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Research Article

Evaluation of Lipid Profile of Four Most Consumed Herbal Drinks in Uburu on Wister Albino Rats

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ABSTRACT

Due to lifestyle changes and the high cost of living, alcoholism has increased, driven by the proliferation of herbal drinks that consumers claim to be sex enhancers and liver cleansing agents, despite a lack of scientific evidence. The habitual intake of herbal-based alcoholic beverages by school children and youth poses a significant public health issue in Uburu, Southeast Nigeria.

Our study evaluated the lipid profile of four different herbal bitters commonly consumed in Southeast Nigeria: Akpaka, odogwu, ballamour and confam bitters, using wistar albino rats. A total of 30 male wistar rats were randomly divided into five groups labelled A, B, C, D and E. Group A served as the control and was administered distilled water. The rats in groups B, C, D and E received 50 mL/kg body weight of akpaka, odogwu, ballamour and confam bitters respectively, once daily for 28 days *via* oral intubation.

After 28 days of administration, the animals were fasted and sacrificed. Blood samples were collected from the veins in the left leg into sample bottles for biochemical analysis. Administration of the bitters significantly $p<0.05$ increased plasma triglyceride levels, total cholesterol levels and Low-Density Lipoprotein (LDL) levels in the groups receiving akpaka, odogwu, ballamour and confam bitters. Additionally, there was a significant $p<0.05$ decrease in High-Density Lipoprotein (HDL) levels compared to the control group.

Our results indicate that alcoholic bitters such as akpaka, odogwu, ballamour and confam alter the lipid profile of rats and should be consumed with caution because high doses can lead to cardiovascular and liver diseases.

Keywords: Herbal drugs, Alcoholic bitters, High density lipoprotein, Liver dysfunction, Hepatocellular markers

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INTRODUCTION

In recent times, the consumption of alcoholic bitters has gained recognition and popularity in Uburu, Ebonyi State, Nigeria as a whole. Some individuals claim that these beverages boost sexual energy and aid digestion. Consumers believe there are slight differences in efficacy and safety between locally processed beer and alcoholic bitters; however, there is a paucity of scientific evidence to support these claims.

Herbal drugs and plants have played an important role in African traditional medicine in the past and will continue to be significant due to environmental and health issues. Recently, economic hardships have led consumers to prefer locally made bitters from herbal concoctions that imitate internationally standard alcoholic beers.

Bitters are primarily derived from root extracts and herbs containing therapeutic or narcotic properties from tropical and subtropical plants and spices (Thierry BN, *et al*., 2012). They are alcoholic concoctions composed of various chemical constituents from medicinal plants, produced with different flavours.

According to (Johnson JT, *et al*., 2021), these flavourings result in a bitter, sour, or bittersweet taste. Bitters are typically dark in colour and are appreciated for their potential to stimulate appetite and digestion; hence, they are used as patent medicine, digestive aids and flavouring agents in cocktails (Okwu DE, 2005).

Bitters are characterized by their bitter taste and are believed to enhance vital energy centers in the body. Buyers and end users of bitters are convinced that these beverages contain body purifiers, possess anti-malarial properties, enhance male virility, act as anti-diabetic agents, are hypo-lipidemic and are non-toxic to the kidneys (Igbokwe N, *et al*., 2017; Chineke HN, *et al*., 2015).

Biochemical changes associated with alcohol consumption include *de novo* fatty acid synthesis, abnormal fat deposition, inflammation, congestion, alterations in lipid profiles and hepatocellular markers.

These changes may lead to increased levels of AST, ALT, ALP, bilirubin, MDA, liver dysfunction and hepatocellular damage (Adeyemi OS and Orekoya BT, 2014; George S, *et al*., 2019; Odey MO *et al*., 2019; Gupta S, *et al*., 2010). The metabolism of alcoholic bitters and other xenobiotic occurs primarily in the liver the main site for drug metabolism. Ethanol in alcoholic beverages is considered a xenobiotic when consumed excessively and may lead to liver cirrhosis (Ginsberg H, *et al*., 1974).

The metabolism of alcohol in the liver by alcohol dehydrogenase and the Microsomal Ethanol-Oxidizing System (MEOS) generates intermediates and by-products that can obstruct the metabolism of essential nutrients. An increase in these toxins processed by the liver can result in alcoholic liver disease or hepatic damage (Adeyemi MM, *et al*., 2022; Stogner JM, *et al*., 2014).

Due to economic realities, individuals in Ebonyi State and across Nigeria who previously consumed refined beer have shifted to alcoholic bitters because they are cheaper and more intoxicating.

This trend has led to a significant increase in the consumption of alcoholic bitters among both young and old individuals, particularly school children, to patronize these alcoholic bitters in large numbers. Therefore, our study aims to determine the effects of the four most consumed alcoholic bitters in Uburu, Ebonyi State on the lipid profile of albino wistar rats.

MATERIALS AND METHODS

Chemicals and reagents

All chemicals used in this study were of analytical grade. Odogwu, confam, belamon and akpaka bitters were obtained from a local store in Uburu, Ebonyi State.

Animal handling

Five iron cages were used to house male wistar albino rats weighing 120-130 g. The rats were acclimatized for 7 days at room temperature 25°C with a 12-hour light/dark cycle per day. Feed and water were provided ad libitum.

Experimental design

The 30 male wistar rats used in our study were randomly divided into five groups labelled A, B, C, D and E. Group A served as the control and was administered distilled water. The albino rats in groups B, C, D and E received 50 mL/kg body weight of akpaka, odogwu, ballamour and confam bitters, respectively, once daily for 28 days.

Measurement of weights

All male wistar albino rats were weighed daily for the duration of the 28-day study.

Collection of blood from animals

After 28 days of alcoholic bitters administration, feed was withdrawn for 24 hours. The rats were then sacrificed under slight unconsciousness using chloroform.

Preparation of serum

Blood samples for biochemical analysis were collected through vein puncture. The hair on the left leg of the rats was shaved to expose the prominent vein, which was cut open to collect blood samples using syringes. The blood samples were then centrifuged at 3000 rpm for 10 minutes to separate the serum for biochemical analysis.

Determination of lipid profile

The cholesterol peroxidase methodology was used to assay serum total cholesterol levels, while the Glycerol Phosphate Oxidase-Phenol Aminophenazone (GPO-PAP) method was used to estimate serum triglyceride levels. A precipitation method using phosphotungstate magnesium reagent was utilized to assay serum HDL levels. Serum Low-density lipoprotein LDL and Very Low-Density Lipoprotein (VLDL) levels were determined using Friedewald's formula.

Statistical analysis

The generated data were analyzed using one-way Analysis of Variance (ANOVA) and Student's t-test for multiple comparisons to assess significant differences between test groups and the control group. Significant differences among groups were determined using Duncan's multiple range test with SPSS for Windows version 20. A probability level of $p<0.05$ was considered significant.

RESULTS AND DISCUSSION

The results of the body weight measurements of albino rats after 28 days of administration of alcoholic bitters akpaka, odogwu, ballamour and confam showed increased water intake, enhanced locomotive activity and reduced feed intake (Ogechi N and Ibioku E, 2019). The molecular mechanisms underlying these observed changes are not well understood but may be attributed to the caloric content of the bitters. Additionally, (Wakabayashi I, 2009) speculates that high alcohol intake increases the likelihood of weight gain and the incidence of obesity. Interestingly, despite the high caloric density of alcohol, users do not seem to gain weight compared to non-users (Jéquier E, 1999). If the total caloric intake from other sources is less than that from alcohol below 50%, the body may inefficiently utilize the energy provided by ethanol due to stimulation of the MEOS. The primary pathway for ethanol oxidation in the liver is through MEOS, which can lead to energy waste; however, its induction is reversible after alcohol abstinence (Lands WE and Zakhari S, 1991; Hétu C and Joly JG, 1985; Lieber CS, 1988).

The effects of odogwu, confam, ballamour and akpaka bitters on the lipid profile of albino rats are presented in *Figures 1-4*. The results revealed significant $p<0.05$ increases in plasma triglyceride levels, total cholesterol levels and LDL levels in the groups that received akpaka, odogwu, ballamour and confam bitters. Conversely, there was a significant $p<0.05$ decrease in HDL levels compared to the control group.

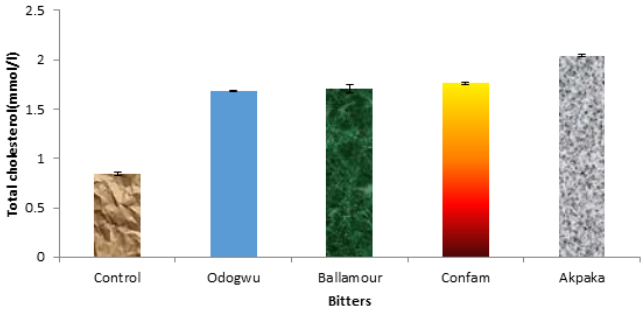

Figure 1: Effect of alcoholic bitters (Odogwu, confam, ballamour and akpaka bitters) on total cholesterol levels in albino rats
Note: (▫) Control; (▫) Odogwu; (▫) Ballamour; (▫) Confam and (▫) Akpaka

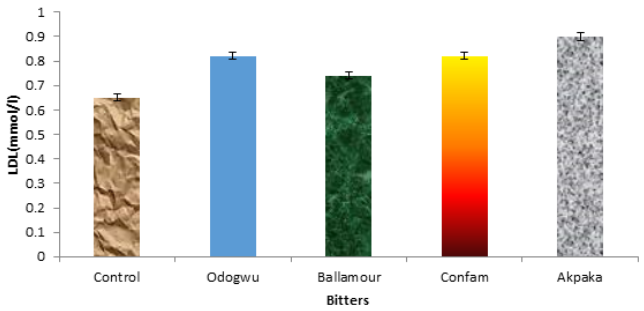

Figure 2: Effect of alcoholic bitters (Odogwu, confam, ballamour and akpaka bitters) on Low Density Lipoprotein (LDL) levels in albino rats
Note: (▫) Control; (▫) Odogwu; (▫) Ballamour; (▫) Confam and (▫) Akpaka

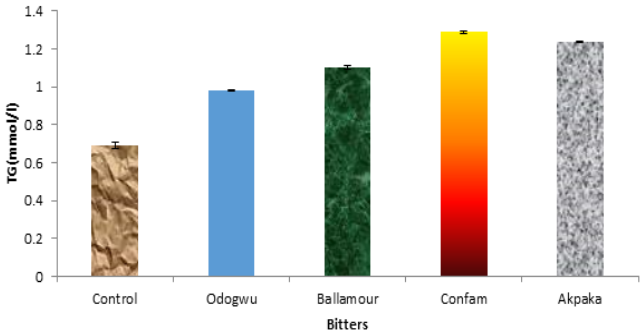

Figure 3: Effect of alcoholic bitters (Odogwu, confam, ballamour and akpaka bitters) on triglyceride levels in albino rats
Note: (▫) Control; (▫) Odogwu; (▫) Ballamour; (▫) Confam and (▫) Akpaka

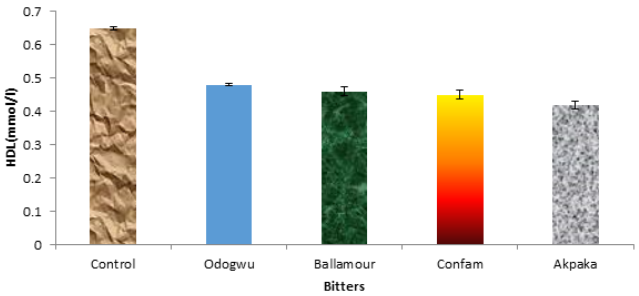

Figure 4: Effect of alcoholic bitters (Odogwu, confam, ballamour and akpaka bitters) on High Density Lipoprotein (HDL) levels in albino rats

Note: (▫) Control; (▫) Odogwu; (▫) Ballamour; (▫) Confam and (▫) Akpaka

According to George S, *et al*., 2019, alcohol administration elevates plasma triglyceride levels and activates hepatic production of VLDL, possibly by inhibiting hepatic oxidation of free fatty acids that contribute to VLDL production and triglyceride synthesis by hepatic cells. High-Density Lipoprotein Cholesterol (HDL-C), known as good cholesterol, carries other cholesterol particles from the bloodstream back to the liver for re-utilization or excretion *via* reverse cholesterol transport. Elevated levels of HDL-C are associated with a lower risk of cardiovascular diseases. Conversely, it is observed that individuals with HDL-C levels below 40 mg/dl or approximately 1 mmol/L are at a higher risk for heart disease. Therefore, consumption of alcoholic bitters can lead to heart and liver problems due to decreased HDL levels compared to controls.

Habitual alcohol intake over extended periods may disrupt lipid transport systems and interfere with both hepatic and extrahepatic lipid metabolism, potentially leading to liver dysfunction and toxicity (Vaswani M and Rao RV, 2005). George S, *et al*., 2019 noted that alcohol inhibits fatty acid oxidation in the liver and *de novo* fatty acid synthesis. (Roy S and Rasheed N, 2015) has observed a decline in the age at which individuals begin consuming alcohol. In Uburu, it has been noted that school children consume these bitters, which may adversely affect their learning.

CONCLUSION

The findings of this study indicate that the consumption of alcoholic bitters, specifically akpaka, odogwu, ballamour and confam, significantly alters the lipid profile of rats. These alterations suggest that while these bitters may have some traditional uses, their high alcohol content can lead to adverse health effects. It is important to consume these products in moderation, as excessive intake may increase the risk of developing serious health conditions such as cardiovascular disease and hepatic dysfunction.

Furthermore, the study underscores the need for public awareness regarding the potential health risks associated with alcoholic bitters. Given their popularity and accessibility, consumers should be informed about the implications of high alcohol consumption on lipid metabolism and overall health. Future research should focus on elucidating the specific mechanisms by which these bitters affect lipid profiles and exploring safer alternatives or formulations that could mitigate adverse effects while retaining potential benefits.

ETHICAL COMMITTEE CONSENT

The use of the albino rats for the experiment was approved by the Animal Care and Ethic Committee of the David Umahi Federal University of Health Science, Uburu, Nigeria (2022/004/0521).

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