

Teratogenic Effect Of Beer And Palm Wine On The Histology Of The Fetal Kidney Of Wistar Rats

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Citation

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Abstract

Palm wine and beer are two alcoholic beverages that play an important role in local ceremonies in Nigeria. This study was to compare the teratogenic effect of maternal administration of various doses of beer and fermented palm wine on the histological features of the fetal kidney of wistar rats. The percentage of alcohol in beer was experimentally found to be 6.1%. The estimated alcohol content in five days fermented palm wine was 4.5%. Twenty five female rats weighing 180 – 200g were used for this study and were caged with sexually matured male rats. The presence of tailed structures in the vaginal smear obtained the following morning confirmed coitus and the sperm positive day was designated as day zero of pregnancy. Oral doses of 4ml, 8ml of beer and 4ml, 8ml of five days fermented palm wine was administered respectively from 7th to 13th day of gestation. On the 20th day of gestation, the rats were sacrificed and the fetuses removed. The kidneys were removed, fixed in Bouin's fluid, stained with Haematoxylin and Eosin and examined under the microscope. Histological result showed marked distortion of normal kidney architecture in the treated groups, particularly those whose mothers received 8ml of beer and 8ml of 5 days fermented palm wine. Our results suggest that consumption of beer and fermented palm wine may be nephrotoxic to the developing kidney.

INTRODUCTION

Beer and palm wine are alcoholic beverages. Palm wine is milky in appearance, when fresh it is sweet and contains about 11.5% of total sugars including glucose (0.15%) fructose (9.5%) and raffinose (0.05%). The protein content is about 0.1% and the specific gravity about 1.02. The estimated alcohol content of palm wine varies from 2.3% when fresh to 5.1% when fermented. The sugar and alcoholic constituents of palm wine varies with the stages of fermentation¹.

Nigerian palm wine is usually obtained from the sap of *Raphia Vinifera*, *Raphia Hooderi* (raphia palm) and *Elaeis Guineensis* (oil palm)^{2,3,4}. In certain rural communities especially Abia, Akwa Ibom, Rivers, Delta, Edo and Imo States, palm wine is an indigenous alcoholic beverage tapped/derived from natural fermentation of the sap obtained from either palm tree or raffia palm tree. Fresh harvested unfermented sap is a clear colourless liquid with a sweet sugary taste and no alcohol content but soon becomes milky and increasingly less sugary and more intoxicating⁵.

Beer and palm wine are consumed by both men and women including pregnant women. Alcohol is a low molecular

substance and is therefore capable of crossing the placental barrier and entering the fetus, causing the level of alcohol in the fetus to be approximate to that of the mother⁶. Adverse health effects that are associated with alcohol exposed pregnancies include miscarriage, premature delivery, low birth weight, sudden infant syndrome, and prenatal alcohol – related conditions such as fetal alcohol syndrome. Fetal alcohol syndrome is one of the leading causes of mental retardation, and is directly attributed to drinking during pregnancy. Fetal alcohol syndrome is characterized by growth retardation, facial dysfunction such as learning abnormalities and lower intelligent Quotient (IQ) as well as behavioural problems⁷.

Alcoholic beverages, especially palm wine have gained cultural interest and the consumption rate has been on the increase among the educated and non-educated pregnant women in our society. Since the kidney is involved in excretion of substances in the body, it may be directly or indirectly affected by alcoholic content of beer and palm wine. This study seeks to find out the effect of beer and palm wine on the histology of the kidney of fetal wistar rats.

MATERIALS AND METHODS

Twenty five female wistar rats weighing about 180 – 200g were used in this study. The female rats were divided into five groups labeled A, B, C, D and E, each group consisting of five rats. Group A was the control group, with group B, C, D and E as the experimental groups. Female rats of proven fertility determined by daily vaginal lavage were caged overnight with sexually matured male rats of the same strain. The following morning, the vaginal smear was done to check the presence of sperm in the female tract. The presence of spermatozoa signified day zero of pregnancy. Groups B, C, D and E female rats were given 4ml, 8ml of beer and 4ml, 8ml of five days fermented palm wine respectively on the 7th through 13th day of gestation through an oral route with an aid of orogastric tube. The control group A animals received corresponding volumes of distilled water on the corresponding days of gestation. Pregnancy was terminated on the 20th day of gestation by chloroform inhalation method and the fetuses collected by uterectomy. The fetuses were blotted dry and examined for possible gross malformations. The kidneys were dissected out and fixed in Bouin's fluid for haematoxylin and eosin staining₈.

RESULTS

Histological study of the kidney using Haematoxylin and Eosin staining method showed in the control group A, normal renal architecture: renal corpuscles made up of glomeruli (G) and Bowman's capsule (BC). Also seen were proximal and distal convoluted tubules (Plate 1).

Shrunk glomerulus (SG), enlarged capsular spaces (ECS) and slight dilation of tubules (DT) were seen in groups B and C that received 4mls and 8mls of fermented palmwine (Plates 2 & 3). The kidneys of groups D and E animals that received 4mls and 8mls of beer showed degeneration of glomerular (DG), and acute tubular necrosis (TN), with the effect being more severe in group E (Plates 4 & 5).

Figure 1

Plate 1: Photomicrograph of the kidney section of group A (control) showing normal renal architecture: renal corpuscles consisting of glomeruli (G) and Bowman's capsule (BC). The renal tubules (T) are also well shown. Mag x100 (H&E).

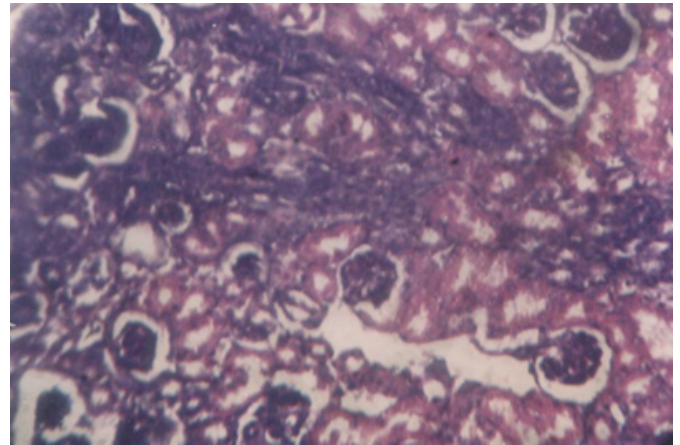


Figure 2

Plate 2: Photomicrograph of the kidney section of group B animal that received 4ml of palm wine showing enlarged glomerulus (G), narrowing of the capsular spaces (BC) and slight dilation of tubules (T). Mag x100 (H&E).

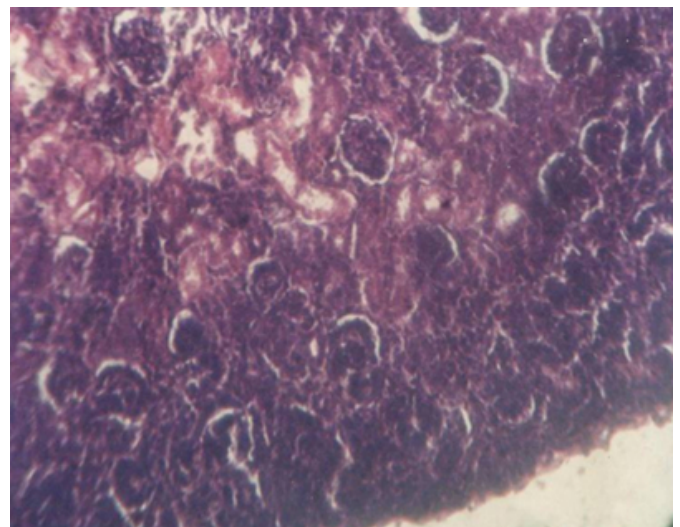


Figure 3

Plate 3: Photomicrograph on the histology of the kidney section of group C animal that received 8ml of palm wine showing shrunken glomerulus (G), and enlarged capsular spaces (BC). Mag x100 (H&E).

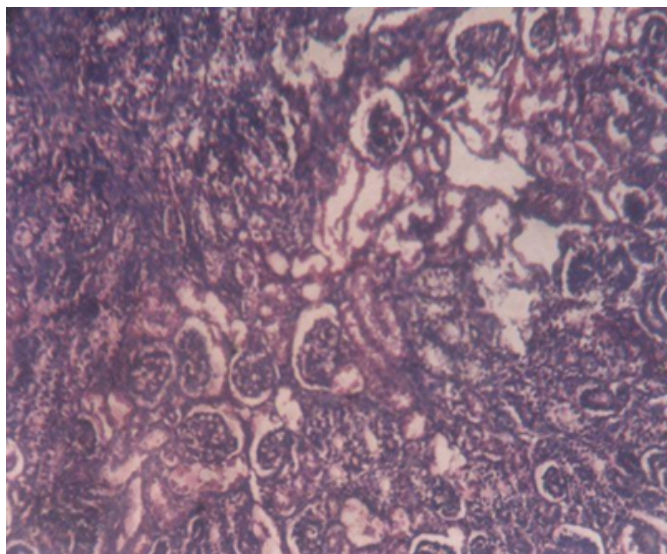


Figure 4

Plate 4: Photomicrograph on the histology of the kidney section of group D animal that received 4ml of beer showing degeneration of glomerulus (G) and slight acute tubular necrosis (T). Mag x100 (H&E)

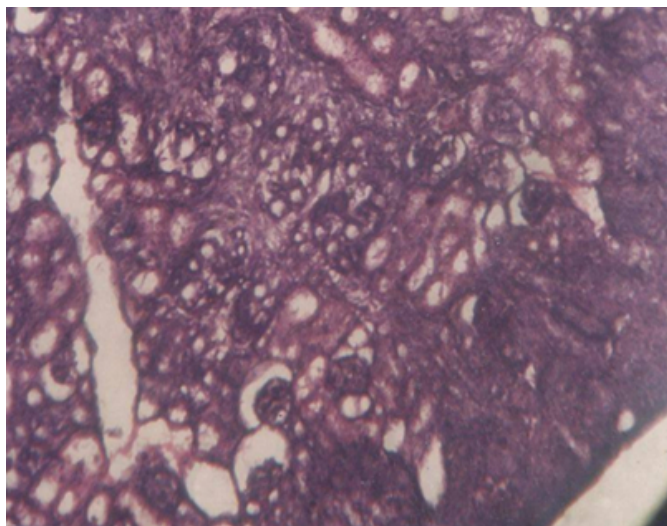
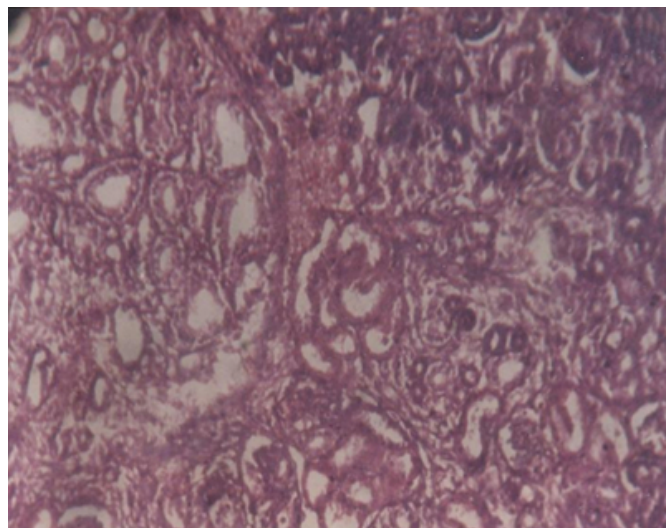


Figure 5

Plate 5: Photomicrograph on the histology of the kidney section of group E animal that received 8ml of beer showing severe acute tubular necrosis (T) and degeneration of the glomeruli (G). Mag x100 (H&E).



DISCUSSION

In the present study, glomeruli enlargement, dilation of the renal tubules, mild and severe degeneration of the glomeruli and severe tubular necrosis were observed within the kidney sections treated with 4ml, 8ml of beer and 4ml, 8ml of palm wine. This is in conformity with the findings by several workers⁹. This changes in histological features may have been due to the detrimental effect of alcoholic content of beer and palm wine on the structure and functions of the kidney. It has been reported that alcohol changes the structure and functions of the kidney and impairs their ability to regulate the volume and composition of fluid and electrolyte in the body¹⁰.

The dilation of the renal tubules and shrunken glomeruli as seen in groups B and C animals that received 4ml and 8ml of fermented palm wine may have been due to increased tubular secretion; a mechanism employed to clear harmful toxins and drugs from the body¹¹. Mild and severe degeneration of the glomeruli, acute tubular necrosis observed in groups D and E especially in Group E animals may have been due to adverse effect of alcoholic content of beer on the glomeruli and renal tubules leading to progressive decrease in renal flow and glomerular filtration rate. It has been reported that adverse effect caused by drugs affects morphological sites like the tubules, interstitium, glomeruli and vessels¹¹. It has also been reported that glomerular damaged impairs the flow through peritubular vascular system¹².

From this study, beer had the most detrimental effect on the fetal kidney than palm wine. It can be concluded from the result of this study that maternal administration of beer and palm wine from 7th through 13th day of gestation is nephrotoxic to the developing kidney of wistar rats.

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