2 served as the normal control and oil control respectively, groups 3, 4 and 5 received 2.5%, 5% and 7.5% LD50 of uppercott orally for 28 days. Results obtained revealed that uppercott exposure significantly ($p<0.05$) increased serum aspartate aminotransferase (AST) activity, alanine aminotransferase (ALT) activity and alkaline phosphatase (ALP) activity when the test groups were compared with control. Also, uppercott exposure raised serum bilirubin concentration slightly insignificantly ($p>0.05$) compared to the control. Superoxide dismutase (SOD) activity was significantly ($p<0.05$) reduced across all test groups as compared with compared with control. Histology of liver tissues revealed patchy necrotic sessions in the liver tissues of the test experimental groups (2.5%, 5% and 7.5%). The results obtained from this study are strongly indicative of the hepatotoxic effect of uppercott pesticide and hence, caution during usage is advised.

KEYWORDS: Alanine Transaminase, Alkaline Phosphatase, Aspartate Transaminase, Superoxide dismutase, Hepatotoxicity, Uppercott Pesticide.

INTRODUCTION

Pesticides are chemicals used to eliminate pests but they may pose some danger to other organisms which were not the original targets (Srivastava *et al.,* 2018). Uppercott is a pesticide made up of cypermethrin (30g/l) and dimethoate (250g/l). Cypermethrin is a pyrethroid and non-selective insecticide with the ability to act quickly on the nervous system and interrupt its normal function (Tao *et al.,* 2008). It builds up in areas like kidneys, ovaries, skin, brain and liver due to the fact that it is lipophilic (Tao *et al.,* 2008). Artificial pyrethroid pesticides are in use now for controlling pests and consequently increasing crop yield (Muthuviveganandavel *et al.,* 2008). Pyrethroids are commonly used because they are less harmful to animals, fowls and insects (Srivastava *et al.,* 2006). Dimethoate is an organophosphate insecticide with long term activity against a wide array of pests, and on a variety of plants (EPA, 1998). It is easily absorbed through the skin, which is common with other organophosphates. Its harmfulness is heightened in warm conditions or when exposed to visible or ultraviolet light (Occupational Health Services, 1991).

The central organ for poisons, medicines and other lethal substances is the liver. This is due to its multifaceted structural and functional nature. The liver is dominantly involved in the absorption, breakdown and elimination of these toxic substances, thereby making it vulnerable to their adverse properties (Navarro and Senior, 2006).

This study was undertaken to determine the effects that will be observed on the liver when exposed to uppercott in female albino wistar rats.

MATERIALS AND METHODS

Materials and apparatuses

Refrigerator (thermocool, Nigeria), homogenizer (Kinematica, England), spectrophotometer (6320D, Jenway), wooden cages, feeding troughs, weighing balance (AE 260, Mettler), cuvette, water bath (Gallenkamp, England), MSE clinical centrifuge, water bottles, non-heparinized samples, syringes and needles, canula, test tubes, test tube racks, reagent kits, chloroform and deionized water.

Chemicals

All biochemical assays were done with Agappe assay kits.

Procurement of uppercott

Uppercott pesticide was gotten from Agro chemicals company in Calabar. Uppercott is a pesticide made up of cypermethrin (30g/l) and dimethoate (250g/l)

LD_{50} determination

The LD_{50} was determined using the method of Lorke, 1983. The LD_{50} is then calculated by the formula; $LD_{50} = \sqrt{(D_0 \times D_{100})}$. Where D_0 = Highest dose that gave no mortality; D_{100} = Lowest dose that produced mortality. The LD_{50} was determined to be 14.14 mg/kg b.wt".

Experimental animals

Thirty (30) Wistar albino female rats weighing between 150-180g were used for the experiments. They were gotten from the animal grooming section of the department of Biochemistry, University of Calabar. All animals were maintained under standard conditions and were given normal pellet diet *ad libitum*. They were divided into five (5) groups of six (6) rats each. The groups are shown below:

Experimental design and treatment schedule

Table 1 shows the animal distribution into experimental groups. The rats were acclimatized in the experimental animal house for one week before the experiment commenced. The animals housed in stainless steel cages were fed with the normal rat pellets. All the rats in both test and control groups were allowed free access to food and water *ad libitum*, throughout the experimental period.

Table 1: Distribution of animals into experimental groups

Groups	Treatments
Group 1	Control (untreated)
Group 2	Control administered only oil
Group 3	2.5% (0.35 mg/kg b.wt) of LD_{50}
Group 4	5% (0.71 mg/kg b.wt) of LD_{50}
Group 5	7.5% (1.06 mg/kg b.wt) of LD_{50}

After one week of acclimatization, the rats in groups 3 to 5 were exposed to oral administration of uppercott at the different doses for 28 days. At the end of the exposure, the rats were sacrificed and the various biochemical analysis run to check for toxicity effects as compared to the control group.

Collection and preparation of blood samples for analyses

Blood samples were collected by cardiac puncture into plain screw-cap sample bottles for the liver function tests (LFTs). The blood samples collected for the LFTs were allowed to clot, and the serum extracted with Pasteur pipette after spinning with MSE model (England) table-top centrifuge at 2000 rpm for 5 minutes. The serum collected were used for biochemical analyses. All biochemical analyses were carried out within 24 hours of serum separation.

Biochemical analyses

Biochemical analyses that were carried out are described below. Bilirubin was estimated using Span assay kits (Jendrassik and Grof, 1938). AST was assayed using Agappe assay kits (Thefeld *et al*., 1974). ALT was assayed using Agappe assay kits (Thefeld *et al*., 1974). Alkaline Phosphatase activity in serum was assayed using Agappe assay kits (Schlebusch *et al*., 1974). Superoxide dismutase (SOD) activity assay **w**as assayed using Fortress assay kits by measuring the oxidation of NADH (Paoletti *et al*., 1986).

Statistical analysis

Data obtained was expressed as Mean ± Standard Deviation and analyzed using the SPSS package 19.0. One-way Analysis of Var-iance (ANOVA) was used. Values at $P < 0.05$ were regarded as statistically significant.

RESULTS

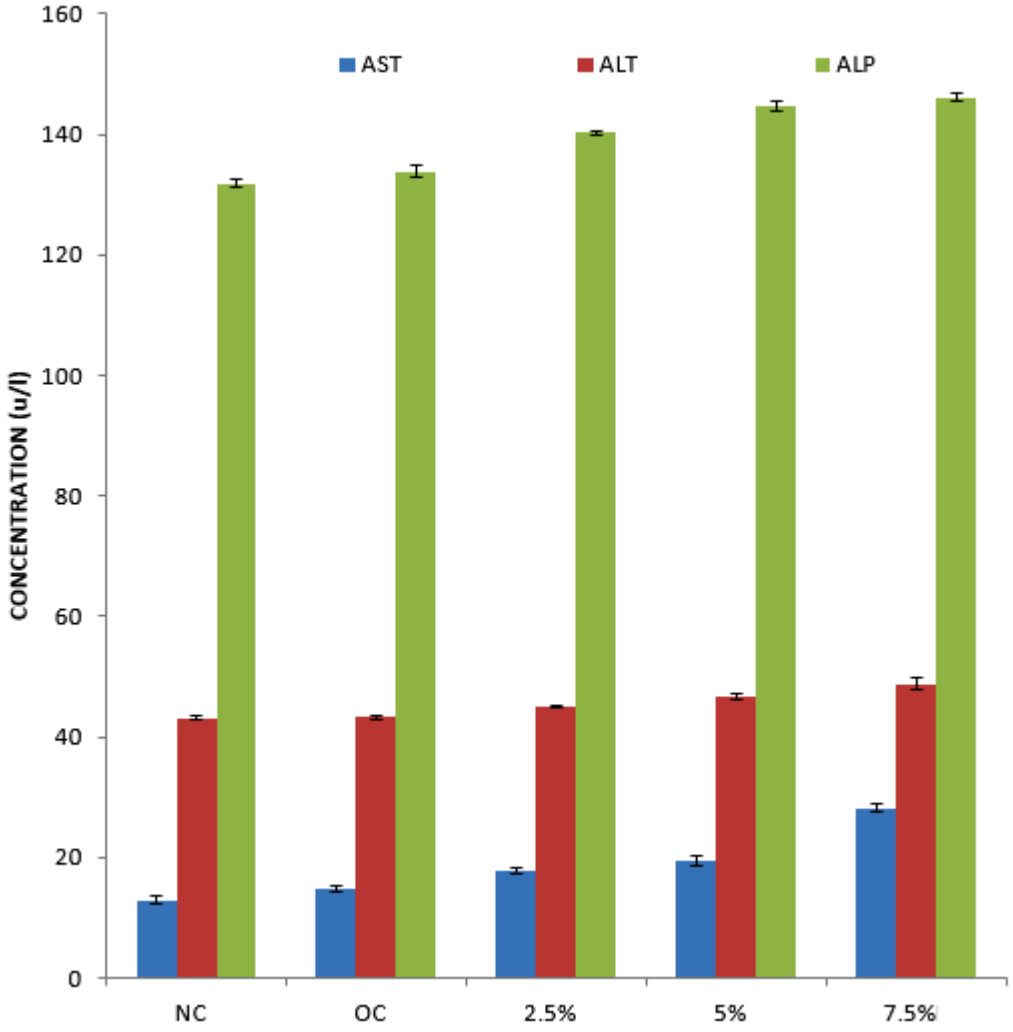

Fig. 1: Serum liver enzymes concentration in the experimental rats

Values are expressed as mean ± SD, n = 5-6.p>0.05

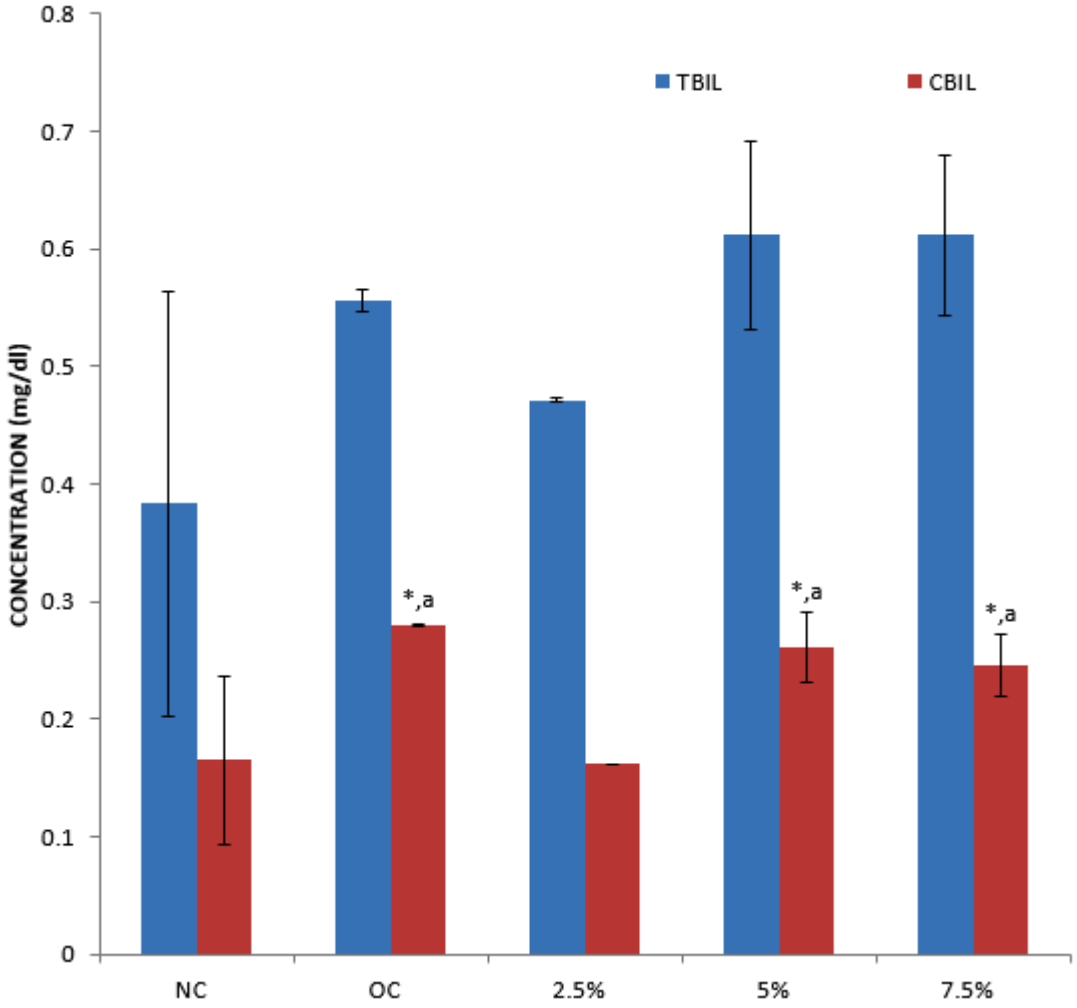

Fig. 2: Billirubin concentration in the experimental rats

Values are expressed as mean ± SD, n = 5-6. *p<0.05 is significant against the control

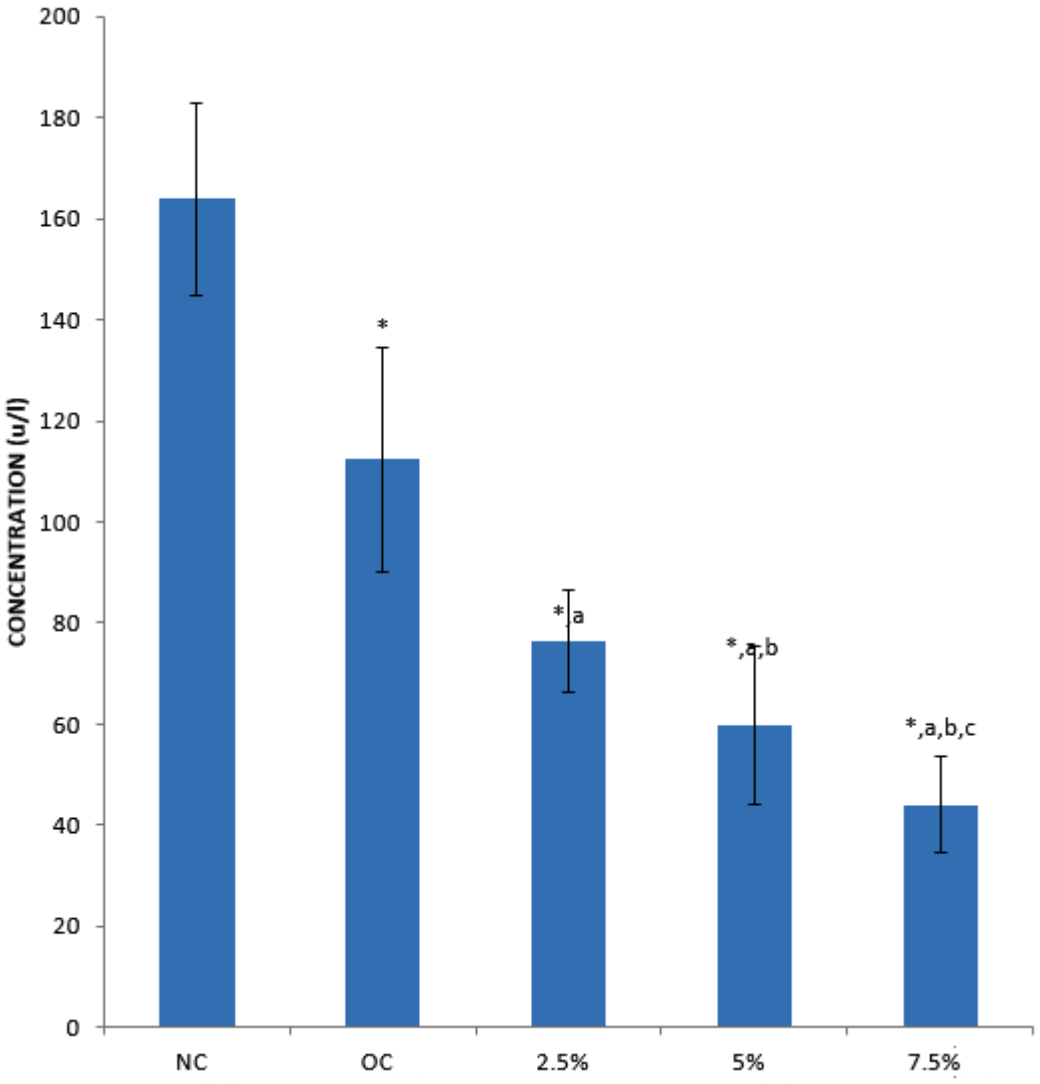

Fig. 3: Superoxide dismutase concentration in the experimental rats

Values are expressed as mean ± SD, n = 5-6

*p<0.05 is significant against the control

HISTOLOGY

Plates 1a-1e show the histological sections of the liver tissues. There was preserved histo-architecture of the liver cells having central veins and radially displaced hepatocytes in normal control (NC). The central veins were slightly congested and the sinusoidal spaces were prominent. There were patchy necrotic sessions in the liver tissues of the oil control and other experimental groups (OC, and 2.5%, 5% and 7.5%). These are shown below

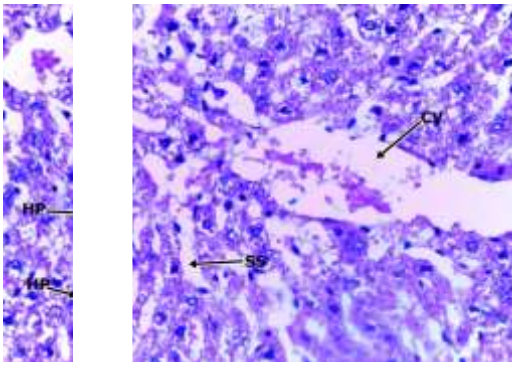

Plate1a: Photomicrograph of normal control (NC) rat liver. (Mag. x 400)

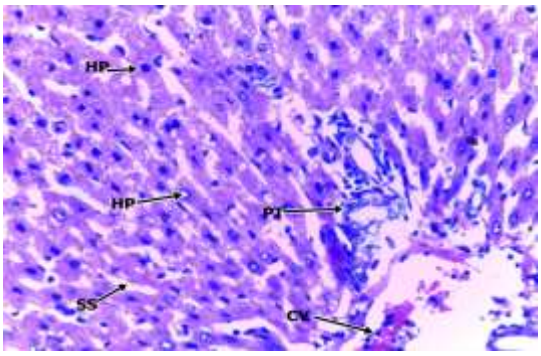

Plate1b: Photomicrograph of oil control (OC) rat liver.(Mag x 400)

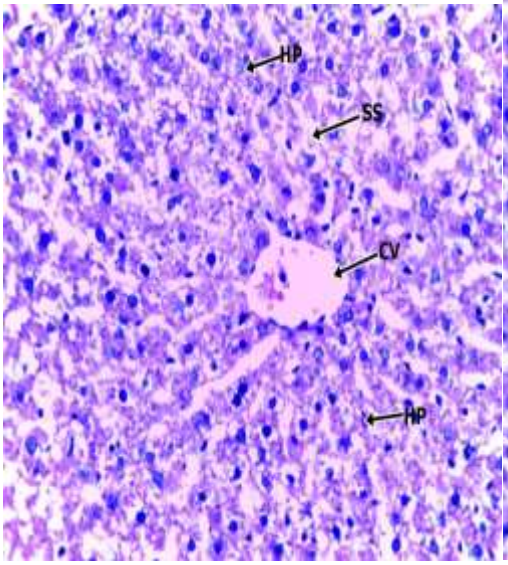

Plate1c: Photomicrograph of rat liver exposed to 2.5% uppercott insecticide (Mag. x 400)

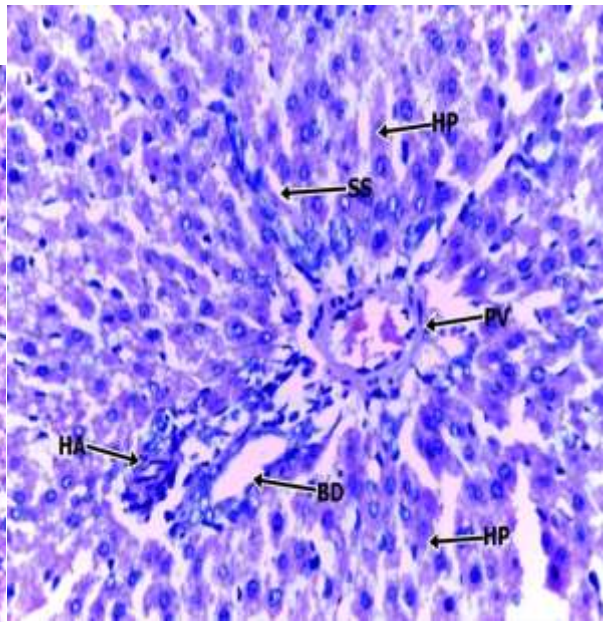

Plate1d: Photomicrograph of rats liver exposed to 5% uppercott insecticide (Mag.x 400)

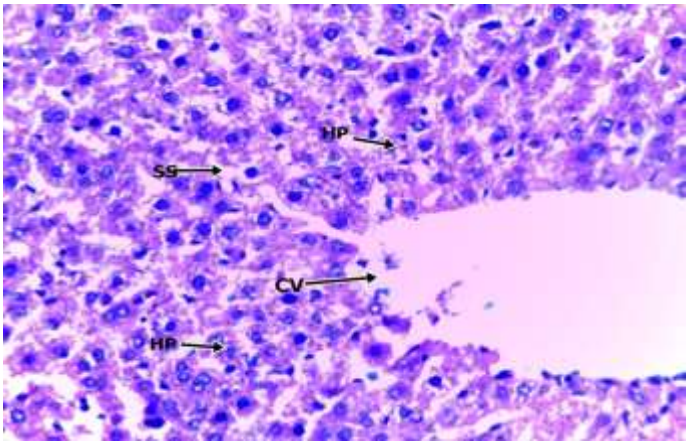

Plate1d: Photomicrograph of rats liver exposed to 5% uppercott insecticide (Mag.x 400)

DISCUSSION

Pesticides are poisonous substances which pollute the land, waters and atmosphere. They have also been identified in organs of animals and man (Carvalho, 2017). Deleterious effects of these substances on organs like eyes, skin, liver, kidney, the nervous system and reproductive system have been found following protracted period of contact (IPCS, 2010).

The liver is a significant and vital organ due to its role in the breakdown of poisonous substances including pesticides. Consequent upon this, any permanent modification to its role may result in severe damage with dire consequences. In this study, exposure to uppercott pesticide significantly ($P<0.05$) increased ALT, AST and ALP compared to control. This significant increase in the aforementioned hepatic marker enzymes may have been triggered by an accrual of uppercott pesticide in the tissues of the liver bringing about injury to the cell membrane which results in the discharge of the enzymes into the blood. The toxic effect of uppercott in the liver was also shown by the significant decrease in the levels of SOD. Oxidative stress helps to stimulate the commencement and advancement of hepatotoxicity (Li *et al*., 2015). Previous studies have shown a significant decrease in antioxidant levels during liver damage (Seven *et al.*, 2004). Singlet oxygen and peroxyl radicals which are byproducts of oxygen metabolism were shown to impede SOD activities (Escobar *et al.*, 1996). The foregoing may be the reason for the significant reduction in SOD activity in uppercott-exposed female rats as seen in this study. Dimitrova *et al.* (1994) proposed that superoxide radicals may cause the cysteine in the enzyme to be oxidized, thereby reducing the activity of SOD. They stated further that the decrease in SOD activities may be a pointer to oxidative stress following contact with dimethoate. Gomaa *et al.* (2011) established that cypermethrin prompted a significant elevation in the levels of AST, ALT, ALP and MDA and a reduction in the activities of antioxidant enzyme (CAT, SOD and GPx) in rats liver. Work by Srivastava *et al.* (2018), Sami *et al.* (2018) and Ahmed and Mohamed, (2010) also corroborate our study. Results from histology show changes in the tissue as a result of the administration of uppercott to the female rats.

CONCLUSION

This study has shown that exposure to uppercott pesticide could distort the normal functioning of the liver in female rats. Care should therefore be exercised during its usage.

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