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THE EFFECT OF ALCOHOL INTOXICATIONS ON HEMATOLOGICAL PARAMETERS OF ADULT ALBINO WISTAR RATS

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ABSTRACT

Due to the accessibility of alcohol, people around the world become readily intoxicated with it and in turn, it produces protease devastating effects in the human system. This study investigates the hematological effects of alcohol in albino rats grouped into three (A, B and C). Group A and B served as test while C served as control. For 14 days, 3ml/kg and 9 ml/kg of alcohol was administered to group A and B respectively. At the end of the experiment, blood samples were collected from the rats, and the changes in PCV, RBC, Hb, platelets, WBC, and differential counts, were accessed. The results showed no significant ($P > 0.05$) increase in Hb, RBC count, WBC count, but a significant decrease ($P < 0.05$) in platelet count of group B rats. Similarly, there was no significant increase in Hb, but a significant increase in PCV ($P<0.05$) of group A rats when compared with the control. The results suggest therefore, that chronic ingestion of alcohol in a dose dependent fashion, can induce hematoxicity and hence the need to curb excessive consumption of alcohol.

Keywords*: Haematology, Bone marrow, Alcohol, Platelet.*

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INTRODUCTION

Alcohol consumption abuse has been blamed for various social and economic problems. It has also been considered as one factor responsible for high violent death rates in populations and a common cause of hospital admissions throughout the western world (Lieber, 1995).

Descriptively, 'an alcoholic' is an individual who consumes an amount of alcohol that is capable of producing pathological effects on the body. The amount of alcohol capable of producing a disease condition depends on a variety of factors which includes genetic predisposition, malnutrition and concomitant viral infections of the liver.

Acute or chronic alcohol consumption of alcohol causes degeneration in different internal organs and systems of the body (Watabiri *et al*., 1999) including diarrhea and other gastro-intestinal symptoms, as well as weight loss.

The focus of this study however, is to evaluate the effects of alcohol intoxication on some haematological indices in adult Wistar rats.

MATERIALS AND METHODS

Study Site: This experiment was conducted at the Haematology unit of the Medical Science research laboratory, Ebonyi State University, Ebonyi State, Nigeria.

Experimental design: Ten adult albino Wistar rats of both sexes with body weight ranging from 120.5g to 300g were used for this study. The rats were housed in double-compartment fly-proof cages and maintained in a 10 hour light and 14-hour dark regiment. The upper compartment housed the rats while the lower compartment (filled with saw dust) was left for their urine and faecal matter to avoid contamination.

The rats were randomly divided into three (3) groups: group A (n=3); B (n=3); and group C (n=3). While groups A and B served as test groups, group C served as the control. After acclimatization for two weeks, the test groups were placed on alcohol treatments for 14 days (2 weeks). Group A received grower's mash plus an oral administration of 75% gin (0.03ml/kg body weight) while groups B received grower's mash plus absolute alcohol (100% gin; 0.03ml/kg body weight) orally, at 2 hour intervals. However, the control groups were fed with normal feed (grower's mash) only for the two weeks with water provided *ad libitum*.

Sample collection/analysis: The rats were weighed and the basal blood samples were collected by vein puncture into K_2 – EDTA container and appropriately

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labeled. The blood samples were then subjected to complete blood cell count, platelets count and the red cell indices.

Estimation of Packed Cell Volume (PCV) was done using the microhaematocrit method described by Cheesbrough (2006). RBC, Platelets, WBC and differential counts were determined using the improved neubauer counting chamber method described by Cheesbrough (2000), while hemoglobin estimation was done by the cyanomethaemoglobin method described by Cheesbrough (2006).

Data analysis: Statistical comparisons were evaluated with student's t-test. Incidences were compared with fisher's exact probability test. Values are expressed as mean ± SD with level of significance set at $p<0.05$.

RESULTS

The results showed that the RBC count of group A and B were $5.07\pm0.45x10^{6}\mu l^{-1}$ and $5.0\pm 0.44x10^{6}\mu l^{-1}$ respectively. Both were not significantly lower ($P>0.05$) than that of the control which was 5.29 ± 0.224 $x10^{6}\mu l^{-1}$. The PCV for group A was 42.0±2.16% and was not significantly higher ($P>0.05$) than that of the control unlike that of group B (38.3±4.73%), which was significantly higher than that of the control (38.3± 4.73%).

Furthermore, the Mean haemoglobin values was observed not to be significantly higher in group A (13.5 ± 0.89 gdl^{-1}) and lower in group B (12.4 ± 1.37 gdl^{-1}) when compared to the control (13.4 ± 1.63 gdl^{1}). The mean MCV value showed a significant but progressive increase from 83.0 ± 2.65 fl in group A and 84.3 ± 3.2 fl in group B when compared with the control value of 72.5 ± 5.07 fl. On the other hand, the mean MCH for group A and B was found to be 26.7±1.53pg and 25.0±2.65pg respectively. They were significantly higher in group A but lower in group B when compared with the control (25.25±3.09pg). The mean cell haemoglobin concentration (MCHC) were reduced in group A (32.1 ± 0.85 g/dl) and B (29.5 ± 3.37 g/dl) as compared to the control (35.05 ± 4.45 g/dl) (see table 1 below).

On WBC count, the value for group A was $5.5.7\pm0.93x10^{6}l^{-1}$ while that of group B was $5.33\pm1.04x10^{6}l^{-1}$. Both were however, not significantly ($P>0.05$) lower than that of the control (7.075 ± 0.86 $x10^{6}l^{-1}$). The platelet count for group A was $351.7\pm83.2x10^{6}/l$ while that of group B was $172.3\pm25.4x10^{6}/l$ as compared to the control value ($466.5\pm144.7x10^{6}l^{-1}$).

For the differentials, mean neutrophil counts were 45.3±7.024% for group A and 45.0±5.0% for group B. Both values were not significantly lower ($p>0.05$) than that of the control (52.5±10.25%). The mean lymphocytes counts were 45.7±12.0% for group A and 46.7±7.89% for group B. These values were also not significantly higher ($p>0.05$) than that of the control group which was 43.0±9.76%. The mean monocytes counts were 8.3±8.4% for group A and 5.3±2.05% for group B. Similarly, the values recorded for A and B were not significantly higher ($p>0.05$) than that recorded for the control group (3.8±1.708%) as shown in table 2 below. Thus, the result of this study indicate that there is a profound pancytopenia in group B and a moderate cytopenia in group A

Table 1: Characteristics of the observed parameters (RBC, PCV, Hb and Indices)

Parameters	Groups C (control)	Groups A (75% alcohol)	Groups B (100% alcohol)
RBC($10^{6}\mu l^{-1}$)	5.29±0.224	5.07±0.450	5.00±0.440
PCV (%)	38.30±1.26	42.0±2.16	38.3±4.73
Hb(g/l)	13.4±1.63	13.5±0.89	12.4±1.37
MCV(fl)	72.5±5.07	83.0±2.65	84.3±3.20
MCH (pg)	25.25±3.09	26.70±1.53	25.00±2.65
MCHC(g/dl)	35.05±4.45	32.10±0.85	29.50±3.37

Values were (Mean ± SD); RBC: Red Blood Cell counts; PVC: Packed cell volume; Hb: Haemoglobin count; Red cell indices: MCV-Mean Corpuscular Volume; MCH-Mean Corpuscular Haemoglobin; MCHC-Mean Cell Haemoglobin Concentration.

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Table 2: Characteristics of the observed parameters (platelet, WBC, differential)

Parameters	Groups C (control)	Groups A (75% alcohol)	Groups B (100% alcohol)
Platelets (10^6/l)	466.5±144.70	351.7±83.20	172.3±25.4
WBC(10^6/l)	7.1 ±0.86	05.6±0.93	5.3 ±1.04
Neutrophil (%)	53 ±10.25	45 ±7.024	45 ±5.0
Lymphocyte (%)	43 ±9.76	46 ±12.00	46 ±7.89
Monocyte (%)	4 ±1.71	08 ±8.40	4±0.55

Key: WBC-White Blood Cell

DISCUSSION

The results of this study have shown that ethanol and its derivatives, has the capacity to induce hematotoxic effects. The changes in haematological parameters and red cell indices provide useful information on the general state of blood after such exposure to exogenious insult. The changes observed for RBC count following alcohol intake may be associated with low hemoglobin levels (Jaana, 2004), and microcytic anemia may occur if the treatment had continued for a longer period (Herman, 1998).

In addition, the influence of ethanol intoxication suggests a diverse pattern of hematological effects on group B rats with macrocytosis and thrombocytopenia. Elevated MCV was a characteristic feature of group B and high MCV has frequently been used as part of a screening procedure for detecting alcohol abuse, although it may not completely be said to occur mainly because of alcohol ingestion as there are other factors that might be implicated; for example liver disease (Chu, 2000).

Furthermore, the observed lower levels of platelet counts in group B, might be due to the suppression of platelet production which probably led to thrombocytopenia. This condition may have occurred as a result of the cytotoxic effects of ethanol (Kristenson *et al.*, 2008). However, the observed increase in lymphocyte counts following exposure to alcohol may be one of the mechanisms devised to defend the body against the toxic effect of alcohol (Akanni *et al.*, 2010).

Generally, the findings of this study suggest that alcohol abuse can induces a wide array of adverse effects as evident in the observed indicators for erythrocytopenia, thrombocytopenia and leucopenia. We opine therefore, that excessive alcohol ingestion should be avoided. Moreover, it is rather unnecessary to ingest an excessive amount of a substance that has capacity to induce hematological toxicity, liver disease, kidney disease, and some neurological disorders in the brain like ataxia, which leads to increase personality decadence. Although acetaldehyde is toxic, the amount capable of producing disease depends on a variety of factors, which can be genetic, malnutrition, and/or concomitant viral infections of the liver. Hence it is concluded from this study that ethanol is highly toxic and is capable of inducing severe hematological alterations.

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AUTHOR(S) CONTRIBUTION

All the authors (Okoroafor C., Ogbo I., Azi S) contributed to this study.