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Comparative Study of the Effect of Locally Made Beer (*Burukutu* and *Pito*) and Star Lager Beer on Liver Function Parameters

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Abstract

Alcohol consumption has a long history in human existence and is implicated as one of the major risk factors in the development of liver diseases. The comparative impact of locally made (burukutu and pito) sorghum-based beer and Star Larger beer on the liver biomarkers of albino rats was investigated. 35 albino rats were grouped into 7 groups of 5 rats each. Group one served as the control group and received only distilled water. Group 2 and 3 received 10 and 20 mL/kg b.wt of pito, groups 4 and 5 received 10 and 200 mL/kg b,wt of burukutu, while group 6 and 7 received 10 and 20 mL/kg of Star Larger beers, respectively, for 21 days after which the liver function parameters were assessed. There was a significant decrease ($p<0.05$) in albumin level of the treatment groups when compared with the control group. Bilirubin and ALP showed no significant difference ($p<0.05$) from the control group. There was no significant difference ($p<0.05$) in ALT levels of burukutu and Start Larger when compared with the control group, however, the groups treated with pito showed a significant increase ($p<0.05$) when

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compared with the control group. There was a significant increase ($p<0.05$) in all the treatment groups when compared with the control group, where group 3, which was treated with the higher dose of pito (20 mL/kg b.wt.) had the highest significant increase($p<0.05$). albumin levels of the treatment groups showed a significant decrease ($p<0.05$) when compared with the control group. The three beers compared are toxic to the liver, with pito having the greatest toxicity.

Keywords: Cadmium; Neurotoxicity; Metabolomics; Oxidative Stress; Chelating Agents; Inflammation

INTRODUCTION

The multiple effects of alcohol consumption on human health have received increasing attention from the scientific community internationally (Poli *et al*., 2013). However, while the harms associated with high intake of alcohol are well known, the effects of moderate doses are more complex to deal with and are the subject of a lively debate (De Gaetano *et al*., 2016).

Burukutu and pito are popular indigenous alcoholic beverages of a vinegar-like flavour, consumed in the Northern Guinea savannah region of Nigeria, the Republic of Benin, and in Ghana (Kolawole *et al*., 2007). The basic characteristics of pito and burukutu include a slightly sour taste due to the presence of acids, including lactic acid, a pH of 3.3 to 3.5, and an opaque color because of suspended solids and yeast (Kolawole *et al*., 2007; Yusuf *et al*., 2020). They contain vitamins, iron, manganese, magnesium, phosphorus, and calcium as well as about 26.7g of starch and 5.9g of protein per liter. It is mainly produced from the grains of guinea corn (Achi, 2005).

Typically, burukutu is produced by soaking sorghum grains in water throughout the night, after which the steeping water is removed (Atter *et al*., 2014). Then, the soaked sorghum is spread on a surface, usually a mat, covered with a layer of plant leaves, and left until it germinates (Atter *et al*., 2014; Yusuf *et al*., 2020). During this germination period, water is added at one-day intervals for about one week, after which it is dried and ground into powder. To this ground malt, starch from raw grain and/or sweet potato and hot water is added (Chavan *et al*., 1998; Atter et al., 2014). The blend is usually allowed to sour for up to 48 hours before it is boiled for about 240 minutes and kept for another 48 hours to mature.

The final product is typically a dense beverage (about 3 to 8% alcoholic) called burukutu. However, some of the endogenous sorghum microorganisms are pathogenic or may produce toxic substances, such as mycotoxins; however, pasteurizing a freshly brewed burukutu sample at 60 degrees Celsius for 30 minutes delays spoilage for up to two weeks (Egemba, 2007; Eze *et al.*, 2011).

The alcoholic pito has been the focus of most of the research in recent times (Ayanu, 2012) owing to its popularity and the unique microbial culture associated with the fermentation of the drink, but few studies have been performed on the different processing methods used to brew it (Ayanu, 2012). The effects of the brewery processes on the quality of the drink have also not been studied or defined, and thus, raises concerns about the safety of the drink, and hence the need to evaluate the production methods (Zaukuu *et al.*, 2016). This study compared the effects of pito, burukutu and Star Larger on liver function.

MATERIALS AND METHODS

Experimental animals

Thirty-five (35) healthy albino rats of both sexes weighing 180 – 200 g obtained from the animal house of Adamawa State University, Mubi, were used for the study. They were housed in a well-ventilated environment at a room temperature, photoperiod of 12/12 hours light/dark, and humidity of 50-55 percent. They were fed and watered as needed. Bottled Star Larger were purchased at random from bars and restaurants within the study area daily.

Sample collection

Samples of pito and burukutu were collected daily from local drinking parlors located in different parts of Mubi metropolis, which were transported to the laboratory in plastic sample bottles and refrigerated at 20°C until needed.

Experimental design

The animals were grouped into seven (7) groups of five (5) rats each. Groups 1 and 2 received 10 and 20 mL/kg of body weight (b.wt.) of pito, respectively, groups 3 and 4 received 10 and 20 mL/kg b.wt. of burukutu, respectively, and groups 5 and 6 received 10 and 20 mL/kg b.wt. of star larger respectively, while group 1 received only distilled water, for twenty-one days (21) days.

Collection of blood samples

A desiccator saturated with chloroform was used to induce anesthesia after which the blood samples were collected using syringes and needles by direct cardiac puncture. The samples were collected in clean EDTA bottles which were transported to laboratory in a glacial sample bag for analysis.

Determination of liver function parameters

Determination of ALP was done using the methods described by Egoro *et al.* (2017), while the method described by Todd *et al.* (1979) was used to determine ALT and AST. The method described by Tietz (1994) was used to determine bilirubin, and albumin was determined by the method described by GRANT (1987).

RESULTS

Table 1. showed the effect of locallay made beer (pito and burukutu) and Star Larger on liver function parameters of albino rats. A significant decrease ($p<0.05$) was in the albumin level of the treatment groups when compared with the control group. Bilirubin and ALP showed no significant difference ($p<0.05$) from the control group. There was no significant difference ($p<0.05$) observed in ALT levels of burukutu and Start Larger when compared with the control group, however, the groups treated with pito showed a significant increase ($p<0.05$) when compared with the control group. There was a significant increase ($p<0.05$) in the levels of AST of all the treatment groups when compared with the control group, where group 3, which was treated with the higher dose of pito (20 mL/kg b.wt.) had the highest significant increase($p<0.05$). Albumin levels in all the treatment groups showed a significant decrease when compared with the control group. Groups treated with higher doses of pito and Star Larger showed the lowest significant ($p<0.05$) decrease when compared with the other treatment groups.

Table 1. Effects of locally made beer (burkutu and pito) with star larger on liver function parameters

Groups	Albumin (g/dL)	Bilirubin (g/dL)	ALT (UL)	AST (UL)	ALP (UL)
Control	4.16 ± 0.04^{c}	52.74 ± 5.32^{a}	31.33 ± 3.84^{a}	27.00 ± 1.15^{a}	80.53 ± 20.78^{a}
10 mL/kg pito	3.06 ± 0.19^{b}	64.08 ± 5.75^{a}	86.00 ± 52.08^{ab}	53.00 ± 10.01^{b}	44.16 ± 5.58^{a}
20 mL/kg pito	3.16 ± 0.0^{ab}	68.37 ± 6.05^{a}	156.00 ± 12.39^{b}	101.66 ± 14.71^{c}	65.93 ± 0.06^{a}
10 mL/kg burukutu	2.76 ± 0.11^{a}	64.38 ± 25.16^{a}	48.66 ± 32.74^{a}	40.00 ± 6.24^{ab}	98.26 ± 8.19^{a}
20 mL/kg burukutu	2.68 ± 0.20^{a}	53.05 ± 22.91^{a}	25.33 ± 2.33^{a}	41.00 ± 3.78^{ab}	99.56 ± 9.11^{a}
10 mL/kg star Larger	2.98 ± 0.01^{b}	75.15 ± 3.45^{a}	22.33 ± 5.36^{a}	44.33 ± 4.63^{ab}	84.33 ± 4.22^{a}
20 mL/kg star larger	3.30 ± 0.98^{ab}	92.15 ± 29.82^{a}	22.15 ± 29.28^{a}	61.33 ± 4.70^{b}	49.60 ± 21.42^{a}

Values are expressed as mean ± standard error of mean. Values with the same down the column are not statistically different ($p<0.05$). n=3.

DISCUSSION

The liver function indices are parameters for measuring the functional status of the liver (Iweala *et al.*, 2013). The elevation of transaminases characterizes liver diseases and dysfunction due to toxic compounds (Owolarafe *et al.*, 2022). GGT, a cholestatic enzyme, is mainly an affirmation parameter for liver dysfunction because it is found predominantly in the liver, and its elevated activity in the serum is a clear sign of damage to the hepatocyte cell membrane (Owolarafe *et al.*, 2022). The hepatobiliary enzymes, like aspartate aminotransferase (AST) and alanine aminotransferase (ALT), convey information on hepatocyte injury, whereas bilirubin, albumin convey information on liver function (Agrawal *et al.*, 2016). The serum levels of AST in this study reflected a significant ($p<0.05$) increase in the treatment group when compared with the control group, thus, may indicate damage to the hepatocytes of albino rats used in the study. When the treatment groups were compared, the group treated with pito showed the highest significant increase ($p<0.05$) when compared with the group that received burukutu and star larger. This may indicate that pito is more toxic than burukutu and star larger in terms of hepatocytes, followed by star larger and burukutu, respectively. Therefore, compared comparing the three beers, burukutu is the beer that has the mildest toxicity. This is evident in the serum level of ALT, as the groups that received burukutu and star larger showed no significant difference ($p<0.05$) when compared with the control group, while groups 2 and 3 that were

treated with pito reflected a significant increase($p<0.05$) when compared to the control group. ALP reflects the impaired bile excretion and bile flow, while the serum total and conjugated bilirubin represent the metabolic functions of the liver (Ahmed *et al*., 2022). From the results obtained, there was no significant difference ($p<0.05$) observed when all the groups were compared, as well as the levels of bilirubin. This may indicate that both pito, burukutu, and star larger do not affect bile excretion and bile flow, and the metabolic function of the liver is not impaired, since there was no elevation in bilirubin from all the treated groups when compared with the control group. Albumin is an important protein produced by the liver (Rothschild *et al*., 1997). There was a significant decrease ($p<0.05$) observed in the levels of albumin from all the groups treated with pito, burukutu, and Star Larger when compared with the control group. This may indicate an impairment to the synthetic function of the liver as a result of the prolonged beer intake, which could lead to severe cirrhosis, hepatitis, and fatty liver (Jagdish et al., 2021). Pito, however, has a greater activity when compared with burukutu and Star Larger, as it is evident in the highly elevated levels of ALT and AST in groups treated with pito.

CONCLUSION

In a more general term, this study suggests that the three beers compared (pito, burukutu, and Star Lager) are toxic and could lead to severe liver injury. Considering the results, however, Pito has greater activity than Burukutu and Star Larger beers. Thus, consuming large amounts of beer for a longer period could lead to chronic liver damage.

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