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Effects of AlcoholAdministration During Pregnancy on Litter Size, Litter and Maternal Body Weights of Albino Rats

*Onyemelukwe Anulika O.[1], Achukwu Peter U.[1], Azubuike Nkiruka C.[1], Onwukwe Okechukwu S.[1], Maduakor Uzoamaka C.[1], Ogu Cornelius O.[1],Ikele Ikenna T.[2], Okongwu Uzoma C.[1], Uchenna Chisom A.[1], Odo Ogechukwu F.[3]

[1](Department of Medical Laboratory Sciences, College of Medicine, University of Nigeria, Enugu Campus)
[2](Department of Anatomy,Faculty of Basic Medical Sciences,College of Medicine, University of Nigeria, Enugu Campus)
[3](Department of Morbid Anatomy, Enugu State University Teaching Hospital, Enugu State)

Abstract :*Problems related to alcohol ranks among the global public health concerns. The objective of this study was to determine the effect of alcohol consumption during pregnancy on litter size, litter and maternal body weights. Twenty (20) female albino rats divided into five groups A – D (n=5) were used. Groups D served as pregnant control and received food and water only. Groups A, B, and C received 0.3g/kg, 0.8g/kg and 2g/kg body weight of ethanol respectively once daily via oral gavage until delivery. Litter sizes and birth weights were recorded on the days of birth. The pups were also examined for any overt physical abnormalities in comparison to those obtained from the pregnant control. The body weights of the treated and control rats before and at the end of the experiment were recorded. Results showed a statistically significant dose-dependent decrease in body weight gain of the rats in groups B and C when compared with the control. Marked reduction in litter size and birth weights were also observed after delivery especially in treatment groups B and C ($p<0.05$). In conclusion, the present study revealed that alcohol consumption in pregnancy may be associated with negative outcomes in pregnant rats and their litters.*

Keywords -*Alcohol, pregnancy, albino rats, body weight, litter size, litter weights*

I. INTRODUCTION

Alcohol use for most people is enjoyable, socially accepted but unassociated with problems. Unfortunately, alcohol use progresses to alcohol abuse or alcoholism (alcohol dependency) for about 10% of people who suffer from a brain disease with high morbidity and underreported mortality [1]. In Nigeria, alcohol consumption is widespread because of its use in social, cultural and religious occasions. In a study done in a community in Bayelsa State, South-South Nigeria, it was found that 90% of adult population regularly consumed alcohol [2].

In the South-South and South- East regions of Nigeria, a prevalence of 52.9% and 22.6% of alcohol consumption during pregnancy was recorded in previous studies respectively[3,4]. Conversely, reduced prevalence rates of 12.2% and 5.8% respectively were recorded in the United States and Canada National

surveys [5, 6]. In a wine producing region in South Africa, a prevalence of 42.8% was recorded [7] whereas a rate of 20.4% was documented in a Ghanaian study[8].

In Nigeria, the most common brands of alcoholic beverages consumed by the alcoholic drinkers were Stout beer, larger beer, and other brands like red wine, palm wine, refined gin/spirit, local gin (*ogogoro*) [4]. It is believed that consumption of alcohol causes euphoria leading to appetite depression which is the reason why heavy drinkers tend to eat poorly and become malnourished. Previous studies, however, have documented unchanged compensatory amounts of energy subsequent to preloading with alcoholic drinks in humans [9-11]. Moreover, Lieber [12] documented that alcohol intake affects digestion, storage, utilization, and excretion of nutrients, thus interfering with the nutritional process of the body system. These negative effects of alcohol on nutrition may doubly affect the pregnant women who take alcohol in low/high repetitive doses due to their immune compromised state, and these may invariably affect their offsprings. Thus, alcohol consumption in pregnancy has become a major public health problem.

Recently in Nigeria, there is a rising trend in alcohol use among pregnant women [3, 4]. This is due to unlimited access to free alcoholic drinks during social gatherings and societal tolerance [13]. Despite public awareness campaign, Nigeria health system is yet to devise a means to discourage pregnant women from consuming alcoholic drinks to protect their unborn children [3]. As part of the practical ways of achieving this goal in our society, generation of indigenous data which demonstrates the deleterious effects of alcohol consumption during pregnancy is pertinent. In view of this, the present study investigated the effects of alcohol consumption during pregnancy on litter size, litter weight and maternal body weight.

II. MATERIALS AND METHOD

2.1Procurement and Reconstitution of Ethanol: Absolute ethanol (concentration of 0.788kg/l) used for the study was purchased from Sigma Aldrich Chemicals limited, USA. A dilution of 20% was prepared from the stock by adding 800mls of pyrogen free water to 200mls of ethanol. This was kept in the refrigerator at $4 \pm 2^{o}C$ until needed.

2.2Animal Housing: Twenty-eight (28) albino rats (twenty females and eight males) (~180 – 200g) were obtained from Animal House of Department of Physiology, University of Nigeria Enugu Campus (UNEC). They were housed under standard condition of temperature ($27 \pm 2^{o}C$) with twelve-hour light/dark periodicity. The animals were weighed and divided into five groups (A - D) of five (5) female and two (2) male rats each. These animals were housed in clean gauzed cages in groups and fed on standard feed pellets (Guinea feed® Nigeria Plc) and clean water *ad libitum*. Acclimatization was for two weeks. Animals were handled in this study in accordance with protocols approved by Institutional guidelines on Animal Care and Use Committee and conform to established guidelines set by National Institutes of Health on experiments involving the use of animals.

2.3 Estrous Cycle Determination and Animals Impregnation: Determination of Estrous cycle was conducted as previously described [14] and mating was done on twenty female rats in groups A – D at ratio of2:5 [male/female rats] i.e. 2 male rats/cage. The female rats were left with the males until presence of vaginal plug (signs of mating) were detected. After the period of mating, conception was achieved in the rats.

2.4 Experimental Design: Groups A, B & C served as the test groups and received daily doses of 0.3g/kg, 0.8g/kg and 2g/kg body weight of ethanol respectively via oropharyngeal route using oral cannula until delivery. Group D received no treatment and hence served as the pregnant control. On the days of births, litter sizes and birth weights of pups were recorded. They were also examined for any overt physical abnormalities and compared to pups obtained from the control group. Maternal body weights were also recorded before and after the experiment.

2.5 Statistical Analysis: Data obtained were expressed, where appropriate, as mean ± standard error of mean (SEM) using the Statistical Package for Social Sciences (SPSS) version 20.0 software. Differences between mean values were determined with one-way analysis of variance (ANOVA) followed by Tukey's post hoc tests and Students'*t*-test. $p<0.05$ was considered significant.

III. RESULTS

3.1Maternal Body Weight: The pattern of body weight changes in the various groups of the rats before and after the treatment are shown in Figures 1 and 2. A dose-response relationship is indicated in the weight changes following treatment which were statistically significant ($p<0.05$) (Figure 2). Mean weight gain of treated rats decreased with increase in dose of ethanol administered. The weight of the control rats increased appreciably at the end of the study.

3.2Litter Size and Litter Weight: The result of the intrauterine effect of maternal consumption of alcohol on mean litter size (number of rat offspring) and mean litter weights respectively at birth from rats in the pregnant control [group D] and that from alcohol treated rat groups are represented as bar charts shown in Figures 3 and 4 respectively. Statistically significant decrease in mean litter sizes in groups B and C was observed when compared with the control ($p<0.05$). Mean litter weights from rats in all treatment group were observed to be significantly lower ($p<0.05$) when compared with those of the control.

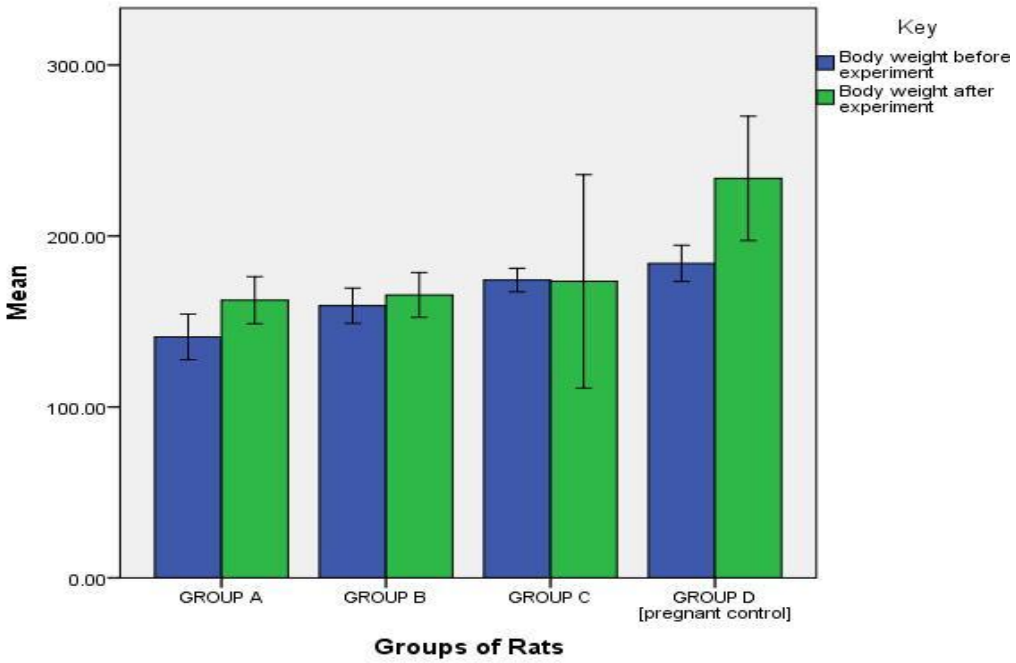

Figure 1: Chart showing the Mean weight of ethanol-fed rats and control before and after the experiment.

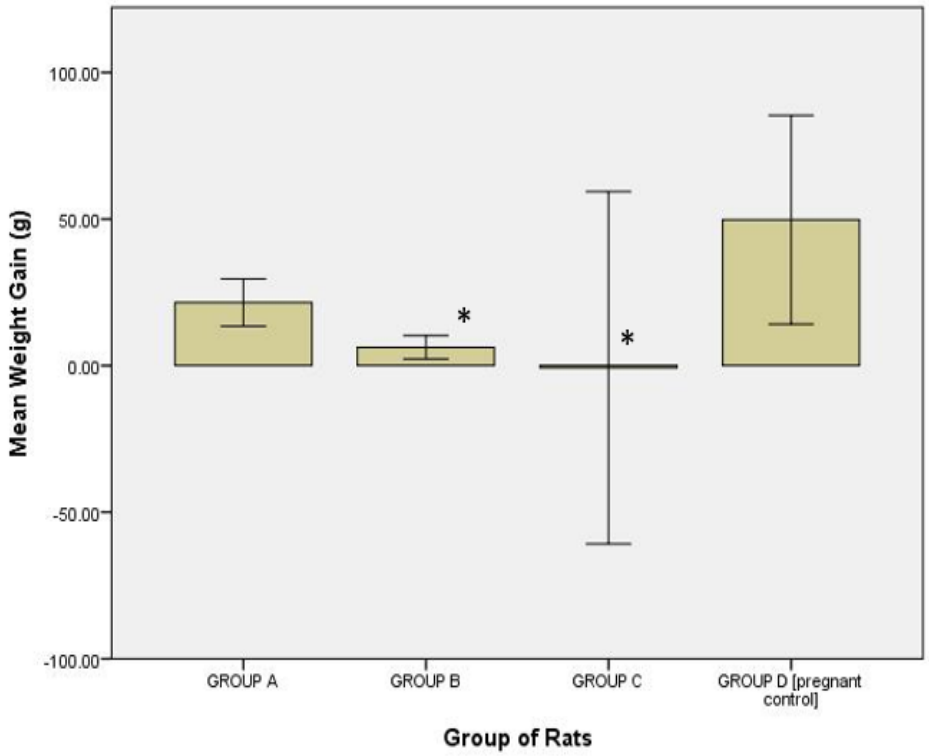

Figure 2: Chart showing the Mean weight gain of ethanol-fed rats and control at the end of the experiment.

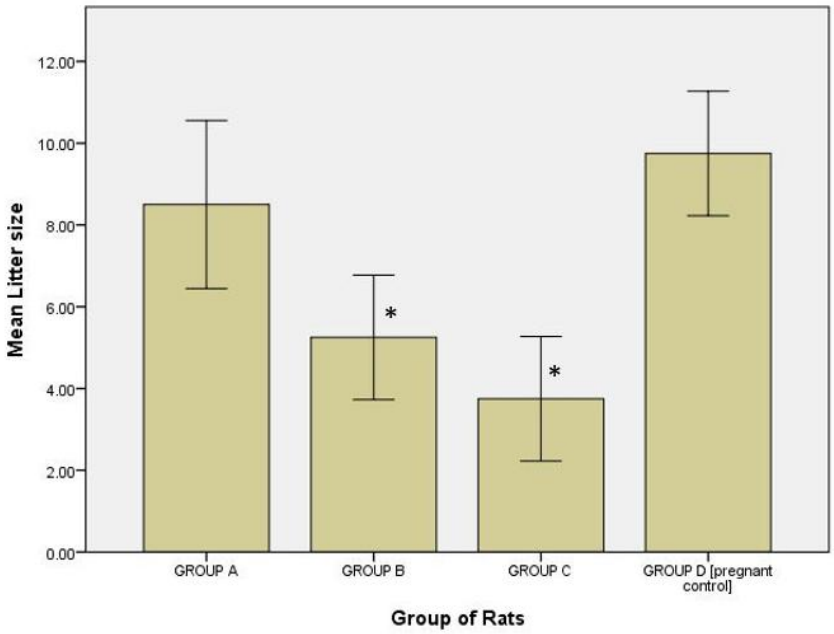

Figure 3: Bar chart showing mean litter sizes from rats in groups A, B and C (treated with 0.3, 0.8 and 2g/kg b.wt of ethanol respectively) compared to control. * = $p<0.05$ when compared to control.

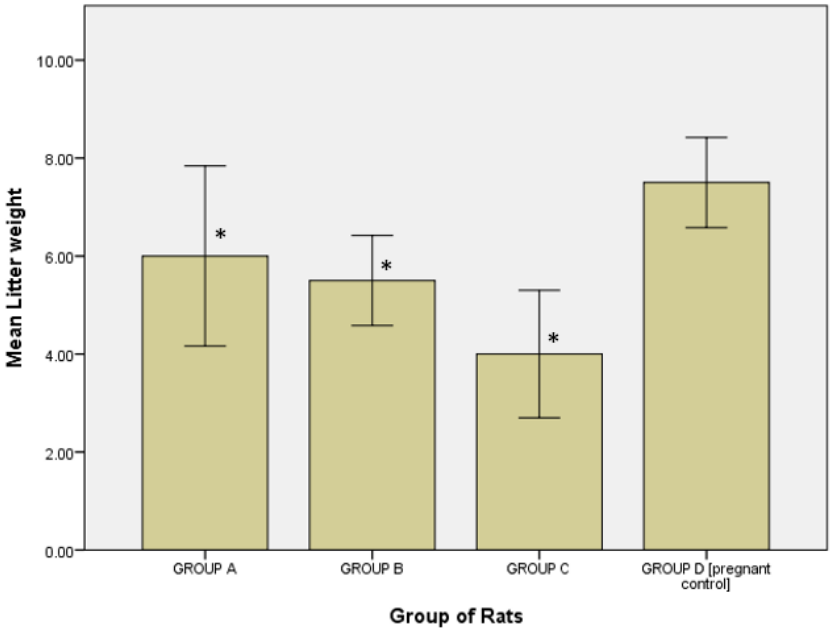

Figure 4: Bar chart showing mean litter weights from rats in groups A, B and C (treated with 0.3, 0.8 and 2g/kg b.wt of ethanol respectively) compared to control. * = $p<0.05$ when compared to control.

IV. DISCUSSION

The devastating high prevalence of alcohol use disorders has contributed to significant clinical problems due to its health impact across the globe [15, 16].The use of alcoholic drinks by women in pregnancy has become a major public health problem. This study was aimed at investigating the effects of alcohol exposure in pregnancy on the litter size, maternal body and litter weights in pregnant female albino rats.

The results obtained from this study showed that alcohol ingestion may lead to a decrease in body weight gain. An increase in the body weight of rats treated with low dose of ethanol [0.3g/kg] was observed although not comparable to that observed in the control. However, markedly decreased body weight gain was observed in rats treated with 0.8g/kg/day and 2kg/day of ethanol. Hence, this suggests that alcohol consumption to 2g/kg/day may reduce the capacity of the body system to gain weight. The exact mechanism that brought about this effect cannot be explained, however, a reduction in food intake was observed in the treatment group during the study period. It may therefore be deduced that loss of appetite could be associated with ethanol treatment. A similar attenuation of food consumption was observed in a previous work done by Sigh and Snyder [17]. In their work doses of 2.7g and 3.1g/kg/day showed a significant decrease in body weight during the entire gestation period. Contrarily, Poppitt *et al.* [11] documented that appetite remains unchanged or potentially heightened and therefore no compensatory decrease in the amount of food eaten is noted following consumption of an alcoholic beverage.

A reduction in litter weight and litter size (number of pups or offspring delivered by the ethanol fed rats)was observed in the moderate and high dose groups when compared with the control group. Abel [18] also reported a similar effect on the offspring of mother rats prenatally exposed to 1.0 or 2.0g/kg/day intragastrically. In his work, he suggested that the reduced litter weight may be as result of a reduction in maternal food intake during pregnancy. The term fetal Alcohol syndrome (FAS) in humans is used to describe the pattern of ethanol-related effects on the fetus due to maternal ethanol ingestion. Efforts made to reproduce the adverse effect of ethanol in the offspring in diverse experimental procedures using animal models revealed minimal to gross malformations. These effects of moderate alcohol consumption defined as <2g drinks/day (about <0.6g/kg/day on fetal malformation still remains controversial [19] due to many conflicting reports. Several studies have described

teratogenicity of ethanol using relatively higher ethanol doses [20,21]whereas other reports have shown variations in the litter size or birth weight at relatively low doses of ethanol [18,22].

V. CONCLUSION

In conclusion, the present study using experimental animals has demonstrated that decreased maternal body weight gain, reduction in litter size and weight may be negative outcomes associated with consumption of alcohol during pregnancy.

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