

## Effect of Alcohol Consumption on Haematological and Reproductive Parameters in Female Albino Rats

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**Abstract:** The effect of oral administration of 20% alcohol (10 ml/kg BW) on haematological and reproductive parameters in female albino rats were investigated. The alcohol was orally administered for 30 days for haematological study, but administered orally for 21 days for estrous cycle study.

Treatment of rats with 10 ml/kg BW of alcohol caused significant ( $p < 0.05$ ) reductions in the RBC and lymphocyte counts relative to their respective controls but caused no significant ( $p > 0.05$ ) changes in the PCV, Hb, platelet and TWBC values relative to their respective controls.

Treatment of rats with 10 ml/kg BW of alcohol produced a significant ( $p < 0.05$ ) increase in the proestrous phase and a significant ( $p < 0.05$ ) decrease in the metestrous phase of the estrous cycle relative to their respective controls.

These findings indicate alcohol consumption could have some deleterious effect on the blood chemistry and fertility of female albino rats.

**Key words:** Alcohol, Red blood cell, Total white blood cell, Estrous cycle, Albino rats.

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### I. Introduction

An alcohol is an organic compound in which the hydroxyl functional group is bound to carbon atom (Nic *et. al.*, 2006).

Alcohol addiction and dependence have become increasingly serious health and social problems. Many clinical studies have indicated that adolescence is a key period for the development of this addiction (Crew *et. al.*, 2007) and it has been generally acknowledge that both genetic and environmental factors contribute to the propensity to drink alcohol (Pohorecky, 1991).

Chronic alcohol consumption has been reported to have detrimental effect on behavior and cognitive processes such as learning and memory (Beracochea *et. al.*, 1987). Chronic alcohol consumption has also been reported to produce cell loss in specific cerebrial structures (Belzunegui *et. al.*, 1995) reduced regional metabolic activity (Bontempi *et. al.*, 1996), and produced a significant increase in the latency of MKB (Mouse-Killing Behaviour) (Chiang *et. al.*, 2008).

However, due to scanty information from literature on the effect of alcohol on haematological and reproductive parameters in female albino rats, this study aims at investigating the effect of alcohol on these aforementioned parameters.

### II. Materials And Methods

#### Experimental Animals

Adult female albino rats weighing between 160 g and 180 g bred in the Animal House of Physiology Department, LAUTECH, Ogbomoso were used. They were housed under standard laboratory conditions with a 12 hours daylight cycle and had free access to feed and water; they were acclimatized to laboratory conditions for two weeks before the commencement of the experiments. All experiments were carried out in compliance with the recommendations of Helsinki's declaration on guiding principles on care and use of animals.

#### Alcohol

Absolute alcohol (BDH Analar Grade) was bought from Oarsman Limited Ibadan, Nigeria.

#### Experimental Design

##### (i) Haematological study

Ten animals were randomly divided into two groups with each group consisting of five rats. The two groups of rats were subjected to the following oral treatments once a day for 30 days:

Group I rats received 10 mg/kg BW of alcohol

Group II rats received 0.5 ml of distilled water as the control group.

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Twenty-four hours (day 31) after the last dosing of the four groups, blood samples were collected.

### Collection of Blood Sample

Blood samples were collected through the medial cantus into EDTA bottles for haematological assay.

### Determination of Haematological Parameters

The red blood cells (RBC) and white blood cells (WBC) counts were determined by the improved Neubauer haemocytometer method. The haemoglobin (Hb) concentration was determined according to Jain (1986), using the cyanomethaemoglobin method. The packed cell volume (PCV) was determined by the micro-haematocrit method according to Dacie and Lewis (1991). Schilling method of differential leucocyte count was used to determine the distribution of the various white blood cells (Mitruka and Rawnsley, 1977). Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were computed according to Jain (1986).

#### (ii) Study of Estrous Cycle

Five matured female rats (160-180g) showing at least three regular 4-5 day cycles were used. Vaginal smears were examined microscopically everyday at a constant interval of 10-11 a.m. for 21 days. The smears were classified into one of the phases of estrous cycle using the Papanicolaou's staining technique. The relative proportions of cells recognized were used to determine the phases of the estrous cycle according to Long and Evans (1922). The duration of the estrous cycle was determined. Then, the rat received 10 ml/kg BW of 20% alcohol for another 21 days and vaginal smears were similarly evaluated during the administration of the alcohol. In this study, the experimental animals also served as the control. The first 21 days served as the control days, while the last 21 days served as the treatment days.

Vaginal swab stick was used for smear collection from the vaginal lumen by introducing the swab stick gently into the vaginal and gently rotating it along the floor of the lateral walls of the vaginal. The swab stick was then rotated or smeared in duplicate on a microscope slide and the slide was stained using the Papanicolaou's staining technique.

### Statistical Analysis

The mean and standard error of mean (S.E.M.) were calculated for all values. Comparisons between the control and the treated groups were done using the student's t-test. Differences were considered statistically significant at  $p < 0.05$ .

## III. Results

Table 1 shows the effect of treatment of rats for 30 days with alcohol on haematological parameters.

Treatment of rats with 10 ml/kg BW of alcohol caused significant ( $p < 0.05$ ) reductions in the RBC and lymphocyte counts relative to their respective controls but produce significant ( $p < 0.05$ ) increases in neutrophil count relative to the control. Treatment of rats with 10 ml/kg BW of alcohol caused insignificant ( $p > 0.05$ ) changes in the PCV, Hb, platelet, TWBC, monocyte, eosinophil and the hematmetric indices (MCV, MCHC, MCH) values relative to their respective controls .

Table 2 shows the effect of treatment of rats for 21 days on estrous cycle.

Treatment of rats for 21 days with 10 ml/kg BW of alcohol produced a significant ( $p < 0.05$ ) increase in proestrous phase and a significant ( $p < 0.05$ ) decrease in metestrous phase of the estrous cycle but caused no significant ( $p > 0.05$ ) changes in both the estrous and diestrous phases of the estrous cycle.

**Table 1: Effect of 30 days treatment with 20% alcohol 10ml/kg BW haematological parameters (n=5, p<0.05)**

Parameters	Control	Treated
PCV (%)	37.00 ± 0.55	35.68 ± 1.20
Hb (g/dl)	12.42 ± 0.23	11.50 ± 0.60
RBC (X10 <sup>6</sup> /μL)	6.42 ± 0.17	5.17 ± 0.19*
MCV (fL)	61.61 ± 0.97	59.96 ± 1.43
MCHC (g/dl)	32.98 ± 0.23	33.22 ± 0.25
MCH (pg)	20.35 ± 0.41	19.77 ± 0.58
TWBC (x10 <sup>3</sup> /μL)	8.41 ± 0.41	8.47 ± 0.62
Platelet (x10 <sup>5</sup> /μL)	1.40 ± 0.09	1.47 ± 0.10
Neutrophil (%)	35.40 ± 6.8	56.00 ± 3.05*
Lymphocyte (%)	62.40 ± 7.32	42.00 ± 3.02*
Eosinophil (%)	0.40 ± 0.25	1.34 ± 0.37
Monocyte (%)	1.60 ± 0.68	0.67 ± 0.37

**Table 2: Effect of 21 days Treatment with 20% alcohol (10ml/kg BW) on estrous cycle (n=5, p<0.05)**

Parameters	Control	Treated
Proestrous	5.00 ± 0.55	9.80 ± 0.97*
Estrous	3.60 ± 0.40	2.80 ± 0.74
Metestrous	4.40 ± 0.51	2.60 ± 0.25*
Diestrus	7.80 ± 0.86	5.80 ± 0.86

#### IV. Discussion

The values obtained for RBC showed significant reduction after treatment of rats with alcohol on red blood cells (RBC) counts when compared with the control. This is an indication that there was destruction of red blood cells and change in the rate of production of RBC (erythropoiesis). The significant decrease in RBC count after treatment of rats with alcohol probably indicates that there was reduction in the oxygen-carrying capacity of the blood and the amount of oxygen delivered to the tissues since RBC and haemoglobin (Hb) are very important in transferring respiratory gases (De Gruchy, 1976). It has been reported that values of RBC and associated parameters lower than normal ranges are indicative of anemic conditions while higher values are suggestive of polycythemia (American Diabetes Association, 2000), thus, the treatment of rats with alcohol may have the potential to induce anemia. Also, the treatment of rats with alcohol may have adverse effects on the bone marrow, kidney and haemoglobin metabolism, since it has been reported that only substances which significantly affect the values of red blood cells and associated parameters would have effects on the bone marrow, kidney and haemoglobin metabolism (Young and Maciejewski, 1997).

Alcohol caused non – significant changes in the MCV and MCH values which could be an indication of absence of macrocytic anaemia since increased MCV and MCH values are known to be indicative of macrocytic anaemia. Also, alcohol caused non- significant change in the MCHC value which suggest and absence of hereditary spherocytosis since MCHC values are known to be elevated in hereditary spherocytosis.

The significant increase in neutrophil count caused by alcohol probably indicates that the ability of the body to attack and destroy invading bacteria, viruses and other injurious agents (Phagocytosis) has been enhanced. The significant decrease in lymphocyte count suggests that the acquired immune responses of the body has been compromised by the alcohol; while the non- significant change in monocyte count probably indicates that the phagocytic function of the blood has not been compromised by alcohol. The non – significant change in eosinophil count probably indicates that the anti-allergic and anti-parasitic infectious response of the body have not been compromised by alcohol.

The insignificant change in TWBC count caused by alcohol suggests that the immune system has not been compromised. Contrary report was given by Adewusi and Afolayan (2009) in *Pelargonium reniforme* extract treated rats. Also, the insignificant change in the platelet count caused by extract could be an indication that it does not has the potential to stimulate thrombopoietin production (Li *et al.*, 1999) with the hemostatic capability of the blood maintaining the *status quo* since platelets mediate in the blood –clotting mechanism.

The estrous cycle study revealed that alcohol caused significant changes in the duration of some phases of the estrous cycle. Contrary report was given by Oyediji and Bolarinwa (2010) in *Portulaca oleracea* extracts treated rats. This suggests that alcohol caused an imbalance of the ovarian and extraovarian hormones, since it has been reported that imbalance in these hormones leads to irregularity in the ovarian functions and duration of the estrous cycle (Circosta *et. al.*, 2001). Treatment of rats with alcohol induced significant increase in proestrous phase of the estrous cycle which probably indicates that the maturation of the follicles in the preovulatory phase was delayed, leading to non-maturation of the Graafian follicles. Treatment of rats with alcohol also caused reductions in the metestrous and estrous phases of the estrous cycle which suggests the non-availability of matured Graafian follicles.

In conclusion, this studies have shown that alcohol could have some deleterious effect on the blood chemistry and fertility of female albino rats. Considering these findings in animal models, it is recommended that women with blood disorder or infertility problems should abstain from taking alcohol during the treatment period.

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