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Assessment of the quality of locally made burukutu and kunu (Sorghum based alcoholic and non - alcoholic) beverage in Anyigba, Kogi State, Nigeria

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Abstract

The research is designed to examine the quality of locally made burukutu and kunu in a university town of Anyigba, Kogi State. Anyigba, a university town was chosen for this study. A total of eight samples (4 each of burukutu and kunu) were collected. The samples were collected randomly from different vendors or sellers at different locations and the samples were analyzed according to the procedure of AOAC. Results revealed that the concentration of Fe was the highest of all the metals determined. The difference in mean concentration of Fe in burukutu and in kunu is statistically significant (p>0.05). Average concentration of Na, Mg, K and Ca in burukutu was 1.30±0.00, 5.8±2.2, 0.52±0.00 and 5.3±2.6 (mg/kg) respectively. Corresponding values of Na, Mg, K and Ca in kunu are 0.31±0.00, 5.3±2.6, 0.02±0.00 and 3.0±2.2 (mg/kg) respectively. The order of concentration of metals in burukutu was Fe>Mg>Ca>Zn>Na>Cu>K. The corresponding trend in kunu was Mg>Fe>Zn>Na>Cu>K. Lead and cadmium were not detected in this study. The mean value of heavy metals in seasoning and spices in this study was also compared with mean values from previous work and regulatory standard limits. The proximate composition of burkutu and kunu analysis shows that the pH was slightly acidic and both contained good percentage carbohydrate content. Burukutu and kunu are nutritious, body building and energy beverages. Current quality does not pose threat to human health.

Keywords: Alcoholic, Non-alcoholic, Beverage, Sorghum, Millet.

Introduction

Cereals have been defined as a grain or edible seed that belong to the grass family *Gramineae* [1]. Cereals are known to be highly nutritious and are referred to as grains. Some cereals have been a source of staple foods both for human consumption and indirectly via livestock feed since the beginning of civilization[2]. Cereals serves as sources of food and such foods are major sources of energy, protein, B vitamins and minerals for the world population[3]. Beverages are liquid foods that provide nutrient and nourishes the body[4]. Like cereals, they also provide energy for human. In Nigeria, there are different types of local alcoholic and non –alcoholic beverage.

Burukutu a known local alcoholic beverage is continuously being produced and consumed in some West African countries like Nigeria, Republic of Benin and Ghana. The flavor is like vinegar, a suspension that is brownish in colour. In most cases it is produced from the grains of guinea corn mainly the species of *Sorghum vulgare* and *Sorghum bicolor* [5]. Burukuru has a short life of 1 – 8 days. The short life span may be due to low lactic acid content, low titratable acidity, low alcohol content, high concentration of vitamins, fermentable sugars and the presence of lipoxidation product[6].

Kunu has been reported to be a non – alcoholic beverage produce from cereals[7]. This beverage is taken by people that have phobia for alcohol or better still by those for religion reasons avoid alcohol consumption. Unlike burukutu, kunu is sometimes given to children. It is local beverage that is consumed in Nigeria and is very popupalar in the northern part of the country. It is known for its thirst quenching properties[8] and this probably account for increase in rate of consumption in dry season[8,9]. It is often produced from grains such as millet (*Pennisetum typhoduim),* sorghum (*Sorghum vulgare*), maize (*Zea mays*), rice (*Oreza sativa*) and acha (*Dijitap exilis*)[10,11].

During the production process of burukutu and kunu, additives are always added to spice and add flavor to improve the taste. These include ginger, black pepper, garlic and red pepper. Sugar is also added as a sweetener. In some cases honey is added as a sweetener with little quantity of sweet potatoes. The quality assurance during the production process could be of concern. The packaging is also of concern. This concern stern from the fact that there have been reported cases of deaths resulting from the consumption of locally made alcoholic and non-alcoholic drinks. At least 60 people were reported to have died in Tripoli, Libya after drinking locally made alcohol and 709 other cases of alcohol poisoning. This has so far not been reported in Kogi State, Nigeria. There is need therefore to monitor the quality of locally made alcoholic beverages and to report to relevant government agencies of any health risk that may arise from the quality of such beverages. In view of the reported cases of death resulting from the consumption of locally made alcoholic and

non-alcoholic drinks, there is need therefore to monitor continuously their quality. This research is designed to examine the quality of locally made burukutu and kunu in a university town of Anyigba, Kogi State. The level of some metals that may be present.

Materials and methods

Sampling and sample preparation: Anyigba, a university town was chosen for this study. A total of eight samples (4 each of burukutu and kunu) were collected. The samples were collected randomly from different vendors or sellers at different locations within the town. The samples are labeled A, B, C and D on each beverage and immediately kept in ice-chest container. Samples were transported to the laboratory and stored in the refrigerator prior to analysis. In the laboratory the pH, titratable acidity was determined using the method that has been described by Karl *et al.*[12]. Samples were also analyzed for total dissolved solid, crude protein, fat content, fibre content, ash content, moisture content, carbohydrate content and vitamin C content according to the procedure of AOAC[13]. Elemental metals were extracted by a tri acid mixture of concentrated H_2SO_4:HNO_3:$HCLO_4$.

pH Determination: A 25 ml each of (burukutu and kunu) sample was mixed separately with 100 ml of distilled water in a 500 ml beaker and was shaken to mix properly. This was allowed to stand for 15 minutes and then filtered. The filtrate was used for pH determination using pH meter (Hanna HI 96107 model) calibrated with buffer 4 and 7 solutions.

Ash Content Determination: A 2.0 g each of the (burukutu and kunu) samples was weighed into separate previously ignited, cooled and weighed crucible. To eliminate fumes, the samples were pre-ashed on a hot plate and then transferred into a muffle furnace (LMF4 from Carbolite, Bamford, Sheffield England) at 580^0C for 4 hours until it turned white. The sample was then removed from the furnace, cooled in a desiccator and re-weighed. The weight of the ash was then calculated:

$$Percentageash = \frac{Weight\ of\ ash}{Weight\ of\ original\ sample} \times 100 \ldots\ldots AOAC^{13}$$

Determination of Moisture Content: A 2.0 g each of the (burukut and kunu) sample was weighed into a separate clean dried pre-weighed crucible. Each of the samples was placed in an oven for 3 hours at 105°C. The dried samples was cooled in desiccators and reweighed. The process was repeated until constant weight was obtained. The loss in weight was calculated as the moisture content.

$$Percentage\ moisture = \frac{W_2 - W_1}{W_2 - W_3} \times 100 \quad \ldots\ldots\ldots\ AOAC^{13}$$

Where: W_1 = Initial weight of empty dish, W_2 = Weight of dish + undried sample, W_3 = Weight of dish + dried sample.

Determination of Titratable Acidity: A 25 ml of each of the samples was made up to 100 ml with distilled water in a conical flask and placed in a water bath for 60 minutes at a temperature of 50°C and the mixture was filtered and 25 ml portions were measured and titrated with 0.1 M NaOH until pH 7.0 using phenolphthalein as indicator. Titration results were calculated in terms of malic acid.

Determination of Crude Protein: The micro kjeldahl method as outlined by AOAC[13] was used. A 2.0 grams of each of the samples was mixed with 10 ml of concentrated tetraoxosulphate (vi) acid in a heating tube. Selenium added as a catalyst and mixture heated inside a fume cupboard. The digest was transferred into distilled water. A 10 millimeter of the digest was mixed with equal volume of 60% NaOH solution and transferred quantitatively into a Kjeldahl distillation apparatus. The mixture was distilled and the distillate collected into 4% boric acid solution to which was added 2 drops of methyl red indicator. This was titrated with 0.01 M hydrochloric acid. The nitrogen content was calculated and multiplied with 6.25 to obtain the crude protein content.

$$Percent\ Nitrogen\ \frac{(100 \times N \times 14\ VF)\ T}{100 \times Va} \ldots\ldots\ldots\ldots\ldots AOAC^{13}$$

Where: N= Normality of the titrate (0.1M), VF= Total volume of the digest= 100ml, T= Titre Value, Va= Aliquot Volume distilled.

Determination of Fat Content: A 2.0g of the sample was weighed into a thimble and inserted into an extraction tube. A boiling clean round bottom flask, which has been cleaned, dried and weighed as W_2 was filled with 100ml of petroleum ether and fitted to the apparatus. The sample was heated under reflux for about 6 hours. Thimble was removed with care and the clean colourless fat-free solvent in the flask was drain into another container. The remaining fat solvent content was subjected to evaporation, leaving only the fat extract in the flask and was re-weighed as W_2. The percentage crude fat was then calculated as difference in weight as follows:

$$Crudefat = \frac{W_1 - W_0}{W_2} \times 100$$

Where: W_0= weight of the empty extraction flask, W_2= weight of the flask and fat extracted, W_2= weight of the sample.

Determination of Fibre Content: A 2.0g of sample and 1.0g of asbestos were put into 200ml of 1.25% of H_2S0_4 and boiled for 30 minutes. The matrix was poured into Buchner funnel equipped with linen cloth and secured with elastic band. It was filtered and residue transferred into a beaker containing 200ml boiled NaOH. The boiling continued for 30 minutes, transferred to the buchner funnel and filtered. The residue was washed twice with alcohol, and then with petroleum ether thrice. The

residue was put in a clean dry crucible and dried to a constant weight using a moisture extraction oven. The dried crucible was removed, cooled and weighed. The difference of weight (loss in ignition) is recorded as crude fibre and expressed in percentage crude fibre.

$$Crude\ fibre = \frac{W_1 - W_0}{W_2} \times 100$$

Where: W_0 = weight of sample before incineration, W_1 = weight of sample after incineration, W_2 = weight of original sample.

Carbohydrate content determination: The nitrogen free method[13] was used. The carbohydrate is calculated as weight by difference between 100 and the summation of other proximate parameters as Nitrogen free Extract (NFE) percentage carbohydrate.

$(NFE) = 100 - (m + p + F_1 + A + F_2)$

Where: m = moisture, p = protein, F_1 = Fat, A = ash, F_2 = Crude fibre.

Elemental Analysis: A 5.0g each of (burukutu and kunu) product was weighed into a conical flask containing 5 ml of concentrated tetraoxosulphate (VI) acid, 10 ml of trioxonitrate (v) acid and 10 ml of hydrochloric acid and boiled on a hot plate until the solution was cleared. The digest was allowed to cooled, filtered into a standard flask and made up to mark with distilled water. Metal contents of K, Na and Ca were determined using flam photometer. Other metals Cd, Pb, Fe, Zn, Cu, and Mg were determined using Atomic Absorption Spectrophotometer (ASS-Buck 210 VGP Model).

Quality Assurance: Appropriate quality assurance procedures and precautions were carried out to ensure reliability of the results. Samples were generally carefully handled to avoid contamination. Glassware was properly cleaned, and the reagents were of analytical grade. Double distilled deionised water was used throughout the study. Reagents blank determinations were used to correct the instrument readings. Stock standard solutions for the atomic absorption analyses were prepared from Analar R grade salts. Working standards were made from the stock by dilution of measured aliquots. The statistical analysis of the data was carried out with the aid of the General Linear Models statistical package, using appropriate tool, such as the Analysis of Variance, confidence level was held at 95% and P>0.05 was considered not significant.

Results and discussion

Proximate Composition: The proximate composition of burkutu and kunu are shown in Table-1. The average burukutu and kunu pH values were 4.30±0.02 and 6.09± 0.07 respectively. The pH of burukutu ranged from 4.28 to 4.32 while that of kunu ranged from 6.02 to 6.12. Results indicated that all pH values were acidic. Burukutu samples had lower pH compared to kunu. The range of pH of this analysis compared well with range of 4.00 to 4.30 earlier reported by Ofudje *et al*. in Ogun State[14] and 5.25 to 5.65 reported in another research work[15]. Reports had it that the acidity of burukutu and kunu drinks may be as a result of added species and the activity of some bacteria such as *Lactobacillum, Acidophillus*, *Candida* species and *Saccharomyces cerevisiae* which aid acid fermentation of the products and essential to human being[16, 17, 18]. Report also had it that low pH will prevent the growth of pathogenic microorganisms[19]. The observed percentage moisture content of burukutu average 87.0% while kunu had average value of 85.1%. The range of values observed for brukutu was similar to that of kunu. The percentage ash content of burukutu and kunu were 0.05% and 0.02% respectively. The range of values for burukutu (0.04% to 0.06%) and kunu (0.0%2 to 0.03%) were lower than range of 1.60% to 2.00% and 1.48% to 1.78% reported by Ofudje *et al*.[14]. This study values were also lower than 1.00% to 2.00% obtained previously[15]. The average titratable acidity of burukutu was 0.19 ± 0.01% and that of kunu was 0.15 ± 0.01%. These values were lower than 1.55 ± 0.01% reported for burukutu[20,21]. The low value has been reportd to account for the short life span. Total dissolved solid result for burukutu ranged from 11.3% to 12.0% while kunu ranged from 13.4% to 14.6% with mean values of 12.4 ± 0.92% and 14.1 ± 0.53% respectively. The result of analysis shows that percentage protein of burukutu ranged from 1.01% to 1.23% with a mean value of 1.1±1.2%.

Table-1: Physicochemical parameter of burukutu and Kunu.

Parameter	Burukutu		Kunu	
	Range	Mean	Range	Mean
pH	4.28-4.32	4.30±0.02	6.02-6.12	6.09±0.07
Titratable acidity (%)	0.17-0.02	0.19±0.01	0.13-0.16	0.15±0.01
TDS (%)	11.3-12.0	12.4±0.92	13.4-14.6	14.1±0.53
Ash (%)	0.04-0.06	0.05±0.01	0.02-0.03	0.02±0.01
Moisture (%)	86.1-88.1	87.0±0.98	84.6-86.1	85.1±0.56
Crude protein (%)	1.01-1.23	1.13±1.2	0.70-0.96	0.83±0.11
Crude fat (%)	0.10-0.14	0.13±0.02	0.10-0.12	0.11±0.01
Crude fibre (%)	0.04-0.06	0.05±0.01	0.01-0.01	0.01±0.00
Carbohydrate (%)	10.5-12.7	11.7±1.1	13.0-14.5	13.9±0.65

Corresponding value for kunu were lower than burukutu values. The values ranged from 0.70% to 0.96% and a mean value of

0.83±0.11%. Similar mean value (0.98±0.02% and 0.67±0.05%) had been reported in hawked kunu in Port Harcourt River State by Essien *et al*.[22]. It has been reported that proteins in cereals are in the testa and germ and in the cause of processing, these components are sieved off and this probably account for the low protein content[23,22]. The ranges of percentage proteins obtained in this research are lower than the range of values of 2.69% to 3.25% obtained in Kaduna[19]. The level of proteins depends on the cereals from which it was prepared. Records showed that those prepared with guinea corn are of higher protein content compared to those prepared with millet or maize. This probably account for higher protein content in brukutu than kunu in this research work. From the questionnaire carried out, vendors submitted to the use of guinea corn in the preparation of burukutu while kunu was prepared with millet. The mean crude fibre content of burukutu and kunu were 0.05±0.01 and 0.01±0.00 respectively. Thus burukutu is of higher fibre content than kunu and consequently more energetic beverage than kunu. High value of crude fibre content of burukutu has been reported to arise from continuous utilization of the reducing sugar and extractable fat[24]. Percentage crude fat of burukutu ranged from 0.10% to 0.14%. Similar value was recorded for kunu. The mean values of 0.13 ± 0.02% and 0.11 ± 0.01% for burukutu and kunu was observed respectively. The result of the mean value of Kunu of this study is significantly lower than reported value of 13.7±6.9% of Kunun aya in Kaduna[19]. Carbohydrate content ranged from 10.45% to 12.67% for burukutu with mean value of 11.7 ± 1.1%. Corresponding kunu value ranged from 13.01% to 14.47% mean value of 13.92 ± 0.65%. The mean values of 11.7 ± 1.1% and 13.92 ± 0.65% for burukutu and kunu of this study are significantly higher than the mean value of 7.52±0.19% for kunu-zaki reported in Uyo, Akwa Ibom State[25].

Elemental Content Analysis: The results for the mineral element of burukutu and kunu are shown in Figure-2 and Figure-3 respectively. The observed results showed that Ca, Fe and Mg were dominantly present compared to the other elements. The concentration of Fe in burukutu in all samples ranged from 10.0 mg/L to13.0 mg/L with a mean value of 11.5±3.6 mg/L while kunu ranged from 2.00 mg/L to 6.00 mg/L with a mean value of 4.00±1.80 mg/kg.

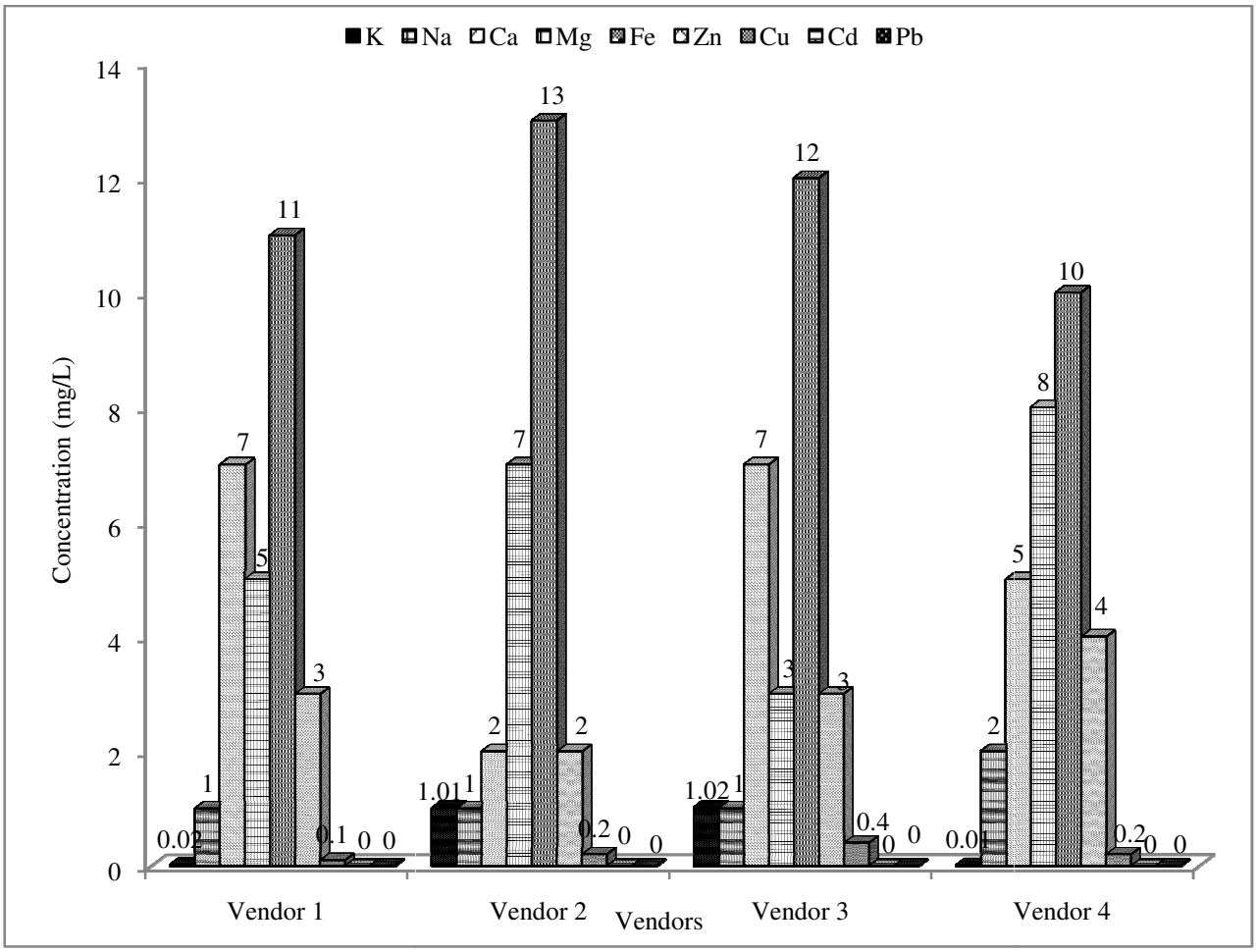

Figure-2: Average level of some heavy metals in burukutu.

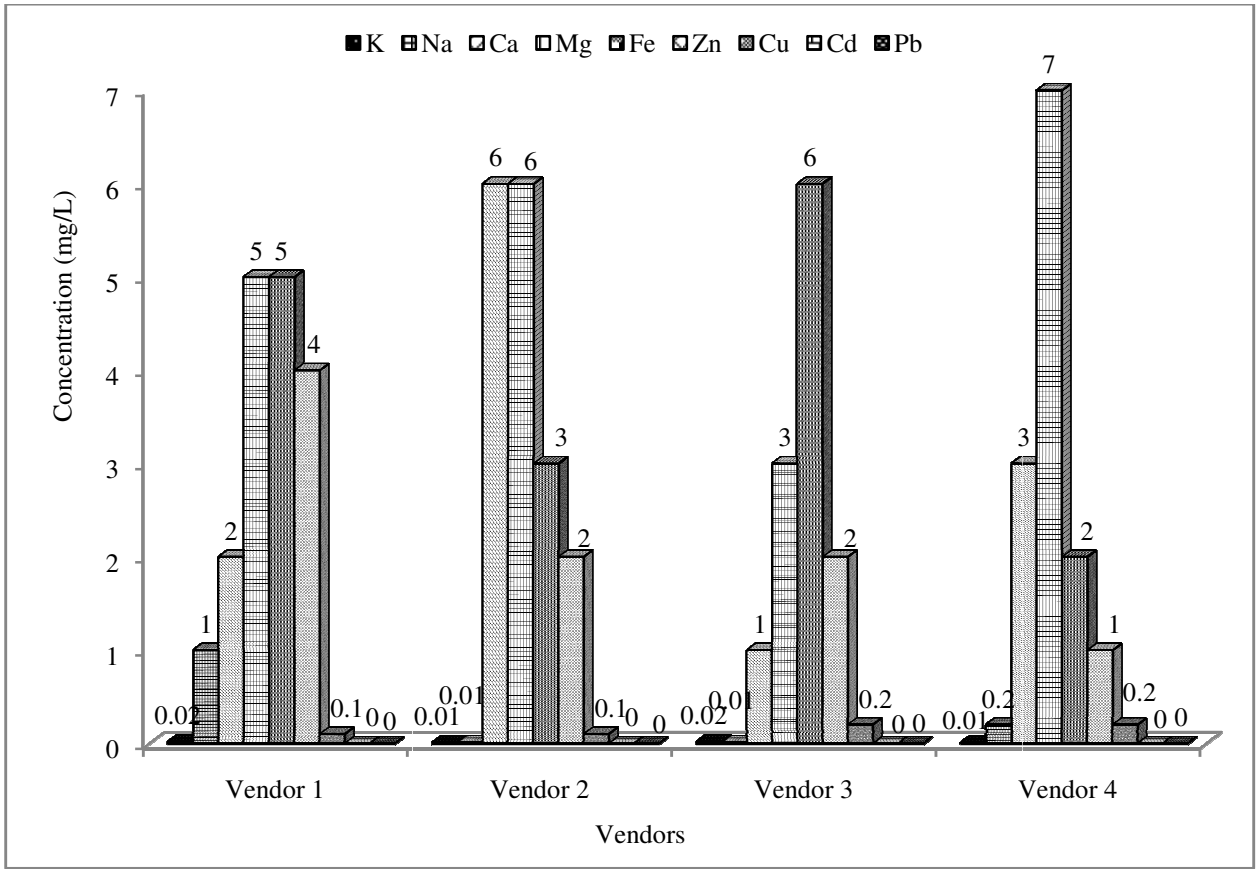

Figure-3: Average level of some metals in kunu.

The difference between average value of Fe in burukutu and Kunu is statistically significant ($p>0.05$). The concentration of Fe was the highest of all the metals determined. Fe plays a vital role in the formation of haemoglobin, oxygen and electron transport in human body[26]. The order of concentration of metals in burukutu was Fe> Mg>Ca>Zn>Na>Cu>K. The trend in kunu is Mg>Fe>Zn>Na>Cu>K. Iron and calcium had similar concentration. The concentration of Mg was highest in kunu with a value of 7.00 mg/kg with vendor 4. Vendor 2 had similar concentration (6.00mg/kg) for Ca and Mg. Average concentration of Na, Mg, K and Ca in burukutu was 1.30±0.00, 5.8±2.2, 0.52±0.00 and 5.3±2.6 (mg/kg) respectively. Corresponding values of Na, Mg, K and Ca in kunu are 0.31±0.00, 5.3±2.6, 0.02±0.00 and 3.0±2.2 (mg/kg) respectively. The value of Fe, Mg and Ca makes burukutu and kunu a good source of these mineral elements when consumed. Minerals are essentials for human health as they play important role in cellular function. It has been reported that minerals are vital for normal growth, maintenance, effective immune system and prevention of cell damage[27]. Further functions of mineral elements include growth and production of bones, blood, hair, teeth, hormones, energy production, muscular protection and blood circulation[27]. The level of Cu and Zn as trace element in burukutu and kunu also makes the products satisfying. Copper plays a very important role in our metabolism largely because it allows many critical enzymes to function properly. A deficiency of Cu in diet for prolonged period especially during stages of active growth leads to anemia, growth retardation, defective keratinization and pigmentation of hair, hypothermia, mental retardation, changes in skeletal system, and degenerative changes in aortic elastin. Zinc is a critical micronutrient whose impact on human health is being increasingly appreciated and its deficiency may play a key role in the appearance of diseases[28]. Zinc deficiency affects health in all age groups. In children it causes an increase in infections and diarrhea. Zinc deficiency has been indicated as a risk factor for immune deficiency and susceptibility to infections in the elderly especially pneumonia[29, 30]. In this study heavy metals such as Cd and Pb were not detected in burukutu and kunu samples. Therefore the burukutu and kunu can be taken as refreshing drinks without any fear of health hazard that could arsie if these metals were to be present. The result of this study indicated that all the elements determined are within FAO/WHO permissible limit in fruit drinks.

Conclusion

The study revealed that burukutu contains slightly more food nutrients than kunu. However, kunu has a higher carbohydrate percentage than burukutu. Burukutu and kunu are nutritious, body building and energy beverages.

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