



Level of Some Mineral Elements in Zobo (*Hibiscus sabdariffa*) Drink Consumed within Gombe Metropolis

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Authors' contributions

This work was carried out in collaboration among all authors. Author SMU designed the study and wrote the first draft of the manuscript. Author FUM helped in sample collection and laboratory analysis and author JJI did the statistical analysis and report documentation. Author JS managed the literature searches and some of the lab analysis. All authors read and approved the final manuscript.

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ABSTRACT

The study was conducted to determine the levels of magnesium, phosphorus, potassium and calcium present in Zobo Drink consumed in Gombe metropolis. Zobo (*Hibiscus sabdariffa*) drink has been consumed for decades as a non-alcoholic beverage, thus, the knowledge of its nutritional value is of huge interest. Hence, it is important to determine the level of some minerals present in the beverage. Ten samples were bought from different retailers within Gombe metropolis and were digested using Aqua regia (1:3 of HNO₃ and HCL) in the laboratory and the levels of the various elements in each sample were determined using Atomic Absorption Spectroscopy (AAS). The results obtained showed that the sample from Gombe State University commercial area 1 has the highest (P<0.05) magnesium content (9.38±0.02 mg/kg). Calcium (2.90±0.02 mg/kg) and Phosphorus (9.11±0.02 mg/kg) were found to be highest in samples obtained from Arawa market and Gombe State University commercial area 2 respectively. Potassium was (14.45±0.05 mg/kg) was highest in the beverage gotten from Gombe State University commercial area 2. The results

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showed that Zobo drink sold in Gombe metropolis possess some amount of the assayed minerals but are lower than the Regular Dietary Intake (RDI) permissible by the World Health Organisation.

Keywords: Mineral; beverage; potassium; *Hibiscus sabdariffa*; calcium.

1. INTRODUCTION

Most of the African communities are known with one type of local food/drink or the other, such as Danwake, Zobo drink, Kunun zaki, Ginger drink among others. Zobo being one of the most popular locally prepared drink is a non-alcoholic and nutritional local drink made from different varieties of dried petals, acid-succulent calyces of the flower *Hibiscus sabdariffa* by boiling and filtration [1] [2]. One interesting fact about Zobo drink is that it is consumed by different class of people irrespective of their socio economic status, sex and age in Nigeria especially in the Northern region and other neighboring African countries [3]. Even though there are many varieties of Hibiscus such as Tropical hibiscus, Hardy shrub Hibiscus, hardy Perennial, Sabdariffa etc, available, but the Sabdariffa variety is the one used for Zobo drink usually because of its nice flavor. According to [4,5], the most active ingredient used in the production of Zobo drink is *Hibiscus sabdariffa*, which belongs to the *Malvaceae* family. *H. sabdariffa* are mainly cultivated as vegetables for soup preparations, folk medicine and tea preparations.

Hibiscus sabdariffa grows very well on sandy-loam soil, most preferably with a tested acidic pH of 5.5 to 6.5 and it is planted either through seed broadcast or stem propagation. *Hibiscus sabdariffa* is found in several tropical and subtropical countries of the World especially in India and Africa [6]. In Nigeria, it is mainly found in the Middle belt and North eastern region [7]. However, two types of *Hibiscus sabdariffa* are found in Nigeria including red/brown and green [8]. The green type is found in Southern guinea savanna while the brown type is prevalent in the Northern Guinea and Sudan savanna [8]. The calyces of the red variety have gained wide acceptance as a medicinal herb and a raw material used for the production of Zobo drink, while the calyces of the green variety are used to cook soup, stew and sauces [9] in the West African sub-region as it is being consumed by several millions of people from different socio-economic classes and background, especially amongst youth, who sees Zobo drink as an alternative source of cheap and relaxing non-alcoholic drink in social gathering [10].

This popular drink is known differently in different areas and serve for different purposes depending on the area of usage and is also prepared for commercial purpose. It is called Zobo, Yakuwa or Zoborodo (in Hausa), Iseipa (in Yoruba) and Sorrel in English [11]. However, based on the name of this useful drink in different languages, the popular name used in Nigeria is the Hausa name [12]. Zobo has gained prominence in several parts of the country and are sold in public places. Zobo is one of the nutritional drinks that are served during festivals and in a number of other ceremonies [13] in different parts of Nigeria.

Minerals are inorganic substances, present in all tissue and fluids and their presence is necessary for the maintenance of certain physicochemical processes which are essential to life. Minerals are chemical constituent used by the body in many ways. Although they yield no energy, they have important roles to play in many activities in the body [14]. Every form of living matters requires these organic element or minerals for their normal life processes [15]. Mineral may be broadly classified as macro (major) or Micro (trace) elements. The third category is the ultra-trace elements. The macro-minerals include calcium, phosphorus, sodium and chlorine, while the micro-elements include iron, copper, cobalt, potassium, magnesium, iodine, zinc, manganese, molybdenum, fluoride, chromium and sulphur [14].

The macro minerals are required in amounts greater than 100mg/dl and the micro minerals are required in amount less than 100mg/dl. The ultra-trace elements include boron, silicon, arsenic and nickel which have been found in animals and are believed to be essential for these animals. Evidence for requirements and essentialness of others like cadmium, lead, tin, lithium and vanadium is weak [16].

The proximate analysis carried out on the *H. sabdariffa* calyx revealed that it has appreciable ash content (12.24g/100g) [9]. These locally prepared drinks contain certain amount of mineral elements, and which their content in those local prepared foods or drinks are not

accurately determined and measured in proportion to the level required by the body system. This, coupled with the increasing level of consumption of the drink made from it necessitated this study. Thus, this research work focused on detecting the presence and amounts of some minerals present in Zobo drink.

2. MATERIALS AND METHODS

2.1 Materials

Zobo drink samples were purchased from different retail outlets in Gombe metropolis. Five (5) samples were purchased from different retailers in Gombe State University campus and five (5) from Kasuwan Mata, Tashan Dukka, Arawa, Tunfure and Fantami respectively. The materials, equipment and reagents used for this work includes: Kjeldahl flask, Atomic absorption spectroscopy (model: Buck Scientific 205), Glass wares: such as Funnels, beakers, conical flask, measuring cylinder (pyrex glasses company: VMR, U.S.A), Whatman's Filter paper (pyrex glasses company: VMR, USA), Sample bottles, Hydrochloric acid (Kermel India), Nitric acids (qualities fine chemicals pvt. Ltd India) and De-ionized water.

2.2 Methods

Each sample was digested as reported by [17]. 75ml of the sample was weight into separate Kjeldahl flask and treated with 25cm of Aqua regia (Nitric acid with HCL in a ratio 1:3) and digested on a Kjeldahl electric hot plate. And the acid was continuously added until the colour changes to pale-yellow. The content of the flask was allowed to cool, filtered through Whatman filter paper into a volumetric flask and made up to volume of 20cm with de-ionized water. The digests were analyzed for the mineral content using Atomic Absorption Spectrophotometer (Buck scientific model 205).

ANOVA statistical analysis was adopted for analysis.

3. RESULTS AND DISCUSSION

3.1 Results

The result from Table 1 showed that there was significant difference ($P < 0.05$) among all the samples for each of the elements assayed. The sample from GSU commercial area 2 displayed

the highest potassium content (14.45 ± 0.05 mg/dl) and that from Kasuwan Mata had the lowest calcium content (1.02 ± 0.05 mg/dl). The magnesium content of 9.38 ± 0.02 mg/dl obtained from the sample gotten from GSU commercial area 1 was highest and the least magnesium content (7.42 ± 0.02 mg/dl) was found in the sample from Kasuwan mata. The sample form GSU commercial area 2 showed the highest phosphorus content (9.11 ± 0.02 mg/dl) whereas the one from Girls hostel showed the least (2.79 ± 0.02 mg/dl).

3.2 Discussion

Minerals are chemical elements required as essential nutrients by organisms to perform functions necessary for life [14]. Since they are essential and have to be ingested as the body cannot synthesize them. Serving as a cofactor for many enzymes catalyzing important biological reactions, magnesium level in this study was lower than the RDI (130-340mg/dl) in all the samples analysed. The sample from GSU commercial area 1 showed the highest magnesium content (9.38 ± 0.02 mg/dl) which is significantly higher ($P \leq 0.05$) than 7.42 ± 0.02 mg/dl obtained in the Zobo drink from Kasuwan mata. The result for magnesium is lower than those obtained for spiced (with ginger and garlic) Zobo drink [4]. This suggests that the addition of spices might have effect on the level of some mineral.

The calcium levels in all the samples were lower than the RDI (700-1300mg/dl). This showed that Zobo drink is not a good source of calcium, therefore alternative sources are needed while taking the drink. The level of calcium in the calyces of *H. sabdariffa* was found to be higher than when the calyces are processed into Zobo drink [9]. This showed that processing the drink might have a role to play in the level of minerals. Calcium is especially needed for stronger skeleton amongst other function.

Phosphorus plays a vital role in the bones, blood vessels, muscles, cell membrane and nucleic acids. The RDI of phosphorus (460-1250 mg/dl) is significantly higher than those obtained in this study and the one carried out on fortified Zobo drink [18]. The amount of phosphorus obtained from the sample in girls hostel of GSU (2.79 ± 0.02 mg/dl) was significantly lower ($P \leq 0.05$) than the 9.11 ± 0.02 mg/dl gotten from the sample from GSU commercial area 2.

Table 1. Elemental analysis of Zobo drink sold within Gombe Metropolis

Samples	Magnesium(mg/dl)	Parameters phosphorus (mg/dl)	Potassium (mg/dl)	Calcium (mg/dl)
Arawa market	8.84 ± 0.01 ^a	3.60±0.01 ^a	13.63±0.03 ^a	2.90±0.02 ^a
Mallamina	8.19±0.04 ^b	3.87±0.03 ^b	12.62±0.02 ^b	2.58±0.03 ^b
Commercial (Halima)	7.80±0.02 ^c	4.64±0.03 ^c	12.18±0.02 ^c	1.50±0.02 ^c
Annex	8.37±0.01 ^d	3.19±0.03 ^d	12.98±0.02 ^d	1.81±0.02 ^d
Jekadafari	8.17±0.04 ^e	3.34±0.03 ^e	12.65±0.02 ^e	1.12±0.02 ^e
Kasuwanmata	7.42±0.02 ^f	7.09±0.02 ^f	11.61±0.02 ^f	1.02±0.05 ^f
GSU comm.	9.38±0.02 ^g	3.33±0.02 ^g	11.47±0.02 ^g	2.31±0.03 ^g
Area 1				
GSU Comm.	9.29±0.04 ^h	9.11±0.02 ^h	14.45±0.05 ^h	2.07±0.04 ^h
Area 2				
Pantami	8.63±0.04 ⁱ	3.08±0.03 ⁱ	13.31±0.02 ⁱ	2.67±0.02 ⁱ
Girls hostel(R)	8.55±0.02 ^j	2.79±0.02 ^j	13.23±0.03 ^j	2.19±0.03 ^j

Values are presented as Mean ± SEM, n =5. Values in the same column with different superscript are significantly different (P=0.05)

The major intracellular cation that regulates body fluids balance is potassium [19]. The level of potassium in all the samples in this study was lower than the RDI (2000-3400mg/dl) and the one obtained in wine red Zobo (235mg/dl) [20]. The process of preparing the drink might be the reason for the low level of potassium as analysis on the calyces of *H. sabdariffa* gave a higher value (49.35mg/dl) as reported by [9].

4. CONCLUSION

The result from this study suggests that Zobo drink is not solely a good source of the assayed minerals but can be taken together with other mineral sources in food.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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