©IDOSR PUBLICATIONS
International Digital Organization for Scientific Research ISSN: 2550-7931
IDOSR JOURNAL OF APPLIED SCIENCES 3(3) 14-23, 2018.

Effects of Maternal Alcohol Consumption on the Haematological Parameters in the Pups of Albino Rats

Ebugosi Richard S., Achara Ngozi I.,Chukwuezi F.O.,Onwuatuegwu J.

Tansian University Umunya Nigeria.

ABSTRACT

It has been observed that some pregnant women especially in riverine areas indulge in heavy alcohol consumption. Alcohol ingestion during pregnancy can result in fetal disturbances in their off-springs. This study was undertaken prospectively to determine the possible effect of maternal alcohol consumption on the haematological parameters in the pups of albino rats. Three groups of the animals A, B and C (10 albino rats in each group) were used in this study. Group A was the control while groups B and C served as test groups. Group B (prenatal group) was exposed to 1ml of 20% alcohol per kg weight up to the delivery time, while group C (postnatal group) was administered with 1ml of 20% alcohol per kg weight up to the weaning period. A total of 120 off-springs from the three groups were used in the investigations. Eight off-springs were randomly selected every week from each group and 2mls of blood was collected by ocular puncture for a period of five weeks. All haematological parameters were evaluated using Sysmex haematology analyzer. The mean leucocytes value was significantly lower ($p<0.05$) in the test group B and C compared with control group A. However there was no significant change in the mean value of haemoglobin levels ($p>0.05$) of the off-springs compared with control. Furthermore while the mean values of haematocrit were significantly lower $P<0.05$) in test groups of weeks 3, 5 and 6, the MCHC showed significant differences in weeks 5 and 6 of test groups compared with control. These investigations have therefore demonstrated that maternal alcohol consumption during prenatal and postnatal periods has some deleterious effects on some haematological parameters and has revealed potential risks in their off-springs. Therefore, there is the need for controlled alcohol consumption during pregnancy.

Keywords: Alcohol, haematological, women, albino rats and haematocrit.

INTRODUCTION

Alcoholism among pregnant women especially in riverine areas has been worrisome and observed to be socially acceptable amongst them. Incidence of liver diseases and reproductive function derangement had been high among this group. Acute and chronic alcohol abuses have wide spread direct and indirect effects on the haematological system which can mimic or obscure other disorders. Haemapoesis from stem cell in the bone marrow may be altered as well as leukocyte, erythrocyte, and thrombocyte functions [1].

Alcohol ingestion during pregnancy can result in fetal disturbances in their off-springs [2]. In experimental animal models the syndrome is characterized by retardation of fetal life. Fetal alcohol syndrome is a pattern of mental and physical defect that can develop in fetus in association with high level of alcohol consumption during pregnancy [3]. Heavy alcohol consumption can cause damage to the central nervous system (CNS) and can affect the fetal brain structure and

functions [4]. Besides damage to the CNS alcohol can result in disruption of hypothalamus pituitory gonadal axis which plays regulatory roles in reproduction. The pituitory on stimulation secrets luteinizing hormone and follicle stimulating hormone which are responsible for testosterone production and sperm cell maturation respectively. Deficiency of these hormones due to chronic alcohol intake could cause testicular, prostate and seminal vesicle atrophy [5], Investigations revealed that light to moderate drinking helps to improve cardiovascular health with decreased mortality rates and with decreased risk of cardiovascular disease [6]. Heavy drinking can increase the amount of triglycerides in the blood. This can cause heart disease, high blood pressure, obesity and type 1 diabetes mellitus. Many of the pathophysiological effects of alcohol ingestion are related to the pathway of ethanol metabolism [7]. Investigations reveal that heavy alcohol consumption affects some haematological patterns and several cell lines. It suppresses platelet production and causes thrombocytopenia, anaemia and many other blood disorders [8].

Alcohol may have direct or indirect impact in the haemopoetic system. The direct effects are primarily seen in the bone marrow and this involves the leucocytes, erythrocytes and the thrombocytes. The indirect effects are as a result of changes in the hepatic functions resulting in liver diseases [9].

Alcohol consumption may bring about changes that may alter the release of liver enzymes by disrupting the membranes of some specific organelles like the mitochondria. Once the liver is compromised, major liver diseases such as fatty liver, alcoholic hepatitis and cirrhosis may set in [10]. The metabolic alterations will equally result to some nutritional abnormalities, such as folate deficiency [11]. Alcoholics frequently have defect in the red blood cells that are destroyed prematurely possibly resulting in anaemia. The direct consequences of excess alcohol consumption according to other researchers include toxic effect on the bone marrow, the blood cell precusor, white blood cell and platelets [12].

In order to monitor the alcohol toxicity in the blood the haematological component of the consumers are to be investigated. These include haemoglobin concentration, the haematrocrit, leucocyte count, mean the cell haemoglobin concentration, platelets and cell morphology. Cell counts reflect the kinetics of entry and lose of cells from circulation, and cell morphology reflects the status of individual cell [1]. A large number of work have exposed the deleterious effect of alcohol during pregnancy on both the mother and the fetus. With the rising increase in alcohol consumption amongst pregnant mothers the need to investigate the effect on the haematological parameters of their off-springs informs the research. This would be achieved by determining various heamatological parametres of the off-springs of albino rats in chronic alcohol ingestion during pregnancy.

MATERIAL AND METHODS

Animal Selection and Grouping

The animals (albino rats) were randomly selected at the weaning age of twenty one (21) days from a colony of inbred rats maintained for research in the animal house of university of Nigeria. Thirty virgin female and 15 immature male rats were used.

RESEARCH DESIGN

The female albino rats were grouped into three (A, B, & C) with 10 animals in each group. Group A served as control while groups B and C were used as test groups. The animals were allowed to acclimatize for 3 weeks. All the groups were fed with water and commercial rat diets. The investigations commenced at the end of six weeks which is the age of sexual maturation. During investigation, the control group A was fed with water and commercial rat diets while groups B and C where fed with 1ml of 20% ethanol per kg weight for 3 weeks. The three groups where bred by using1male per cage of 2 females. Day 1 of pregnancy was presumed after observation of vaginal plug.

Following the diagnosis of pregnancy, groups B and C continued to receive 1ml of 20% alcohol until delivery. After delivery alcohol for group B was replaced with water. This group is called prenatal alcohol exposed, while group C continued to receive 1ml of 20% alcohol till weaning their off-springs at 21 days. This group is called post natal alcohol exposed.

A total 150 male off-springs of the albino rats were used to carry out the work.30 rats died at various stages of the investigations. Only 120 male off-springs were finally used to carry out the investigations. The tests were carried out every week for 5 weeks .In each week,24 male off-springs were randomly selected.8 from each group.

SAMPLE COLLECTION AND ANALYSIS.

About 2mls of blood samples were collected by ocular puncture and placed in tubes containing tripotassium ethylene diamine tetracetic acid salt (EDTA) and mixed thoroughly .The samples were analyzed for haemoglobin concentration, packed cell volume, total leucocyte count (WBC) and mean cell haemoglobin concentration (MCHC) using an autoanalyzer (Sysmex XE-2100 haematology automated analyzer).

ESTIMATION OF HAEMATOLOGICAL PARAMETERS AND INDICES

All haematological parameters were determined with Sysmex XE-2100 haematological automated analyzer. This performs haematology analysis according to radio frequency/ direct current detection method. The size of blood cells was detected by direct current resistance (DC) and the density of blood cell interior by changes in radio frequency (RF).

STATISTICAL ANALYSIS

Data collected were subjected to statistical analysis using the analysis of variance (ANOVA). Values were deemed significant if $p<0.05$.

RESULTS

RESULTS OF HAEMOGLOBIN CONCENTRATION OF THE OFF-SPRINGS

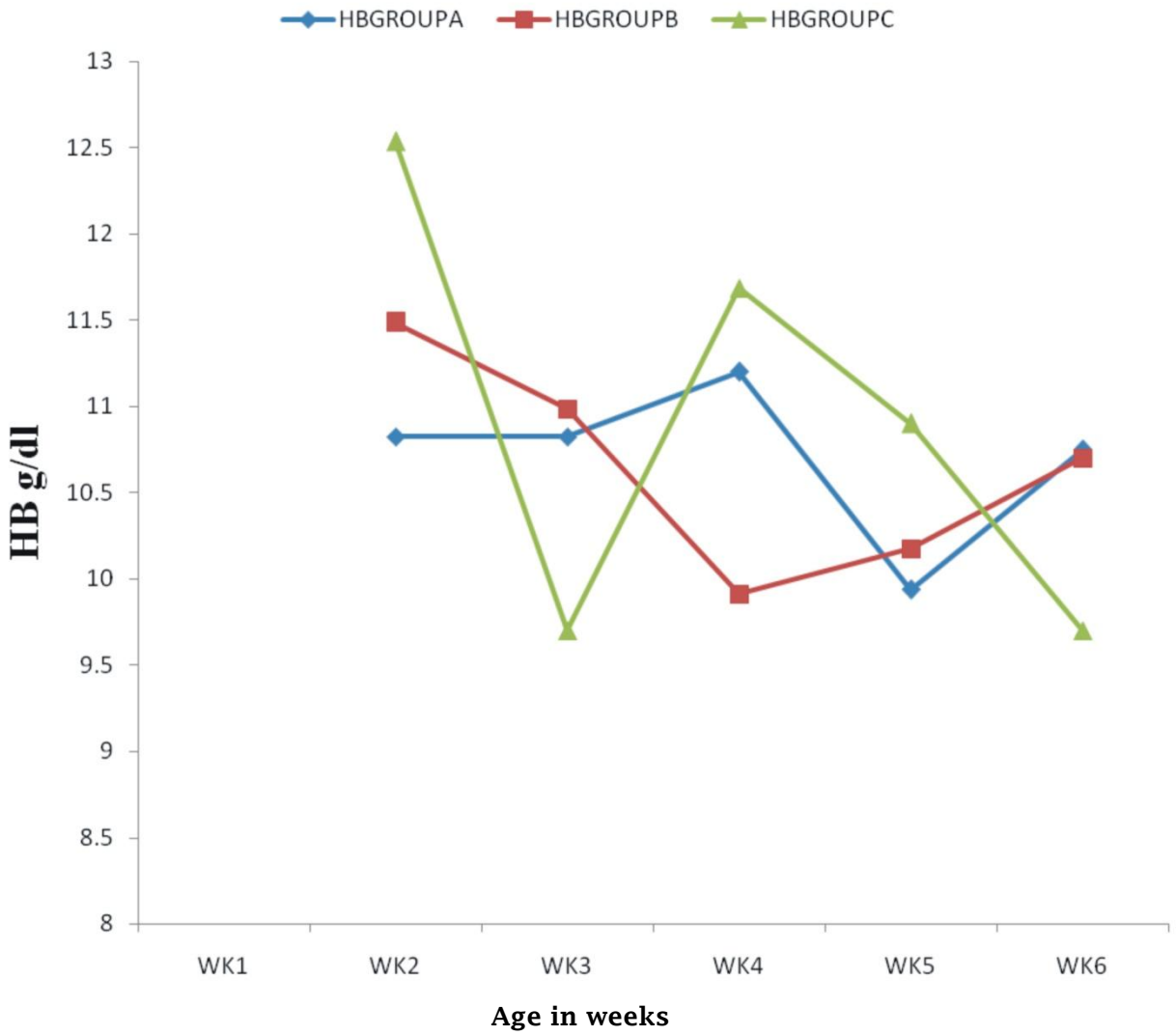

Fig 1: Effect of maternal alcohol consumption on the haemoglobin concentration of the off-springs. No significant differences (P>0.05) on the HB values of the control and the test groups.

LEUCOCYTE COUNTS ON THE OFF-SPRINGS OF THE EXPERIMENTAL RATS

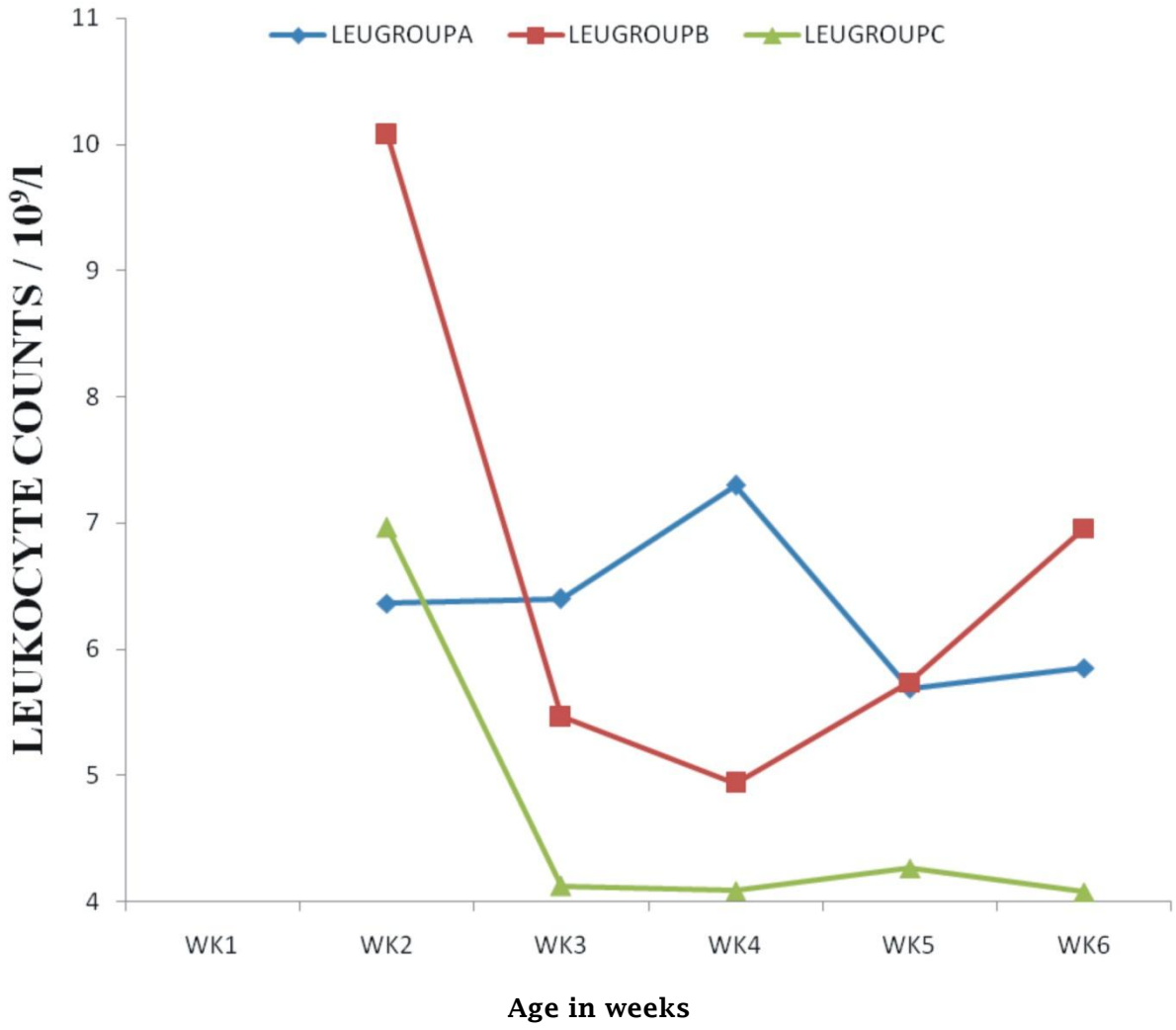

Fig 2: Effect of maternal alcohol consumption on the leucocyte count of the off-springs. Significant differences were indicated (P<0.05). Group C had lowest leucocyte count.

HAEMATOCRIT (PCV) VALUES ON THE OFF-SPRINGS OF EXPERIMENTAL RATS

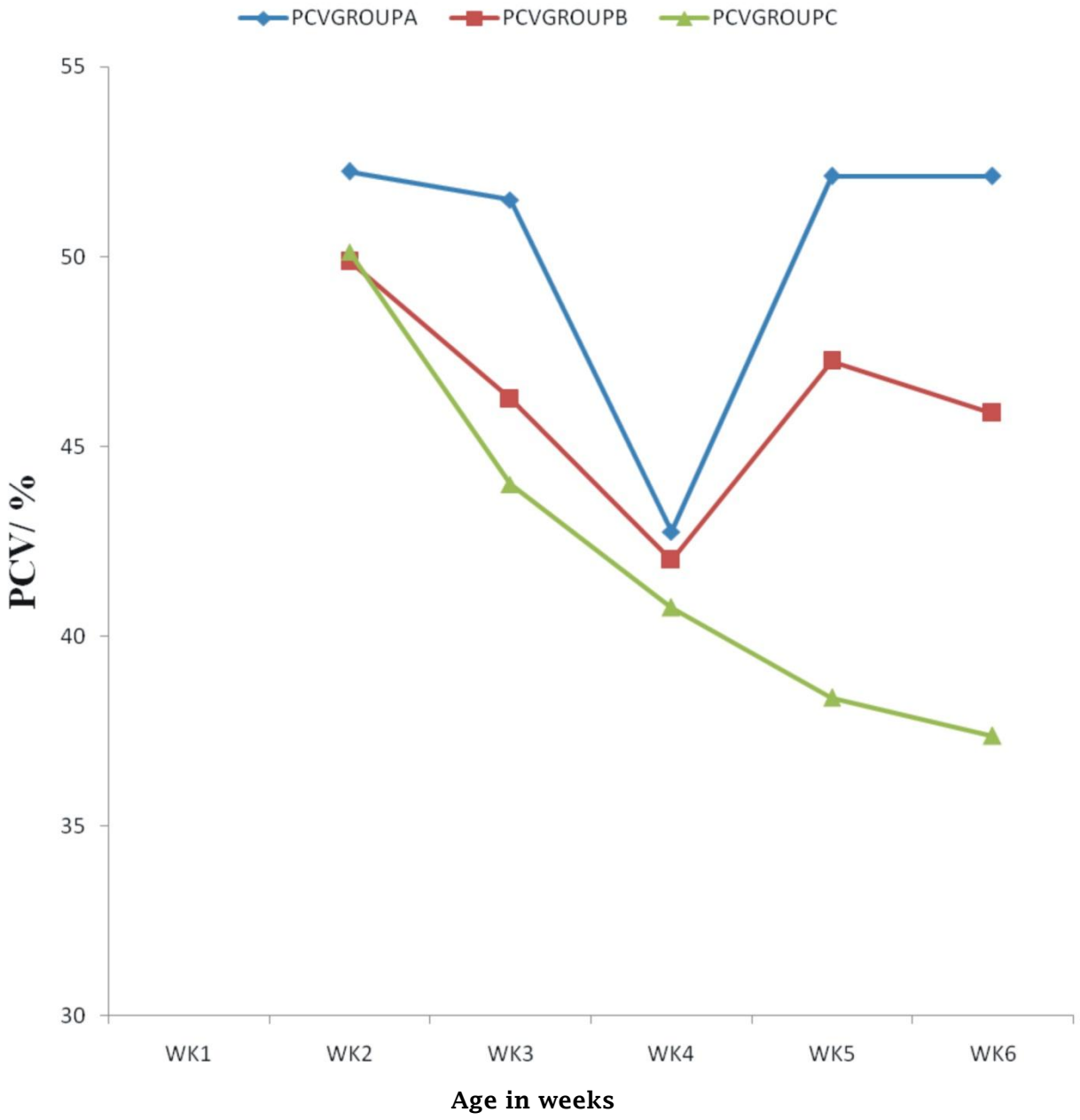

Fig 3: Effect of maternal alcohol consumption on haematocrit (PCV) of the off-springs. There were significant differences in weeks 3, 5 and 6.

RESULT OF MCHC ON THE OFF-SPRINGS OF THE EXPERIMENTAL RATS

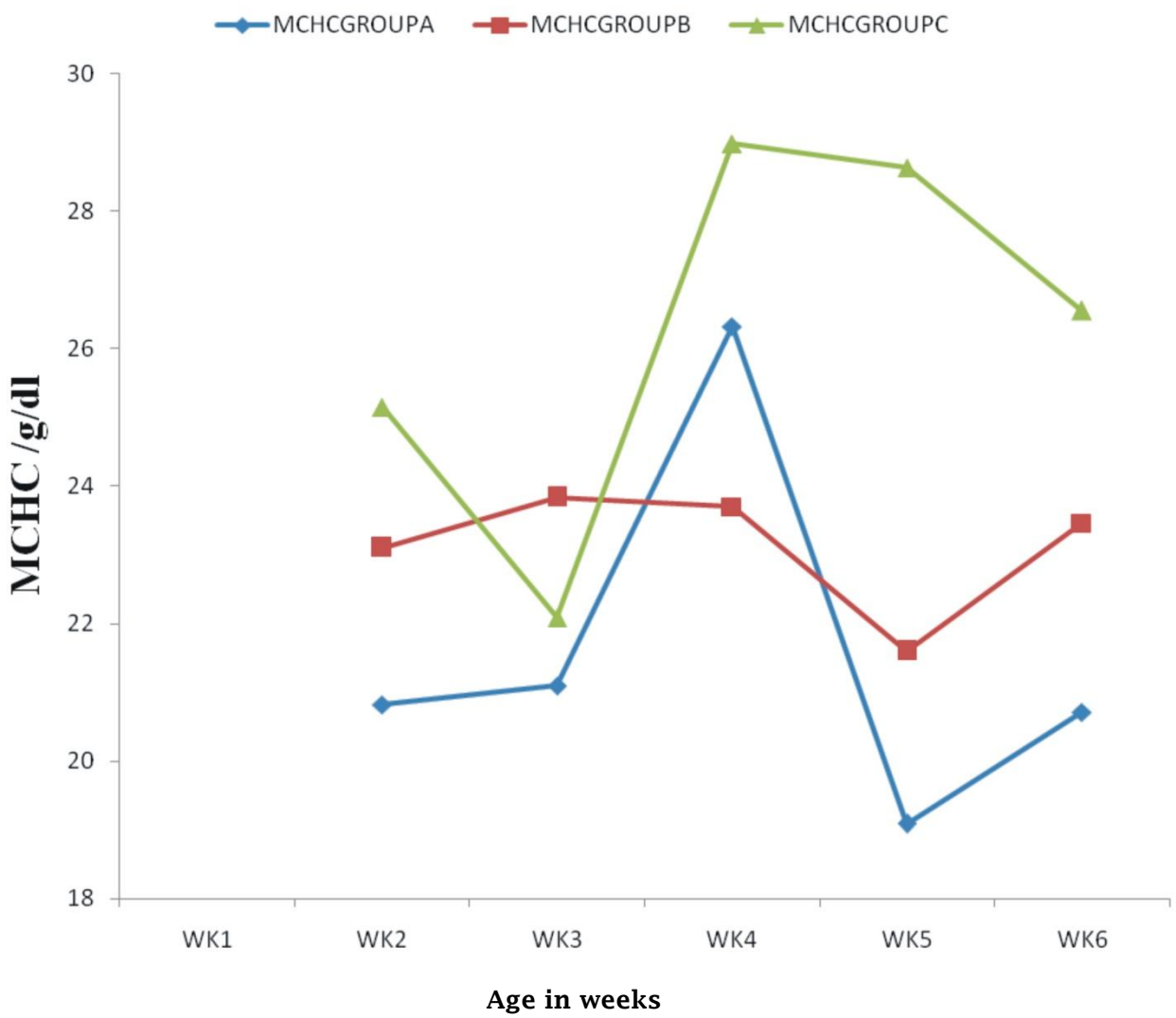

Fig 4: Effect of maternal alcohol consumption on the mean cell haemoglobin concentration (MCHC) of the off-springs. The mean values showed significant changes in weeks 5 and 6 ($P<0.05$).

DISCUSSION

The effects of maternal alcohol consumption on haematological parameters of their pups are shown in Figs 1, 2, 3, and 4. Haemoglobin estimation on the off-springs demonstrated no significant differences (P> 0.05) in test groups B and C compared with control group A as seen in fig 1.

Alcohol doesn't seem to affect the haemoglobin values of these groups compared with control groups. This is in contrast with earlier findings by some researchers. According to work carried out by [12] alcohol has adverse effects on blood cells and their functions. According to them, alcoholics frequently have defective red blood cells that are destroyed prematurely possibly resulting in anaemia. Alcohol exerts a direct effect to the bone marrow, the blood cell precusor, the white cell and platelets which may result to anaemia, leukaemia and thrombocytopenia [1] Alcohol consumption may result in liver diseases such as alcoholic hepatitis and cirrhosis and may indirectly affect haematological functions and metabolic derangement [13].

A study carried out by [1] recorded higher haemoglobin concentration and packed cell volume (PCV) in heavy alcohol drinkers. Our research work with off-springs of albino rats presented neither low haemoglobin levels which is an indication for anaemia nor high haemoglobin concentration as a result of dehydration. Therefore maternal alcohol consumption has no direct effect on the haemoglobin levels of their off-springs. The values obtained for haematological parameters showed a significant differences (P<0.05) in the packed cell volume (PCV) values of the off- spring. (Fig 3). The values obtained from test groups B and C were lower compared with control group A. Those findings are in contrast with previous work carried out by [14] and [15], who recorded higher PCV values in alcoholic as a result of dehydration. The reason for this variation could be adduced to the fact that other researchers carried out their work to determine the effect of alcohol on the direct consumer while this work was designed to investigate the effect on the off-spring of mother indulging in alcohol consumption during pregnancy.

Furthermore, there were significant reduction (P<0.05) in mean leucocyte count of the test group B and C compared with control group (Fig2). Alcohol consumption by pregnant mothers can adversely affect the leucocyte count of their off-springs. This is comparable to previous research of [12] who reported that heavy alcohol consumption has direct consequences in blood cell precursor, mature red cells, luecocyte and thrombocyte but failed to agree with the work of [15] whose work showed high significant leucocyte values.

Maternal alcohol consumption affects the white blood cell of the offspring thus exposing them to various infections. Many clinical observations support that alcohol adversely affect the production and function of virtually all types of blood cells [7], [16].Thus alcohol is toxic to the bone marrow which contains the precursor for all blood cells .

The investigation demonstrated that mean cell haemoglobin concentration (MCHC) in the off-springs of albino rats exposed to alcohol showed significant difference(p<0.05) in weeks 5 and 6 compared with control group (Fig4). Therefore the MCHC of the off-springs

exposed to alcohol are affected by constant exposure to alcohol.

CONCLUSION

In this study alcohol consumption during pregnancy have been shown to have adverse effect on some haematological parameters of the off-springs which could expose them to serious infections. Consistent consumption of excessive alcohol has deleterious effects on the off-springs. Thus pregnant and breast-feeding mothers are advised to take little or no alcohol. More so health workers should be encouraged to carry out public enlightenment to inform the society of haematological health risk of maternal alcohol consumption during pregnancy on their off-springs.

REFERENCES

1. Akanni, E.O. Mbayoje, V.O., Zakariyahu, T.O. and Oparinde, D.P. (2010). Haematological characterization among heavy alcohol consumers in Osogbo metropolis. *Research Journal of Medical Science* . **4** (2) 48-52.
2. Ethen, M.K., Rhamadhani, T.A. and Scheuerle, A.E. (2008). Alcohol consumption by women before and during pregnancy. *Maternal and Child Health Journal* .**13** (2):274-285.
3. Streissguth, A.P., Barr, H.M., Kogan, J. and Bookstein, F. L. (1996). Understanding the occurrence of secondary disabilities in clients with fetal alcohol syndrome (FAS) and fetal alcohol effects (FAE): final report to the Centers for Disease Control and Prevention. **851**. 96-106.
4. Clarren, S.K., Bowden, D.N. and Asley, S. (1985). The brain in fetal alcohol syndrome. *Health Research World.* **10**: 20 - 23.
5. Eriksson, C.J.P., Fukunaga, T. and Lindman, R. (1994). Sex hormone to alcohol. *Nature.* **369** :711.
6. Adam, C. (2011).The Effects of Alcohol on Cholesterol levels. *American Journal of Pharmacology.* **67** (6) 230 -240.
7. Peters, T.J. and V.R. Preedy. (1998). Metabolic consequences of alcohol ingestion. Novatis found symposium, **216**: 19-24.
8. Savage, D. and Lindenbaum, J. (1986). Anaemia in alcoholics. *Medicine*. **65** (5): 322-338.
9. Stryer, I. (1988). Biochemistry. 3rd edition, W.H. Freeman and company, New York. Pp. 554-556.
10. Jacquelyn, J., and Maher, M.D. (1997). Exploring alcohol effects on liver function. *Alcohol Health and Research World.* **21** (1):5-12
11. Hermans, E.H., (1998). Booze and blood: The effects of acute and chronic alcohol abuse on the haematopoietic system. *Journal of Clinical Laboratory Science.* **11**:

229-232

12. Aarold, S. and Ballard, M.D. (1997). The Haematological Complications of Alcoholism. *Alcohol Health and Research World.* ***21*** *(1): 41 – 52.*
13. Chu, Y.C., (2000). Haematological effects of alcohol, long – term ethanol consumption in alcoholics alcohol. *Clinical Experimental Research.* **24**: 117-122.
14. Shaper, A.G., Pocock, S.J., Ashby, D., Walker, M. and Whitehead, T.P. (1985). Biochemical and haematological response to alcohol intake. *Annal of Clinical Biochemistry.* **22**: 50-60.
15. Odula, T.O.G. Adesun, T.A. Odula, N.R. Agbaje and Raheem Z.A. (2005). Biochemical and haematological findings in alcohol consumers in Ile Ife, Osun-state. Drinking pattern, pp: 1-4.
16. Sellah, S. and Bobizien, W. (1999). Bleeding problem in patient with liver disease: ways to manage the many hepatic effects of coagulation.*Postgraduate Medicine*. 106: