Processing and Consumption of Burukutu - A Local Beverage in Three Communities of Jos: A Public Health Concern

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ABSTRACT

Background: *Burukutu, a local alcoholic beverage whose processing relies on doubtful water sources, may contain heavy metals and pathogens.*

Objective: *To assess the physico-chemical and biological hazards in Burukutu, the water used in its production and the perceived health risks associated with its consumption.*

Methods: *A cross-sectional survey adopted a four-stage sampling technique to select 370 respondents. Three Burukutu producing communities (Community A (CA), Community B (CB), Community C (CC)) were selected purposively. A semi-structured questionnaire and observational checklist were used for data collection. Samples of water used in production and Burukutu were analysed for proximate, heavy metals and physico-chemical parameters using the Standard Organisation of Nigeria and National Environmental Standards and Regulations Enforcement Agency standards. A microbial assay was carried out on all the samples. Data were analysed in descriptive and inferential statistics at 0.05.*

Results: *Respondent age was 37.4±9 years, 57% had safety concerns about Burukutu consumption, and 88.6% experienced side effects. Water used for Burukutu production in CA contained Copper (3.520±0.58 mg/L), Zinc (3.52±0.57 mg/L) concentrations, and Nickel concentration in CB was 0.04±0.17 mg/l. Samples of Burukutu showed that the concentration of Iron, Cobalt and Nickel in the three communities were above the SON maximum permissible limit, Zinc in CA, and CC were 3.67±0.57 mg/L and 3.43±0.12 mg/Ll, respectively.*

Conclusion: *High heavy metals and microorganisms concentration were found in both water and Burukutu samples. Training of brewers on hygiene practices and sensitisation of community members on the risk of consumption of unhygienic Burukutu are recommended.*

Keywords: Burukutu, Local alcoholic beverage, Unhygiene practices, Contaminated brews, Health risk

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INTRODUCTION

Burukutu is a local indigenous alcoholic beverage produced and consumed in most African countries, especially the middle belt of Nigeria, Benin Republic and Ghana (1). It is a beverage of vinegar-like flavour and a brown-coloured suspension produced mainly from the grains of guinea corn of Sorghum vulgare and Sorghum bicolor species (2). The high cost of beer and the poor financial status of most people in the urban slums and rural areas led to increased demand and

consumption of local brews such as Burukutu (3).

The production process of local brews is uncontrolled fermentation which often leads to poor-quality brews. The brewing conditions (excessive fermentation period and temperature) favours acetic fermentation and oxidative spoilage of Burukutu, leading to harsh and vinegary products. Low-temperature fermentation and storage are not practised (3). Among the problems associated with the processing of Burukutu are local brewers depending on untreated water supplied by hawkers. Such water could be a potential vehicle for the spread of pathogenic micro-organisms. Furthermore, cooking vessels are made from unsuitable metal or metal alloys. In addition, the processing areas are filthy, and some cases are located near toilets or mining ponds (3).

Contaminants such as organic and inorganic elements are present in foods, including Burukutu (4, 5, 6). Humans are exposed to metals by ingestion and inhalation when such metals contaminate environmental substances such as water, air, soil and foodstuff (7). Plateau State is well known for mining activities over the years, which have left behind numerous mining ponds, streams, and rivers in the environment from where local brewers of Burukutu obtain water for brewing these local alcoholic drinks. The use of water from mining ponds, streams, and rivers found in the environment coupled with crude production and storage methods under improper sanitary conditions is of public health import. This may expose Burukutu to some toxic heavy metals and microbial pathogens. Intake of heavy metals becomes harmful because of their potential to accumulate to toxic levels in different parts of the human body and disrupt numerous biochemical processes leading to diseases (8). Previous studies have reported microbial pathogens in locally brewed alcoholic drinks such as Burukutu due to poor storage (9, 10). Despite these studies, there is a dearth of information on assessing the toxicology of water used in brewing Burukutu and Burukutu in Jos, Plateau State.

MATERIALS AND METHODS

This study was a descriptive cross-sectional survey with a laboratory component. It was carried out in the three Local Governments Areas (LGAs) in Jos, Plateau State. Jos city is well known for mining activities and left behind numerous mining ponds, streams, and rivers in the environment. Purposive sampling and snowballing approach methods were used in selecting 370 respondents. Burukutu production communities were purposively selected as cluster units from the three wards. A semi-structured questionnaire was used to obtain information from the respondents. An observational checklist was also used to document information from the Burukutu production spots, practices and the environment.

Samples collection

Samples of water used for Burukutu production and Burukutu were collected from different production sites in the three communities. Each sample was collected in triplicate with sterilised plastic sample bottles. Samples were transported in an iced cooler and stored at -4° before analysis. Burukutu was analysed for pH, proximate and chemical parameters in line with SON and WHO guidelines.

Chemical Reagents

Chemical reagents used were of analytical grade and were BDH chemicals, Poole's England and Sigma Chemical Company St. Louis, Missouri, USA.

Determination of pH

The pH of the Burukutu was determined using model PHS-25 pH meter (Techmel and Techmel USA) after the calibration of both the pH meter and electrode with buffer solutions of pH 7 and 4. This was done by inserting the probe of the calibrated pH into the Burukutu sample and the pH recorded.

Proximate analyses

The specific gravity, moisture content, protein content, and crude fibre content were determined using the Pyeuometer gravimetric and gravimetric method, the Kjeldahl and the Wende methods, respectively, as James described (11). The total ash content, sugar content, alcohol and fats/oil

were determined using furnace incineration gravimetric, Versanle EDTA Complexiometric titration and flame photometric methods, respectively (12).

Determination of heavy/trace metal content of Burukutu

The samples were digested before analysis using atomic absorption spectrophotometer.

Microbial assay of Burukutu

Microbiological analyses of samples were carried out at the Bacteriology Section of Medical Laboratory, NVRI, Vom, Nigeria. The following were used as culture media and diluents: Universal Beer Agar (UBA), (13), Nutrient Agar (NA), MRS Agar, Blood Agar (BA) (ACUMEDIA Manufacturers INC, Michigan 48912) and sterile distilled water.

Analysis of water use for the production of Burukutu

The procedure above was applied to analyse the water used in the production of Burukutu.

Data collection methods and analysis

Data were collected and analysed using Statistical Package for the Social Sciences SPSS version 16 and GraphPad Instat version 3 software. Results were presented in descriptive statistics. The risk perception score was measured on a three-point scale among respondents that consume the local alcoholic beverage. The scores 20-24, 14-19 and 0-13 were categorised as high, moderate and low risk perception, respectively. Mean, standard deviation and range were calculated for heavy/trace metals for the Burukutu and water samples. The results obtained from the study were presented in charts and tables. Inferential statistics such as ANOVA and the Student t-test were used at $p<0.05$. The values obtained were compared with the Standard Organisation of Nigeria (SON) and World Health Organisation (WHO) guidelines.

RESULTS

Socio-demographic characteristics of respondents

The respondents age was 37.4±9 years, and the majority (63.5%) were male. Most respondents (68.1%) were married, with 19.2% being single. Christianity (94.6%) was the dominant religion. Most respondents, 54.3%, had a high school education, 16.5% had primary education, and 15.1% had no formal education. Trading (25.7%) was the common occupation among the respondents, followed by civil servants (16.5%) and farmers (13.8%).

Respondents' awareness of local alcoholic beverages

The common source of information about the different alcoholic drinks are friends (50.8%) and the elders at home (47.3%). A majority (95.9%) have groups of their friends drinking Burukutu, and more than half (57%) have safety concerns with Burukutu consumption. Most respondents, 60.8%, do not care whether the Burukutu is packaged properly before consumption or not

The pattern of consumption among the respondents

More respondents (36.8%) indicated that they took Burukutu for between 6 to 15 years. More respondents (48.6%) consume the drink once a day, and 19.2% consume it more than once daily. More than half, 53.5%, pointed out they consume less than 4 litres a day, and 31.1% consume 4 to 6 litres. As noted by the respondents, the benefits derived from taking Burukutu were providing nutritive value (58.9%) and giving satisfaction (23.5%). More than one-third of respondents (36.5%) claimed that the benefits were effectively met. A majority (92.7%) of respondents married with children do not give Burukutu to their children. Some reasons respondents preferred Burukutu over bottled alcoholic drinks were Burukutu is natural (55.9%) and cheap (23%) (Table 1).

Table 1: Pattern of consumption of the respondents

Variables	Options	Frequency	%
Duration of consuming Burukutu	Less than a year	24	6.5
	1-5 years	79	21.4
	6-15 years	136	36.8
	13-20 years	66	17.8
	21-30 years	46	12.4
	Greater than 30 years	19	5.1
Frequency of consuming Burukutu	Once a week	22	5.9
	More than once a week	97	26.2
	Once daily	180	48.6
	More than once daily	71	19.2
Average intake of Burukutu in a day by respondent	Less than 4 litres	198	53.5
	4-6 litres	115	31.1
	7-9 litres	41	11.1
	10-12 litres	10	2.7
	More than 12 litres	6	1.6
Benefits of consuming Burukutu	Nutritional value	218	58.9
	Cold Reduction	6	1.6
	Increases sleep	13	3.5
	Improved Vision	27	7.3
	Improved General well being	19	5.1
	Satisfaction	87	23.5
Burukutu is effective for a reason it was taken	Yes	135	36.5
	No	114	30.8
	Not sure	121	32.7
Administration of Burukutu to children	Yes	27	7.3
	No	343	92.7
Reasons for preference of Burukutu over alcoholic drinks	It is natural	207	55.9
	It is cheap	85	23.0
	Promotes general well being	32	8.6
	Family tradition	46	12.4

Table 2: Reported side effects of Burukutu consumption

Variables	Options	Frequency	%
Experienced any side-effect after consuming Burukutu	Yes	328	88.6
	No	42	11.4
Type of side-effect ever experienced	Dizziness	79	21.4
	Loss of taste	38	10.3
	Nausea and Vomiting	74	20.0
	General weakness	68	18.4
	Excessive hunger	20	5.4
	Headache	39	10.5
	Loss of appetite	52	14.1
	General body pain	50	13.5
	Blurredness of sight	6	1.6
Frequency of the side effects	Very often	129	34.9
	Regularly	55	14.9
	Occasionally	138	37.3
	Rarely	48	13.0
Physical signs of ill-health for Burukutu consumption	Paleness	151	40.8
	Excessive stomach protrusion	127	34.3
	Body injuries	66	17.8
	Skin problems	59	15.9
	Weight loss	54	14.6
	Swelling/redness of palms	46	12.4
	Sores	28	7.6
	Numbness & tingling of feet/hands	18	4.9
	Redness of face	12	3.2

Reported side effects of Burukutu consumption

Most respondents (88.6%) experienced side effects from Burukutu consumption, including dizziness (21.4%). Some respondents (37.3%) experienced the side effects occasionally. The reported physical sign associated with Burukutu consumption were paleness (40.8%) (Table 2).

The reported consequence of Burukutu consumption

Some consequences related to Burukutu consumption are injuries or knowing someone who had injuries (70%) and being told by physicians of them having either had liver or kidney problems (11.9%) (Table 3).

Perceived risk score of the respondents associated with the consumption of Burukutu

Most respondents, 65%, had moderate risk perception associated with the consumption of Burukutu (Figure 1).

Association between socio-demographic characteristics and risk perception of the respondents associated with the production of Burukutu

There was a significant difference between

respondents' level of education and risk perception (F (3,366) =3.92, p=0.009). Also, a significant difference was observed between respondents' occupation risk perception determined by one way ANOVA, F (8,361) =4.159, P=0.000). In addition, there was a significant difference between religion and risk perception (F (1,368)=6.08, p=0.014).

Physico-chemical characteristics of the water used in the brewing of Burukutu

The pH concentrations of water obtained from open wells ranged between 6.80±0.58 to 7.10±0.12 from the three communities. The concentrations of Iron, Lead and Cobalt in the water in all three communities were 0.3 mg/l, 0.01mg/l and 0.005 mg/l, respectively. They are above the maximum permissible limits for drinking water. Copper and Zinc concentrations in Community A (3.520±0.58 and 3.52±0.57 mg/l) were higher than the SON maximum permissible limits of 1.00 mg/l and 3.00 mg/l, respectively. The concentration of Nickel in Community B (0.04±0.17 mg/l) was observed to be higher than that of SON maximum permissible limits of 0.02 mg/l (Table 4).

Proximate analysis and heavy metals concentration of Burukutu

The mean pH of Burukutu in the three communities was between the ranges of 4.05±0.58 to 4.20±0.12. The proximate analysis results in the Burukutu samples in the three communities showed that the dry matter content in Community A (4.66±0.23 %) was slightly above the SON standard of 2.5%. The specific gravity of the Burukutu also ranged between 1.06±0.12 to 1.14±0.58 among the three communities.

It was observed that the concentration of Iron, Cobalt and Nickel in all three communities were above the SON maximum permissible limit of 0.30 mg/l, 0.005 mg/l, and 0.02mg/l. The concentrations of Zinc in Community A (3.67±0.57 mg/l) and Community C (3.43±0.12 mg/l) were slightly above WHO maximum permissible limit of 3.00 mg/l. Lead and Chromium were also above the OIV and SON maximum permissible limit in Community B (Table 4).

Microbial assay of water used in brewing the local alcoholic beverage Burukutu

Escherichia coli and *Staphylococcus aureus* were isolated in Community A and Community B with a total coliform count of $12x10^3$ cfu/100ml and $50x10^3$ cfu/100ml, respectively. Community B had isolates of *Escherichia coli* and *Proteus spp.*, with a total coliform count of $5.3x10^3$cfu/100ml (Table 5).

Microbial assay of the local alcoholic beverage Burukutu

Escherichia coli and *Staphylococcus aureus* were isolated in community A and Community C with total coliform count as $3.78x10^2$ and $7.44x10^2$ cfu/100 ml with community B having a total coliform count of $5.46x10^2$ cfu/100 ml with *Escherichia coli* and *Proteus spp.*, being isolated (Table 5).

Table 3: Reported consequence of Burukutu consumption

Variables	Options	Frequency	%
Previously hospitalised because of consumption of Burukutu	Yes	12	3.2
	No	358	96.8
Previously involved in vehicle/motorcycle/bicycle accident after consumption of	Yes	35	9.5
	No	335	90.5
Previously gotten into trouble at work because of consumption of Burukutu.	Yes	29	7.8
	No	341	92.2
You or someone been previously injured as a result of your consumption of Burukutu	Yes	259	70.0
	No	111	30.0
Have you ever been told by a physician or any health worker that you have a kidney or liver problem	Yes	44	11.9
	No	326	88.1

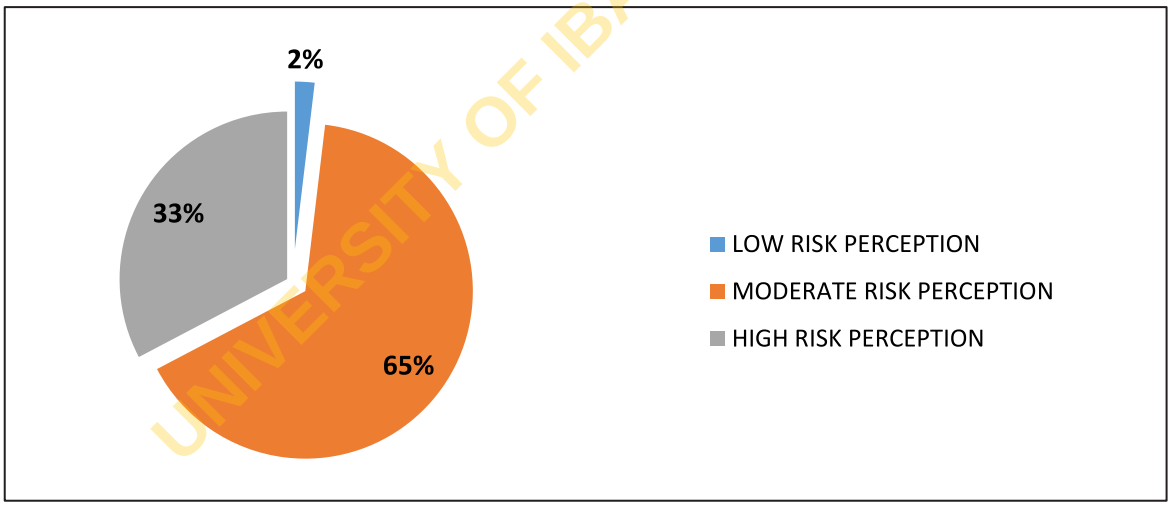

Fig 1: Perceived risk of the respondents associated with the consumption of Burukutu

Table 4: Physico-chemical characteristics of water used in the brewing of Burukutu and Proximate analysis and heavy metals concentration of Burukutu

Parameter	Community A	Community B	Community C	SON, (2007)
Temperature(°C)	15.40±0.01	13.80±0.02	16.20±0.01	40
pH	7.10±0.12	7.20±0.17	6.80±0.58	6.5-8.5
Appearance	Clear	Clear	Clear	Clear
Cu(mg/l)	3.520±0.58	0.100±0.58	0.050±0.58	1.00
Cr(mg/l)	0.014±0.58	0.051±0.12	0.021±0.58	0.05
Fe(mg/l)	1.181±0.15	3.412±0.12	2.492±0.17	0.30
Co(mg/l)	0.013±0.00	0.032±0.12	0.015±0.12	0.005 (WHO)
Mn(mg/l)	0.052±0.11	0.015±0.57	0.005±0.58	0.20
Ni(mg/l)	0.021±0.58	0.040±0.17	0.011±0.12	0.02
Zn(mg/l)	3.521±0.57	2.321±0.57	0.041±0.12	3.00
As(mg/l)	0.001±0.00	0.002±0.58	0.001±0.00	0.01
Cd(mg/l)	0.003±0.58	0.001±0.00	0.002±0.00	0.003
Pb(mg/l)	0.022±0.57	2.321±0.57	0.041±0.12	0.01
Proximate analysis and heavy metals concentration of Burukutu				
Parameter	**Community A**	**Community B**	**Community C**	**SON (2003, 2007)**	**OIV (2008)**
pH	4.05±0.58	4.20±0.12	4.15±0.58	3-6	-
Ash content%	2.63±0.17	2.36±0.58	1.91±0.35	2.5	-
Dry matter%	4.66±0.23	4.44±0.23	3.63±0.27	4-6	-
Crude fibre%	0.43±0.58	0.49±0.23	0.37±0.17	0-2	-
Sugar%	6.47±0.69	5.88±0.46	5.78±0.40	5-8	-
Alcohol%	2.02±0.17	1.87±0.25	2.14±0.12	1-3	-
Crude protein%	3.83±0.17	3.14±0.17	2.85±0.17	5	-
Fat/Oil%	0.42±0.12	0.43±0.17	0.36±0.12	0-1	-
Specific gravity	1.14±0.58	1.10±0.17	1.06±0.12	1.11-1.14	-
Cu(mg/l)	0.035±0.58	0.202±0.12	0.044±0.29	2.00	1.00
Cr(mg/l)	0.020±0.17	0.078±0.64	0.038±0.16	0.05	-
Fe(mg/l)	1.183±0.23	4.115±0.38	3.543±0.23	0.30	-
Co(mg/l)	0.021±0.29	0.045±0.58	0.025±0.12	0.01	-
Mn(mg/l)	0.069±0.52	0.026±0.12	0.008±0.58	0.10	-
Ni(mg/l)	0.036±0.58	0.046±0.58	0.023±0.12	0.02	-
Zn(mg/l)	3.672±0.57	1.496±0.55	3.432±0.12	-	5.00
As(mg/l)	0.001±0.00	0.025±0.17	0.002±0.12	0.10	0.10
Cd(mg/l)	0.005±0.12	0.002±0.58	0.004±0.00	-	0.01
Pb(mg/l)	0.026±0.17	2.373±0.55	0.049±0.17	0.01	0.02

KEY: Community A = Tudun Wada; **Community B** = Zarazon; **Community C** = Kwang; **SON** = Standard Organisation of Nigeria; **WHO** = World Health Organization; **OIV** = International Organisation for Grapes and Wines

Table 5: Microbial assay of water used in brewing Burukutu

Site	Isolates	Total coliform count/100 ml	Total viable count/ml	WHO cfu/100 ml	Water source
Community A	*E. coli, Staphylococcus aureus*	$12x10^3$	320	1.0x10	Ground water (open well)
Community B	*E. coli, Proteus spp*	$5.3x10^3$	76	1.0x10	Ground water (open well)
Community C	*E. coli, Staphylococcus aureus*	$50x10^3$	1200	1.0x10	Ground water (open well)
Microbial assay of Burukutu					
Site	**Isolates**	**Total coliform count/100 ml**	**Total viable count/ml**	**SON cfu/100 ml**	
Community A	*E. coli, Staphylococcus aureus*	$3.78x10^2$	350	$1.0x10^1$	
Community B	*E. coli, Proteus spp*	$5.46x10^2$	380	$1.0x10^1$	
Community C	*E. coli, Staphylococcus aureus*	$7.44x10^2$	490	$1.0x10^1$	

KEY: Community A = Tudun Wada; **Community B** = Zarazon; **Community C** = Kwang; **SON** = Standard Organisation of Nigeria; **WHO** = World Health Organization

DISCUSSION

Socio-demographic characteristics of the respondents

The results showed that there were more married respondents than unmarried. The finding is corroborated with findings that reported that adult males mainly consume locally made alcohols in social engagements, customs, and traditions (14, 15). The predominantly Christian group who drink Burukutu is suggestive that its consumption was not forbidden by religion, as stated by Dumbili (16). Respondents with high school certificates are more. The finding agrees with that of Crum and colleagues (17). They reported that school dropouts were 6.34 times more likely to develop alcohol abuse or dependence than individuals with a college degree.

Respondents' awareness of local alcoholic beverages

Most respondents know about Burukutu through their friends and the elders in their homes. This is corroborated by Oshodin, who found that most respondents began to drink from their homes (18). Similarly, almost all the respondents have a group of friends who consumed the Burukutu who may influence their drinking habits (16). In addition, more than half of the respondents have had safety concerns with the consumption of Burukutu. Most respondents were not bothered whether the brew was packaged and labelled before consumption. This may be attributable to the high cost of bottled or canned beer and the poor financial status of most people in the urban slums and rural areas (3).

The pattern of consumption of the respondents

Most respondents consume the local alcoholic beverage once a day. The majority have been taking it for between 6 to 15 years. The World Health Organization (19) ranked Nigeria and two other countries in sub-Saharan Africa among the thirty nations with the highest per capita consumption level of alcohol worldwide. However, the reported benefits of taking Burukutu included its nutritional value. The finding is supported by Ezeonu, Nwokwu and Kadiri (20), whose respondents claimed that sorghum used in making Burukutu a richer source of essential nutrients and minerals.

Reported side effects and consequences

Most respondents experienced side effects with the consumption of Burukutu. These side effects have been described as short-term effects which occurs depending on the quantity of Burukutu taken. The finding was contrary to that of Adeyanju and colleagues where they found that most respondents were aware of the long-term health effects of the brew (21). However, only a few among those that were aware knew major health effects.

Risk perception associated with the consumption and production of Burukutu

Most respondents had moderate risk perception. This finding was similar to Obot, who discovered significant variability in the risk perception of the respondents (22). Health behaviour theories agree that a high perceived risk should encourage people to reduce their exposure to the risk (23, 24).

Ventilation, safety and waste management facilities inspection at Burukutu production sites

Findings showed that indoor air pollution associated with inadequate ventilation are common in the study sites. Women are exposed to this during Burukutu production, and some work in crowded rooms with minimal ventilation while using wood fires. Zi-Yi and colleagues reported that reducing exposure to indoor air pollutants through good ventilation may be a preventive measure for lung cancer (25).

Waste management such as solid waste deposits in drainages and animal faeces/dung and straying animals were observed in most Burukutu sites. These are possible routes for contamination of open water sources such as stream water, well water, rivers and dams by microorganisms. Similarly, Jidauna and colleagues reported about 8% of the wells are situated close to the source of dirt/contaminants, and 90% of the well are not with concrete rings, which may be responsible for the biological contamination of the wells. Their study also observed that 90% of the wells contain faecal coliform, which renders the well water unfit for consumption unless adequately treated (26).

Physico-chemical characteristics of the water used in brewing Burukutu

The concentrations of heavy metals found in the various water samples used in producing Burukutu were higher than the WHO permissible limits. The accumulation of these metals may be due to the mining activities in the city over the past years. The level of Iron detected in the groundwater in the three communities were above the National Environmental Standards and Regulations Enforcement Agency (NESREA) permissible limits of 0.3 mg/l. Ozoko also found Iron levels in hand-dug wells, mine ponds, and streams ranged between 0.16 mg/l to 10.27 mg/l (27). This exceeds the WHO limit of 0.010 mg/l. Their high concentrations in the body can affect the brain and nervous system, heart and blood vessels, kidneys, digestive system and reproductive system (28,29).

Proximate analysis and heavy/trace metals concentration of Burukutu

The proximate analysis results showed that all the analysed parameters in the Burukutu samples in the three communities were within the acceptable values of the standards. This is similar to Eze and

colleagues' work on the microbiological and nutritional qualities of Burukutu sold in the mammy market (1). All three communities had elevated Iron, Cobalt and Nickel concentrations in Burukutu above SON and NESREA maximum permissible limits. A similar study conducted in Ghana to determine the mineral profile of a local drink, Pito. Nickel, Lead, Iron and Cadmium measured above the WHO guidelines (30). Gazuwa and colleagues reported that cooking vessels are made from unsuitable metal or metal alloys that easily get corroded by cooking water, thus introducing trace elements such as Iron, Zinc, Copper into the beverage (31).

Microbial assay of water used in brewing the local alcoholic beverage Burukutu

The total coliform count indicates exposure of the water to different genera of bacteria leading to contamination. In addition, since most wells are left open, faecal matter coming from grazing animals and washing human faeces into the wells by rains may be other sources of contamination of the water. The main sources of contamination include humans, sewage, utensils, processing tools and environment, handling and storage conditions and rodents (1).

Microbial assay of the local alcoholic beverage Burukutu

Escherichia coli, *Staphylococcus aureus* and *Proteus species* were isolated from the Burukutu. The high coliform count in the drink reveals how the sample was exposed, attributed to high protein content and probably moisture content (1). Lynn and colleagues isolated some pathogens in Burukutu (3). The gram staining and biochemical tests revealed *Staphylococcus aureus* and Shigella and Salmonella species. Eze et al. found pathogenic microorganisms in the Burukutu as well (1).

CONCLUSION

Burukutu samples were contaminated with various microorganisms and some toxic heavy metals; this resulted from using polluted waters to produce the Burukutu and poor handling practices. This poses a serious health hazard to consumers. Consumers at every point should be informed about the potential hazards involved in the excessive consumption of Burukutu and the risk of taking contaminated alcohol.

CONFLICTS OF INTEREST

The authors declare none.

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