HAEMATOLOGY PROFILE OF ALBINO RATS GIVEN FEED AND WATER CONTAMINATED WITH VARIED CONCENTRATIONS OF USED ENGINE OIL

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ABSTRACT

The study evaluated the haemotology of albino rats given feed and water experimentally contaminated with varied concentrations of used engine oil (UEO) for a period of 28 days. 30 rats of 7 weeks of age were used for the study. They were divided into four groups (A, B, C, and D) and given feed and water contaminated with UEO at the levels of 4.0ml, /2. 0ml,1.0ml,0ml per kg of feed and 1.0ml, 0.5ml, 0.2ml and 0ml per litre of water respectively. Feed and water consumption were recorded daily. The body weights were recorded before the commencement of the treatment and thereafter at 7days interval through one month duration of the experiment. The haematology profiles of the rats were assessed after 14 and 28 days of administration. Results showed that there was a significant decrease (P>0.05) of all studied haematological profiles, water consumption and Body weight of the rats when compared to the control But there was a significant increase on the lymphocyte counts of the rats when compared to the control. Feed consumption was found to be statistically similar in all the treatments. From our study, UEO can lead to reduction in haemalogical profiles and weight decrease in rats. Thus proper disposal and recycling of UEO is strongly recommended.

Keywords: Used engine oil, Haematology profile, Albino rats, Weight loss

INTRODUCTION

Engine oil is refined from crude oil or synthetic oil for lubricating of combustion engines. It also cleans, inhibits corrosion, improves sealing and cools the engine by carrying heat away from moving parts. Engine oil, are composed of a virgin base of oil (a complex mixture of hydrocarbons, 80-90% by volume) and performance enhancing additives (10-20% by volume) (Irwin *et al.,* 1997, Collins, 2007).

Used Engine oil (UEO) refers to that lubricating oil that has given its service properties in a vehicle, withdrawn from the meant area of application and considered not fit after its initial purpose (Kojevnikova, 1999). These used lubricants contain a lot of toxic and carcinogenic substances that can cause detrimental effects to the Ecosystem (Irwin *et al.,* 1997).

The composition of used mineral – based crankcase oil varies widely and depends on the original crude oil, the process used during refining, the efficiency and the type of engine it is lubricating, the gasoline combustion products, the additives added to the fuel and to the original oil and the length of time the oil remained in the engine (Vazquez–Duhalt, 1989).

The biological fate of chemical components of UEO when an animal or man is exposed to it depends on the individual properties of the specific chemicals in the oil (Upshall *et al.,* 1993). Chronic effect of naphthalene, a constituent of used engine oil includes changes in the liver and harmful effects on the kidneys, heart, lungs and nervous system. Polycyclic aromatic hydrocarbons

(PAHS) especially alkyl in jet fuel when disposed can contribute to long term hazards in contaminated soils, sediments and groundwater (Upshall *et al.,* 1993).

The common methods of entry of UEO into the environment are various. Motor oil leaked from individual vehicles or dumped by home owners and commercial garages, finds its way into local water bodies through run-off, Top soil and natural vegetation can ordinarily filter many of these pollutants, but the impermeable pavement that covers much of the surface where these pollutants originate carries it right into drains and into streams, rivers, lakes and oceans where it poisons aquatic lives which are sources of food to man. Also the UEO can poison entire riparian or coastal ecosystem (Mahaney, 1994; Anoliefo and Uwioko, 2001)

Waste crankcase oils spilled on soil migrate downward by gravity through soil and possibly to groundwater and spread laterally due to capillary forces and soil heterogeneity (Yong *et al.*, 1992; Mahaney, 1994). Used Engine oil can enter directly into the atmosphere through the exhaust system during engine use and as vapour when used to control dust in rural roads (ATSDR, 1997). The damage caused by unethical dumping of UEO in our environment, cannot be over emphasized and the problems it poses to man, animal and the entire ecosystem cannot be over emphasized. Hence the aim of our study was to find out the effects of UEO on haematological profile of albino rats.

MATERIALS AND METHODS

Test sample: Used engine oil was obtained from Mechanic Village, Nsukka.

Experimental Design: The experimental animals were male Sprague– Dawley albino rats of seven (7) weeks of age, bred and acquired from the Genetics and Animal breeding Laboratory, Department of Zoology, University of Nigeria Nsukka. The rats were kept in clean and well ventilated cages in the Animal House in the Zoological Garden of Department of Zoology, University of Nigeria Nsukka. The rats were fed *ali-bitum* with chicken growers mash feed and clean drinking water.

The animals were divided into four groups (A, B, C and D) with 3 replicate per group and 3 rats per replicate.

The animals were allowed to acclimatize for seven days before treatments commenced. Group A rats were used as control and provided with uncontaminated feed and drinking water. Group B rats were given feed and water containing 4.0 ml UEO per kg of feed and 1.0 ml of UEO per litre of water respectively. Group C rats were fed with feed and water containing 2.0ml UEO per kg of feed and 0.5 ml UEO per litre of water respectively. Rats in group D were given feed and water containing 1.0ml UEO per kg feed and 0.2ml UEO per litre of water. The rats were individually weighed at day 0 and thereafter at day 7, 14, 21 and 28 respectively. Food and water consumption at day 7, 14, 21 and 28 were recorded respectively. Haematology parameters of each group were determined fortnightly at day 14 and 28.

Determination of Haematological Profiles: Blood for haematological study was collected using the orbital technique (Stone, 1954) into a sample bottle containing ethylene diamine tetra acetic acid (EDTA). Immediately after blood collection, the sample bottle was gently shaken to mix up the blood with the EDTA to prevent clotting or lysing of the blood. The PVC was determined by the micro haematocrit method (Coles, 1986). The haemoglobin concentration was determined using the cyanomethinaemglobin method while the erythrocyte count was carried out using the heamocytometer method (Schalm *et al.,* 1975). The platelet count was determined using the Ress–Ecker method (Brown, 1976) and the total leukocyte count was determined using haemocytometer method (Schalm *et al.,* 1975) while the differential leukocyte count was determined using the Leishman technique (Coles, 1986).

Data Analysis: One way ANOVA was used to evaluate the significant difference between the various treatment groups. Results were reported as means and standard error of means. Mean

separation were done using Duncan Multiple Range Test.

RESULTS

Body Weight: The body weight of the rats given contaminated feed and water decreased significantly ($p>0.05$) in all the treatments for days 0, 7, 14, 21 and 28 respectively (Table 1).

Feed Consumption: There was no significant increase in the daily feed consumption of rats given contaminated feed and water when compared with the control for days 7, 14 and 21, but there was a significant increase of the daily feed consumption of the contaminated rats at day 28 in all the groups when compared with the control (Table 2).

Water Consumption: The water consumption of the experimental rats given feed and water contaminated with used UEO decreased significantly in the first 21 days, but there was no significant decrease seen on day 28 when compared with the control in all the treatments for all the groups (Table 3).

Packed Cell Volume: The packed cell volumes of the rats given contaminated feed and water had no significant decrease ($p>0.05$) in the treatments for day 14 and 28 when compared with the control in all treatments for all groups (Tables 4).

Red Blood Cell Count: The red blood cell count of the rats given contaminated feed and water had no significant decrease in all the treatments for days 14 and 28 respectively (Tables 4).

Haemoglobin Concentration: The haemoglobin concentration of rats given contaminated feed and water increased significantly ($p>0.05$) on day 14 and decreased on day 28 (Tables 4).

Mean Cell Haemoglobin Concentration (MCHC): At 14th and 28th days of administration of used Engine oil in feed and water of sampled rats, the treatments increased MCHC significantly on day 14 and decreased it as well in day 28 when compared with the control (Tables 4).

Mean Cell Haemoglobin: The mean cell haemoglobin of the rats given feed and water increased significantly in all the treatments for most of the groups in day 28 (Tables 4).

Mean Cell Volumes: There was a significant increase in the mean cell volume of the rats given feed and water contaminated with UEO treatments for days 14 and 28 (Tables 4).

Total White Blood Counts: There was a significant decrease in the total white blood count of the rats given contaminated feed and water in day 14 when compared with the control but there was an increase of the total white blood count in day 28 (Tables 4).

Platelet Counts: The platelet counts of the rats given contaminated feed and water had no significant increase in day 14, but there was a significant increase in day 28 when compared with the control (Tables 4).

Absolute Neutrophil Counts: The absolute neutrophil count of the rats given contaminated feed and water had a significant decrease when compared with the control in all treatments for all groups in days 14 and 28 (Tables 4).

Lymphocyte Counts: The lymphocyte counts of the rats given contaminated feed and water had a significant increase for days 14 and 28 in all treatments for all groups (Tables 4).

DISCUSSION

The administration of UEO contaminated feed and water on the rats may manifest in various forms including changes in haematological profile and body weight.

In the present research study, different results are presented to address the possible effects that can emanate from UEO contaminated feed and water of albino rats used.

Table 1: Body weight of the rats fed diets contaminated with varied concentrations of UEO at every 7 days interval for 28 days

Experimental Period (Days)	Mean Body Weight (g)			
	Group A	Group B	Group C	Group D
0	110.42±2.76	76.67±5.37	77.50±6.04	75.56±2.17
7	112.67±3.18	83.89±5.79	88.61±6.11	91.11±2.54
14	140.83±3.97	96.67±6.87	100.56±5.49	103.89±1.96
21	155.83±3.41	122.78±6.92	126.39±5.85	117.78±3.50
28	172.50±1.12	149.64±9.95	138.33±5.53^{c}	129.38±5.55

Table 2: Daily feed consumption rate of rats fed diets contaminated with varied concentrations of UEO at every 7 days interval for 28 days

Experimental Period (Days)	Mean Feed Consumption (g)			
	Group A	Group B	Group C	Group D
7	102.00±6.46	96.00±9.10	100.38±9.62	109.14±8.19
14	106.86±5.36	118.76±6.15	109.43±6.00	115.29±7.30
21	121.71±5.51	118.95±5.85	110.10±6.03	120.86±5.69
28	80.00±3.02	135.62±3.63	110.38±6.04	117.33±7.20

Table 3: Daily water consumption rate of rats fed diets contaminated with varied concentrations of UEO at every 7 days interval for 28 days

Experimental Period (Days)	Mean Water Consumption (ml)			
	Group A	Group B	Group C	Group D
7	100.00±0.00	89.38±4.10	84.24±4.77	79.48±5.85
14	100.86±0.00	96.67±2.19	87.62±4.67	95.24±2.98
21	90.00±2.67	100.00±0.00	90.48±3.99	94.76±3.00
28	90.00±2.61	90.48±3.33	85.00±4.01	92.86±3.51

The result of the experiment carried out showed that there was a significant decrease in the body weight and feed consumption of the rats in all treatments for all groups except for day 28, this finding is in agreement with the work of (Api, 1980b., Beck *et al.,* 1984, VANR, 1994) where acute toxicity tests of used composite motor oil was carried out on rabbit, it was shown that the contamination affected the growth and weight gain of the rabbit.

There was a significant decrease in the water intake of the rats given contaminated feed and water in the first two weeks, but there was no significant effect in the later two weeks, this could be attributed to the fact that the UEO does not mix well with water, but the rats later took the water in the later weeks when they were starved of fluid. There was a significant increase in the haematological profile of the rats given contaminated feed and water in the areas of haemoglobin, mean cell haemoglobin concentration, mean cell haemoglobin in the first two weeks for all treatments and in all groups, but there was a decrease in the later two weeks, this decrease could be attributed to the blood cell deficiency because of the presence of a toxic substance. This is in line with the work of Sas 1989 which reported that anaemia was observed in cattle that had ingested an unknown amount of UEO while grazing on a pasture, also the lower than normal haematocrit and mean corpuscular haemoglobin (MCH) reported in mechanics and apprentices exposed to UEO (Ritchie *et al.,* 2001) agrees with the study. But it is in contrast with the works of Eastin et al 1983 on ducks and CEPA (1994) on pheasants where they reported no significant effect on the haematological profiles, as a result, this non significant effect could be attributed to the fact

Table 4: Haematological profile of rats fed diets contaminated with varied concentrations of UEO for 14 and 28 days

Haematological Parameters	14 Days Mean Haematological Profile			
	Group A	Group B	Group C	Group D
Packed Cell volume (%)	45.00±0.00	39.33±3.28	39.00±2.52	41.00±2.51
Red Blood Count ($10^{6/dl}$)	6.42±0.00	5.67±0.47	6.03±0.31	6.34±0.32
Heamoglobin Concentration (g/dl)	10.70±0.00	9.80±0.70	11.10±0.50	12.10±0.87
Mean Cell Haemoglobin Concentration (%)	23.78±0.00	25.05±1.41	28.60±1.38	29.54±1.32
Mean Cell Haemoglobin (pg)	16.67±0.00	17.35±0.73	18.44±0.48	19.07±0.68
Mean Cell Volume(fl)	7.01±0.00	6.93±0.12	6.46±0.15	6.46±0.10
Total White Blood Counts (10^3/µl)	13.60±0.00	6.83±0.87	6.80±1.40	7.80±0.21
Platelet Count(10^3/µl)	760.00±0.00	743.33±139.68	570.00±111.50	676.66±86.67
Neutrophil Counts (%)	31.00±0.00	26.00±3.06	16.33±2.19	28.00±1.53
Lymphocyte Counts (%)	69.00±0.00	73.67±2.85	83.67±2.19	72.00±1.53
	28 Days Mean Haematological Profile			
Packed Cell volume (%)	48.00±0.00	47.00±0.58	45.33±1.33	44.00±0.58
Red Blood Count ($10^{6/dl}$)	6.98±0.00	6.39±0.632	5.91±0.23	6.09±0.41
Heamoglobin Concentration (g/dl)	13.20±0.00	11.50±0.81	9.87±0.26	11.57±0.56
Mean Cell Haemoglobin Concentration (%)	27.50±0.00	24.47±1.71	21.77±0.36	26.27±0.95
Mean Cell Haemoglobin (pg)	18.91±0.00	18.10±0.57	16.74±0.62	19.05±0.57
Mean Cell Volume(fl)	6.88±0.00	7.50±0.79	7.48±0.15	7.28±0.45
Total White Blood Counts (10^3/µl)	4.50±0.00	9.30±1.70	10.40±2.76	9.57±1.48
Platelet Count(10^3/µl)	670.00±0.00	797.00±69.60	687.00±85.11	703.33±62.27
Neutrophil Counts (%)	39.00±0.00	34.00±3.06	25.67±2.85	29.33±3.38
Lymphocyte Counts (%)	61.00±0.00	69.00±3.06	74.33±2.85	71.33±2.73

that the dosages administered to the ducks and pheasants were not toxic enough for the effect to be felt. There was an initial decrease in the haematological profile of rats given contaminated feed and water in the areas of total white blood count, platelet count, but there was an increase in the later 2 weeks of the experiment.

However, there was a total significant increase in the lymphocyte count for all treatments in all groups (when compared with the control) through out the experimental period, this could be attributed to be that the presence of foreign body increases the lymphocyte counts, also there was a total significant decrease in the red blood cell, packed cell volume and absolute neutrophil count in all treatments for all groups for days 14 and 28 when compared with the control, Again this agrees with the findings of Sas (1989) which reported the anaemic condition observed in cattle known to have ingested unknown amount of UEO while grazing on a pasture.

As a result, no death of any rat was recorded during the course of the research which could be attributed to be that the dosages administered during the study was not enough to cause death or that the contamination needed a longer period (>28 days) for its effect to manifest.

Previous works revealed that some individuals may experience adverse effects when exposed to used motor oil due to genetic polymorphisms (Ritchie *et al.,* 2001). Increased risk for liver changes and malfunctioning, squamous cell carcinoma in the lungs, harmful effects on the kidney, heart, and nervous system has been reported in a multi-site, case control study (Siemiatycki *et al.,* 1987).

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