EFFECTS OF SELECTED AGRO-PESTICIDES ON THE PACKED CELL VOLUME AND TOTAL LEUCOCYTE COUNT OF ALBINO WISTAR RATS

BY

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ABSTRACT

Pesticide exposure is known to produce a variety of haematological changes, some of which may be responsible for the adverse biological effects in humans. This study was to determine the effects of some selected agro-pesticides on the packed cell volume and total leucocyte count of albino wistar rats. The experiment was laid out in a complete randomized design (CRD). Each group was assigned a particular oral dose level of the pesticides in the order 5000, 7000, 9000, 11000, 13000 and 15000mg/kg body weight. The control group was not exposed to the treatment. The rats were sacrificed within 24 hours after administration of the toxicants.The Packed cell volume (PCV) and the total leucocyte counts were obtained at once for each blood sample using an Automated Haematology Analyser model 2800 BC produced by Mindray Company, India. From the results, Pack cell volume values were significantly increased although slight fluctuations in mean and standard deviation were also observed across the doses at $P<0.05$.No significant difference was seen in the Packed cell volume of the control group with a mean and standard deviation value of 45.50±1.29 and group administered with 7000mg/kg of the pesticide Basudyn with value 44.25±2.22. A gradual increase was recorded in values of the total leucocyte count (mean and standard deviation) from 17.94±0.03 to 19.82±0.02 as the carbamate based pesticide (Carbofuran) concentration increased in the groups. The increase in total leukocytes count could be attributed to stimulated lymphopoiesis or enhanced release of lymphocytes from lymph myeloid tissue.

INTRODUCTION

Pesticides are said to be universal chemical substances and global statistics have shown increasing use of these chemicals for the control of pests (Zhang, Jiang, and Ou, 2011).Pesticides use is essential in agricultural production. Around one-third of the agricultural yields are achieved by using pesticides. Without pesticide usage, the loss of fruits, vegetables, and cereals from pest damage would reach 78, 54, and 32%,
respectively (Zhang *et al.*, 2011)

The potential risks to the pesticides applicator or farm worker occupationally exposed to pesticides are greater than the risks to someone in the overall population exposed only to traces of pesticides in food and /or water (Amer *et al* 2002). Haematological and biochemical parameters have been related to health indices and are of diagnostic significance in routine evaluation of the state of health; hence the analysis of these parameters is important to risk evaluations of alterations of the haematological system in humans and other animals (Saliu *et al.*, 2012). Haematological records are also used for diagnosis of diseases in mammals and is a prodigious help in veterinary and human

medicine and can help us assess health status of fishes (Saliu*et al.,* 2012)

Exposure to low level of pesticides is known to produce a variety of biochemical changes, some of which may be responsible for the adverse biological effects in humans (Elhalwagy *et al.,* 2009; Ibrahim *et al.,* 2011).

Unfortunately, there are few findings on the haematotoxicity, based on exposures to selected pesticides, using albino wistar rats for experiment. This study was aimed at investigating the effect of some selected agro-pesticides on the packed cell volume and total leucocyte counts of albino wistar rats.

MATERIALS AND METHODS

Test Organisms

A total number of 56 albino wistar rats of the order Rodentia and family Muridae were used were obtained at once for each blood sample for the toxicity test of the agro-pesticide basudyne and carbofuran respectively after 14 days acclimatization

Research Design.

The experiment was laid out in Complete Randomized Design (CRD). The rats were randomly assigned to a control group and six test groups (Grp 1, Grp2, Grp3, Grp4,Grp 5 and Grp 6).The respective test groups were assigned four albino wistar rats each. Each group was assigned a particular oral dose level of the pesticide basudyne and in the order: 5000, 7000, 9000, 11000, 13000, and 15000mg/kg body weight. Treatment was done by the oral route using a gavage for the respective agro-pesticides (basudyne and carbofuran). The rats were sacrificed within 24.0hrs after administration of toxicant. Blood collection by cardiac puncture into K_3 EDTA and plain bottles for haematology tests.

Acute Toxicity Test (LD_{50})

Forty eight rats were divided into 6 groups of four rats each and each group was assigned a particular oral dose level of the pesticide in the order: 1000, 2000, 3000, 4000, 5000, and 6000mg/kg body weight. This was carried out for pesticides (toxicants).The rats were thereafter monitored for toxicity signs and deaths within 24 hours. The number of deaths recorded by the end of 24 hours was used to estimate the LD_{50} value for the extract according to Karber's method, as was used by Enegide *et al.,* (2013).

Determination of Haematology Parameters

The Packed cell volume (PCV) and the total leucocyte count as haematological parameters using an Automated Haematology Analyser model 2800 BC produced by Mindray Company, India.

RESULTS

Results of the respective tests are summarised in Tables 1 - 4 below

Table 1: ACUTE TOXICITY OF CARBAMATE BASED PESTICIDES (CARBOFURAN)

Dose (mg/kg i	Number of	Percentage mortality	Dose Difference (DD)	Mean Death (MD)	DD X MD
500	0	0	500	0.00	0.00
1000	0	0	1000	0.00	0.00
2000	0	0	1000	0.00	0.00
3000	0	0	1000	0.00	0.00
4000	0	0	1000	0.00	0.00
5000	0	0	1000	0.00	0.00
6000	0	0	-	-	-

LD_{50} value must be above 6000 mg/kg body weight

Table 2: ACUTE TOXICITY OF ORGANOPHOSPHATE BASED PESTICIDE (BASUDYNE)

Dose ($^{m}g/^{k}g$)	Number of Deaths	Percentage mortality	Dose Difference (DD)	Mean Death (MD)	DD X MD
500	0	0	500	0.00	0.00
1000	0	0	1000	0.00	0.00
2000	0	0	1000	0.00	0.00
3000	0	0	1000	0.00	0.00
4000	0	0	1000	0.00	0.00
5000	0	0	1000	0.00	0.00
6000	0	0	-	-	-

No death was recorded within the 24 hours of acute toxicity study of the pesticides, even at the highest dose of 6000 mg/kg body weight. The rats had normal disposition and were emotionally stable and all survived the 24 hours period of acute toxicity study.

Table 3: EFFECT OF ACUTE ORGANOPHOSPHATE BASED PESTICIDE (BASUDYNE) TREATMENT ON THE PACKED CELL VOLUME AND TOTAL LEUCOCYTE COUNTS.

Dose	*PCV%*	*WBC^10₃mm₃*
Control	45.50±1.29^{cd}	9.22±0.02^{a}
5000mg/kg	43.00±1.63^{bc}	22.16±0.10^{g}
7000mg/kg	44.25±2.22^{cd}	12.81±0.02^{b}
9000mg/kg	41.00±2.58^{ab}	14.48±0.06^{c}
11000mg/kg	49.75±2.22^{e}	16.51±0.06^{e}
13000mg/kg	39.50±2.38^{a}	20.18±0.03^{f}
15000mg/kg	47.25±1.71^{de}	14.88±0.06^{d}

Different alphabetical superscripts in the same column means there is a significant difference at P<0.05 between treatments according to Duncan test while same alphabetical superscripts in the same column means no significant difference at P<0.05 between treatments according to Duncan test.

There was a slight reduction in mean ± standard deviation of PCV values as the concentration increased. PCV control group has 45.50±2.58%. There was an increase in total leucocyte count with mean ± standard deviation of 22.16±0.10x10₃mm^3

DISCUSSION

The LD_{50} results suggest that carbofuran and basudyne are completely free from any form of acute toxicity as the rats showed no sign of toxicity but instead looked physically healthy and emotionally stable all through the period, including those which were given 6000mg/kg body weights. Madubunyi *et al.,* (2012) had reported that mortality is the expected end point of acute toxicity and non-observation of mortality within a population treated with a dose range at which mortality is expected indicates tolerance or lack of acute toxicity.

Packed cell volume values were significantly increased although a slight fluctuation in mean ± standard deviation was also observed across the doses at P<0.05.The increase in total leukocytes count has been suggested to be due to stimulated lymphopoiesis and/or enhanced release of lymphocytes from lymph myeloid tissue (Das *et al.,* 2003). Such lymphocyte response might be due to the presence of toxic substances which may be associated with the pollutant induced tissue damage and severe disturbance of the non-specific immune system leading to increased production of leukocytes. Several authors have noticed an increase in white blood cells (WBC) in animals repeatedly treated with sublethal doses of insecticides. Increased WBC was observed in rats treated with novel phosphorothionate (Rahman *et al.,* 2006) and lindane and endosulfan (AzharBaig, 2007) .

Table 4: EFFECT OF ACUTE CARBAMATE BASED PESTICIDE (CARBOFURAN) TREATMENT ON THE PACKED CELL VOLUME AND TOTAL LEUCOCYTE COUNTS

Dose	*PCV%*	*WBC* 10 mm^3*
Control	51.50±1.29^c	11.22±0.04^b
5000mg/kg	40.50±1.29^a	17.94±0.03^c
7000mg/kg	43.25±1.71^b	18.21±0.02^c
9000mg/kg	44.50±1.29^b	16.83±0.02^c
11000mg/kg	39.75±1.71^a	19.82±0.02^{cd}
13000mg/kg	43.75±1.26^b	17.02±0.02^c
15000mg/kg	42.00±2.94^{ab}	15.53±0.04^{bc}

Different alphabetical superscripts in the same column means there is a significant difference at P<0.05 between treatments according to Duncan test while same alphabetical superscripts in the same column means no significant difference at P<0.05 between treatments according to Duncan test

A rise and fall in mean ± standard deviation is seen in WBC. WBC values increased from 17.94±0.03x10^{3}mm^3 control group. A drop was seen in 9000mg/kg with mean ± standard deviation of 16.83±0.02x10^{3}mm^3, further drop was seen in 15000mg/kg with a mean ± standard deviation of 15.53±0.04x10^{3}mm^3. A rise and fall in the mean ± standard deviation values was seen in the packed cell volume as the dose increased.

CONCLUSION

It is well established that haematological values may be quite valuable in assessing toxicity effects of substances. Based on the result of the study, the LD_{50} results suggest that the carbamate based pesticide (carbofuran) and organophosphate based pesticide (basudyne) are completely free from any form of acute toxicity as all animals treated with the extract during the acute toxicity study period showed no sign of toxicity but instead looked physically healthy and emotionally stable all through the period. This conclusion is in line with the OECD guideline for acute toxicity studies. OECD (2001).

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