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COMPARATIVE PROXIMATE AND ELEMENTAL ANALYSIS OF TIGERNUT (*CYPERUS ESCULENTUS)* AND MILLET (*PENNISETUM GLAUCUM*) AS ACTIVE INGREDIENTS IN SOME LOCAL BEVERAGES

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Abstract

The need for food to feed the ever increasing population cannot be overemphasized. The challenges are getting highly nutritive food for individuals of different ages in order to meet their demands. In the developing world where under and malnutrition have always being the concern, there is need to determine the nutritive value of the indigenous crops. By doing the former, efforts may then be focused on the use of these crops and supplementation by others to meet the nutritional requirements. This study focused on two different crops; millet and tigernut which are major ingredients of local beverages in the Northern part of Nigeria. They are used separately to make the drinks, often millet and tigernut are used together to make a single drink. Therefore, analysis of the proximate and elemental compositions of millet and tigernut were carried out to provide data on the nutritional values of thelocal beverages. The moisture content, crude fibre, crude fat, crude protein, ash content and carbohydrate of 4.69% and 3.41%, 13.15%, and 6.98%, 27.2%,4 and 29.46% 8.71%, and 25.9%, 1.01%, and 2.09%, and 44.9%, and 28.2% respectively were found for millet and tigernut. Tigernut was found to have higher protein content compared to millet, in contrast millet has higher crude fibre and carbohydrate contents. The mineral composition revealed the presence of sodium,potassium, calcium, magnesium, phosphorous, iron, chromium, and copper in both millet and tigernut, similarly little amount of zinc was detected in millet but absent in tigernut.

Keywords: *Proximate, Elemental, Cyperus esculentus and Pennisetum glaucum*

Introduction

The current global economic meltdown has partly resulted in an upsurge in the number of well-informed consumers who put into consideration the health and nutritional benefits of food products they consume. Provision of adequate and sufficient nutrition is of paramount importance especially in the developing nations (FAO, 2013). Thus to ensure provision of proper and adequate nutrition to such populations, exploitation of underutilised food varieties is crucial (Enujiugha and Agbede 2000). The use of underutilised local food varieties such as millet, maize, corn and cassava as a way of enhancing food security and adequate nutrition especially in developing countries has been suggested (James et al., 2015).

Tigernut (Cyperus esculentus) is a tuber crop that belongs to the family Cyperaceae, which is cultivated throughout the world and is widely found in the northern parts of Nigeria. In Nigeria, it is commonly known as "Aya" in Hausa, "Ofio" in Yoruba and "Akiausa" in Igbo where three varieties (black, brown and yellow) are cultivated (Oladele and Aina 2007). It has been found to contain appreciable quantities of the fatty acids; myristic acid, oleic acid, linoleic acid (Eteshola & Oraedu, 1996; Ezeh *et al.,* 2014). Tigernut have been reported as helping in the prevention of heart attacks and thrombosis by enhancing blood circulation. In addition, Tigernut are believed to assist in reducing the risk of colon cancer (Anonymous, 2005). Tigernut are rich in energy content (starch, fat, sugars and protein), mineral (phosphorus, potassium) and vitamins E and C (Anonymous, 2005; Manek *et al.,* 2012). Tigernut was reported to be rich in sucrose (17.4 to 20.0%), fat (25.5%), protein (8%) (Kordylas, 1990). The nut is also very rich in mineral content (sodium, calcium, potassium, magnesium, zinc and traces of copper (Omode *et al.,* 1995). According to Umerie & Enebeli (1997), tigernut is valued for its high dietary fibre content. Dietary fibre plays an important role in the human health because of the prevention, reduction and treatment of some disease such as diverticular disease, colorectal cancer, diabetes, obesity or cardiovascular disease (Escudero & Gonza´ lez, 2006). However, tigernut is toxicologically safe for human consumption, and products such as starch, ice cream, milk and kunu (a non-alcoholic beverage consumed in Nigeria) have been prepared using Tigernut seed (Umerie & Obi, 1997; Onovo & Ogaraku, 2007; Belewu & Abodurin, 2008).

Millets are group of highly variable small seeded grasses, widely grown across the world as cereal crops or grains for fodder and human food. Millets are important crops in the Semi-arid tropics of Asia and Africa (especially in India, Nigeria and Niger), with 97% of millet production in developing countries. The crop is favoured due to its productivity and short growing season under dry, high temperature conditions for bird seed and livestock fodder in Western Europe and North America. Millets have multiple benefits, their low glycaemic index helps manage glucose level and prevent diabetes. Millets is more than an interesting alternative to the more common grains, it is good source for some of the very important nutrients including carbohydrates, essential amino acids, phytochemicals, vitamins and micronutrients such as copper, manganese, phosphorus, and magnesium (McDonough et al; 2000; Sale et al. 2010; Mal et al., 2010; Singh et al 2012 and James et al., 2015).The health benefits of millets are heart protective properties, development and repair of body tissue, helps prevent gallstones and protective against breast cancer (Badifu *et al.,* 1999).

Kunu is a non-alcoholic beverage prepared mainly from cereals (millet, sorghum among others). It has low viscosity, with sweet sour taste and milky cream appearance. It is a thirst quencher or serves as refreshment in some communities. It is also used as weaning drinks for infants (Sowonola *et al.*,2005). To enrich the nutritional, taste and other organoleptic qualities of *kunu* prepared from cereals, tigernut is locally added, a type of drink (*Kunu*) is made with tigernut as the major ingredients excluding the cereals.

Materials and Method

Sample Source and Preparation

Fresh Tiger nuts and Millets were purchased from the local traders in Keffi market in Keffi, Nasarawa State, Nigeria. The chemicals and equipment used were of analytical grade.These nuts and seeds were sorted; foreign materials, stones, bad/cracked nuts and seeds which may affect the taste and keeping quality of the drink were removed, washed and rinsed with portable water and used to produce milk.

Proximate Analysis

The chemical analysis which include ash content, moisture content, crude fibre, crude protein, mineral content, and protein content were carried out using standard methods of AOAC, (2010). Carbohydrate was determined by difference. Fat was determined by the method described by James (1995).

Moisture content was determined by oven drying method. 2 g of well-mixed sample was accurately weighed into a clean dried crucible and placed in the oven at 100 -105°C until a constant weight was obtained.

Crude fibre was determined by weighing 2 g of sample into crucible dish, 150 ml of 0.1M H_2SO_4 was added, heated and boiled. The mixture was filtered hot and rinsed with distilled water three times to ensure complete removal of acid from the residue. The residue was dried in an oven at 150°C for 1hr, cooled in desiccator and weighed (W1). The residue was ashed in muffle furnace at 550°C for 3 - 4 hrs. The samples were cooled in desiccator and weighed again (W2), the difference in weights gave the crude fibre.

Ash content was done by first weighing the crucible dish (W1), 1 g of the sample was weighed into the crucible (W2). The sample was ignited over a burner with the help of blowpipe, until it is charred. Then the crucible was placed in muffle furnace at 550°C for 4 hrs. The appearance of grey white ash indicates complete oxidation of all organic matter in the sample. After ashing, furnace was switch off. The crucible was cooled and weighed (W3).

% Ash =(Difference in W3-W1÷ Wt of sample) x 100

Crude protein determination; 2g of the sample was placed in digestion flask and 10 ml of concentrated H_2SO_4 along with 8 g of digestion mixture (K_2SO_4 and $CuSO_4$, 8:1) were added and mixed together by swirling in order to maintain homogeneity. The flask was then heated to start digestion until the mixture turned blue-green in colour. After 2hrs of digestion, the digest was cooled and transferred to 100 ml volumetric flask, distilled water was added to make up the volume to the mark. 10 ml of the

digest was introduced into the distillation tube, followed by 10 ml of 0.5N NaOH which was gradually added through the same way, this was left for 10 mins. Ammonia produced in the process was collected as ammonium hydroxide (NH_4OH, yellow in colour) in a conical flask containing 20 ml of 4% boric acid solution with few drops of modified methyl red indicator. The distillate was then titrated against standard 0.1N HCl solution until the appearance of pink colour was observed. Alongside the titration, a blank was also ran using the same 0.1N HCl.

Elemental Analysis

Na, Ca and K analysis of the samples were done by the method of flame photometry. The ash content was washed with dilute HNO_3acid solution and was filtered, Na, Ca, and K were determined from the filtrate. Standard solutions of 20, 40, 60, 80 and 100 ppm were used for Na, Ca and K curve calibration. 2g each of the sample was digested with nitric acid. After digestion, the volume was made up to 100ml in a polypropylene container. The analysis was done using computer controlled AAS 969 SOLAAR spectrometer.

Results

The proximate composition and elemental analysis of Tigernut and millet drinks was carried out. The results of the proximate parameters were as presented in Tables 1 and 2 below.

Table 1: Proximate composition of Millet (*Pennisetum glaucum*) and Tigernut *(Cyperus esculentus).*

Parameters (%)	**Millet**	**Tigernut**
Moisture content	4.69	3.41
Crude fibre	13.15	6.98
Crude fat	27.24	29.46
Crude protein	8.71	25.9
Ash Content	1.01	2.09
Carbohydrate	44.9	28.2

Table 2: Mineral composition (mg/100g) of Millet (*P. glaucum*) and Tigernut, *(C. esculentus)*

	Na	**K**	**Ca**	**Mg**	**P**	**Zn**	**Fe**	**Cr**	**Cu**	**Cd**	**Pb**
Millet	1.11	0.72	1.27	0.89	0.05	0.03	0.33	0.07	0.02	-ND	-ND
Tigernut	0.26	0.27	0.79	0.72	0.02	-	0.11	0.01	0.31	-ND	-ND

ND = not detected

Discussion

The percentage moisture content of millet and tigernut were found to be low (4.69 and 3.41%), this was slightly different from the reports of Enegbede (1999) and Sopade and Kassum (1992). High moisture content of kunu could lead to microbial spoilage if not properly treated since the moisture content of any food could be an index of its activity. This implies that organisms that caused spoilage are likely to survive leading to short-life of kunu.

Low Percentage ash content was observed (1.01%) in the millet drink. This is lower than the average percentage ash content of 3.36% reported by Alfa and Genwa (2013) when they subjected different amounts of ground moisture free proso Millet to ashing (Alfa and Genwa 2013). The ash contents of tigernut (2.09%) was higher than that reported by Sopade and Kassum (1992)of 1.5%, while that in the millet was lower than that of Sopade and Kassum (1992).The actual source locality and handling may affect the parameter.

Higher percentage crude fibre content was observed in millet (13.15%) than in tigernut (6.98%). The crude fibre value of the samples was also observed to be in the range of the recommended value 10 - 15 g/day of FAO/WHO (1998). High crude fibre content may reduce availability of nutrients such as calcium, zinc but will increase viscosity of food. High fibre percentage in millet may imply high energy constituent making it a more energetic beverage drink.

Percentage crude fat was found to be slightly higher in tigernut drink (29.46%) than was found in millet drink (27.24%). This is in accordance with the report of Belewu and Belewu (2007), who observed the crude fat content of tigernut milk to be (26.18%) and further opined that the high fat content makes tigernut a possible source of edible oil with increased nutrient densities thereby making tigernut products as alternative food supplements in both human and livestock diets.

The crude protein content of tigernut drink (25.9%) was found to be higher than that of the Millet drink (8.71%). This is slightly lower than the results of Alfa and Genwa (2013) who reported an average crude protein content of 13.87% in millet sample subjected to Kjeldahl nitrogen and crude protein analysis. However, the result obtained for tigernut contradicts the findings of (Belewu and Belewu 2007) who reported a low percentage protein content of 6.07% in tigernut milk. Similarly, the carbohydrate content was found to be significantly higher in millet drink (44.9%) than in tigernut drink (28.2%).

Mineral elements are present in the millet and tigernut which make them good sources of these nutrients. The sodium contents of the samples were low compared with the dietary guidelines for which recommends that adults who are healthy should limit sodium intake to not more than 2,300 mg/day. Calcium is essential for building the living cells that make the human body balance. It promotes a healthier cardiovascular system and helps in maintaining the volume of water necessary for life process maintenance.Iron may help in increasing haemoglobin which indirectly help against Anaemia.Phosphorus is very essential for bone growth and development as well as for development of ATP which is the energy currency of our body. Magnesium present in both drinks have been shown

to control blood pressure and relieve heart stress. Magnesium helps in the reduction of severity of respiratory problems for asthma patients, is also effective in reducing migraine attacks.

Conclusion

High protein content of tigernut drink makes it a good candidate as a beverage for protein-calorie malnourished populations. Millets are staple food source that is not only providing major nutrients like protein, carbohydrate, fat etc. but also provide ample of vitamins and minerals. In developing country, occurrence of malnutrition and various health problems like obesity, diabetes, cardiovascular disease, skin problems, cancer, celiac disease etc. are most prominent because of inadequate supply of nutrition. This is mainly due to the little utilized agricultural crops as food and unawareness of people and lack of knowledge to people. The result revealed that drink prepared from tigernut and millet could be used as a beverage for both the young and old persons due to the high nutrient contents (protein, fat, etc.). It is suggested from the findings of this work that a combination of tigernut and millet if used will produce nutritionally rich drinks. Producers and food vendors of kunu should be encouraged to utilize the technical assistance of National Agency for Food, Drugs Administration and Control (NAFDAC) towards attaining quality standards.

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