Direct Research Journal of Agriculture and Food Science
Vol. 9, Pp. 236-241, 2021
ISSN 2354-4147
DOI: https://doi.org/10.26765/DRJAFS12141110
Article Number: DRJAFS12141110

https://directresearchpublisher.org/drjafs/

Full-Length Research Paper

Proximate composition and organoleptic properties of *Kunun-Zaki* enriched with date fruit (*Phoenix dactylifera)*

Victor-Aduloju, A. T*., Okocha, K. S., Ezegbe, C. C. and Anarado, C. S.

Department of Food Science and Technology, Faculty of Agriculture, Nnamdi Azikiwe University Awka, Anambra State, Nigeria.
Corresponding author email: at.victoraduloju@unizik.edu.ng; yemtop2013@gmail.com

Received 3 May 2021; Accepted 6 July 2021 Published 19 July 2021

ABSTRACT: This study determined the proximate composition and organoleptic properties of *kunun-zaki* enriched with date fruit. The resulting *kunun-zaki* samples were analyzed for proximate composition (Ash, protein, fiber, moisture and carbohydrate) and organoleptic properties using standard methods. The proximate values for *kunun-zaki* processed from the combination of millet and sorghum with 10% date fruit (KMSD) had the highest moisture and carbohydrate 90.68±0.28 and 2.73±0.71% respectively. The protein contents ranged from 1.52±0.20% to 4.32±0.54%. The *kunun-zaki* sample with only millet had the highest crude fiber content of 1.38±0.13%. The organoleptic properties results denoted that highest mean scores were recorded for colour, taste and aroma in the samples processed with millet containing the date fruit slurry at (10%) concentration. The KMD sample was the most preferred, having the highest mean scores of 6.5±0.85, 6.4±1.17, 6.9±0.99, 6.3±1.49 and 6.6±1.27 in the attributes of colour, taste, aroma, mouth feel and general acceptability. The study showed that inclusion of date fruit slurry in *kunun-zaki* resulted in improved nutrient composition and sensory qualities.

Keywords: *Kunun-zaki,* organoleptic properties, date fruit, proximate composition

INTRODUCTION

Kunun-zaki is an indigenous alcohol-free beverage normally prepared from germinated cereals and is very popular in Nigeria, especially in the Northern part. The beverage is formed from either of the following substrates; *Pennisetum typhoidum* (millet), *Zea mays* (Maize), *Oryza sativa* (rice) or *Sorghum bicolor* (Sorghum), but millet is the most common substrates (Ayo *et al*., 2004; Akoma *et al.,* 2006).

In the processing of *kunun-zaki*, *Ipomea batatas* (Sweet potatoes), *Zingiber officinale* (Ginger), *Eugenia aromatic* (Clove), sugar, *Capsium annuum* (Red pepper), *Piper guinese* (Black pepper), *Allium sativa* (Garlic) and *Dialium guineense* (Tamarind) are often used as additional ingredient to improve the aroma and the taste (Adebayo and Idowu, 2003). It can also be produce with paddy rice (Victor-Aduloju *et al*., 2018). It is considerably cheap beverage drink because of the ingredients used for preparation, and this makes the product readily available (Makinde and Oyeleke, 2012). It is acceptable to people of all works of life and is being served at home and public places as food appetizer, refreshing drink and complementary food for infants (Adeboye *et al.,* 2010). It can be sweetened with honey or sugar together with small quantities of sweet potatoes (Elmahmood and Doughari, 2007).

Pheonix dactylifera L. (Date fruit) belongs to the *Phoeniceae* of the Palmae family (Khanam *et al*., 2012). It is known to be one of the world's oldest crops and is widely cultivated in hot, dry climate regions of Africa, the Middle East and Asia (Al-Farsi *et al*., 2005).

Dates contain both soluble and insoluble fibers. The main components are cellulose, hemicelluloses, pectin and lignin (Al-Shahib and Marshall, 2003). The dietary fiber content of dates can further contribute to their nutritional significance as dates can be used in the preparation of fiber-based foods and dietary supplements (Masmoudi *et al*., 2010). Date seeds have been reported to contain relatively high amounts of protein, 5.1% and fat, 9.0% compared to the date flesh (Saafi *et al*., 2008).

The sweet-savory sensation derived from dates is attributed to the enormous abundance of natural sugars that are sucrose, glucose and fructose. Date fruit is processed into a wide variety of products including dry dates, date bars, date syrup, date juice concentrate, date jam, date butter and date candy (El Hadrami and Al-Khayri, 2012). The chemical combination of dates has been associated to many important health benefits ranging from the treatment of cardiovascular disease to the treatment of stomach disorders (Vayalil, 2012). High intake of fatty fast food coupled with reduced physical activity has promoted childhood obesity in many countries of the world. Increased intake of added sugar is one of the major causes for dental caries, glucose intolerance, diabetes mellitus, cardiovascular diseases, obesity, hypertension and behavioral complications such as hyperactivity in children. In the world, the act of consuming added sugar is much higher than the dietary intake. In many regions, people prefer to drink *kunun-zaki* with refined sugar for sweetness. The consumption of sugar in Nigeria is high. High intake of carbonated drinks has promoted several health issues such as heart diseases, diabetics, obesity and dental caries. Several analysts have used dried fruits to sweeten the traditional drinks but not much has been done on *kunun-zaki*. This study was to examine the proximate composition and organoleptic properties of *kunun-zaki* enriched with date fruit.

MATERIALS AND METHODS

Sources of raw materials

Millet, sorghum, date fruit, sweet potatoes, ginger, cloves, and red pepper were all purchased from Ochanja market Onitsha, Anambra State.

Preparation of date fruit slurry

Date fruit extract was produced according to the method of Odunfa and Adeyeye (1995). Dried date seeds (1 kg) were washed and soaked in tap water (1L) at room temperature (30°C) for 12 hours; changing of the soaking water was observed. The date seeds were washed to reduce objectionable flavour. The nuts were drained, mixed with water (ratio 1:4) and milled (Philips kenwood, UK). The homogenous slurry was filtered using a muslin cloth and the resultant filtrate was date seed slurry.

Preparation of *kunun-zaki* sample

Kunun-zaki was produced using the method described by Akoma *et al.* (2006) with modification. Five hundred (500g) of cereal grains (millet and sorghum) was cleaned and steeped separately in 10 liters of cold water inside a plastic bowl at 30-32ºC for 24 hours. The water in the steeped grains was decanted off and washed with more tap water before wet milling with dried sweet potatoes, ginger, 8g of sweet potatoes, 2.2g of cloves, and 3g of red pepper were added to each of the millet and sorghum. It was blended together with the aid of blender to form a wet thick paste/slurry. The paste was divided into two unequal portions (1:3 v/v). To the larger portion of paste, hot water was added to gelatinize it, it was then cooled to 40°C and added to the un-gelatinized portion to form *kunun-zaki* slurry. The *kunun-zaki* was stirred vigorously for 2 minutes and then allowed to stand and fermented for 8 hours. The fermented *kunun-zaki* was sieved through 350 µm diameter mesh and enriched with date at different concentrations. A control experiment was set up with *kunun-zaki* without the date. It was packaged and kept inside the refrigerator for further analysis (Figure 1).

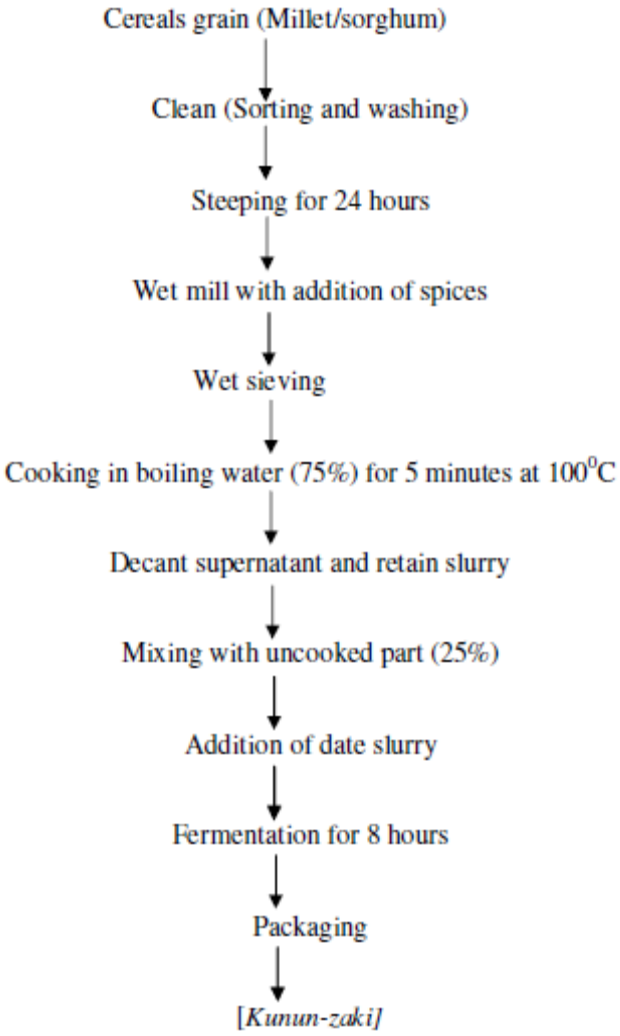
Proximate analysis

Moisture, ash, and crude fiber, crude fat, protein and carbohydrate content of the samples were determined according to standard methods of Association of Analytical Chemists (AOAC, 2005).

Moisture

The moisture content was determined by using oven-drying method. Clean and dry Petri-dishes were weighed by using meter balance and their respective weights were recorded. Five g of the sample was weighed into pre-weighed dry dishes spreading as much as possible. The dishes containing the sample were transferred into the oven maintained at 105°C and dried for 3 hours. After three hours they were transferred to the desiccators to cool and then weighed. This process was continued until a constant weight was taken to be the percentage moisture content.

$$\text{Moisture (\%)} = \frac{(W_2-W_1) - (W_3-W_1) \times 100}{(W_2-W_1)}$$



Where W_1= Weight of empty crucible; W_2= Weight of crucible + sample; W_3= Weight of crucible + dry sample.

Ash

Clean dried crucibles were weighed on analytical balance and 5ml of the *kunun-zaki* sample will be weighed into the crucibles. The samples was dried in the moisture extraction oven until constant weights were obtained and the transferred into the muffle furnace with a pair wags and ash at 550°C for 4 hours until a white ash is obtained. The sample was removed from the furnace and cooled in desiccators and re-weighed. The percentage ash content was calculated:

$$\% \text{ Ash content} = \frac{\text{weight crucible + ash} - \text{weight of empty crucible}}{\text{Weight of sample}} \times 100$$

Crude fiber determination

Two (2) ml of *kunun-zaki* samples was weighed into 250 ml beaker containing 220 ml of 0.125M tetraoxosulphate (VI) acid (sulphuric acid). The mixture was heated in a steam bath at (700-900) °C for 2 hours, and then allowed to cool. The cooled mixture was filtered using a muslin cloth over a Buckner funnel. The residue was washed 3 times with hot water to remove the acid and put into a beaker containing 200ml of potassium hydroxide. The mixture was heated as before over a steam bath for 2 hours. The solution was filtered and the residue washed 3 times with hot water, then with alcohol and water. The final residue obtained was put in clean pre-weighed crucible and dried at 120°C to a constant weight. The crucible with the oven dried sample was put in a muffle furnace and ashes at 550°C for 30 minutes such that the

sample becomes white ash. The crucible and its contents were removed from the furnace, cooled in desiccators and re-weighed.

$$\% \text{ Fiber} = \frac{\text{Weight of oven dried sample – weight of ash}}{\text{Initial weight of sample}} \times 100$$

Fat

Cleaned and dried thimbles were weighed as (W_1) and 5g oven dried sample was added and re-weighed (W_2). Round bottom flask was filled with petroleum ether (40-60°C) up to ¾ of the flask. Soxhlet extractor was fixed with a reflux condenser and adjusted the heat source so that the solvent boils gently, the sample(s) were put inside the thimble and inserted into the soxhlet apparatus and extraction under reflux was carried out with petroleum ether (40–60°C). After the barrel of the extractor is empty, the condenser was removed and the thimble was removed, taken into the oven at 100°C for one hour and later cooled in the desiccators and weighed again (W_3).

$$\% \text{ Fat} = \frac{\text{Weight loss of sample (extracted fat) } (W_2 - W_3)}{\text{Original weight of the sample } (W_2 - W_1)} \times 100$$

Protein

Kjeldahl nitrogen method was employed for the determination of protein content of the sample. 1.0 g of the sample was weighed into the digestion flask. Kjeldahl catalyst (5 selenium tablets) was added to the sample. 20 ml of concentrated H_2SO_4 was added to sample and then fixed for 8 hours in the digestion unit (450°C) of the Kjeldahl apparatus in fume cupboard. The digest, pure yellow after cooling changed into a colourless liquid that was transferred into 100 ml volumetric flask and made up to mark with distilled water. About 20 ml of 4% boric acid solution was pipette into conical flask. A drop of methyl red was added to the flask as indicator. The sample was thereafter diluted with 75 ml of distilled water. 10 ml of the digest was made alkaline with 20 ml of NaOH (20%) and distilled.

The steam exit of the distillatory was closed and the change of colour of boric acid solution to green was timed. The mixture was distilled for 15 minutes. The filtrate was then titrated against 0.1 N HCl. The protein content was calculated from the relationship:

$$\text{Total protein} = \frac{\text{Titre} \times \text{Normality of Acid} \times 0.014}{\text{Sample weight}} \times 100$$

Protein (%) = % Nitrogen x 6.25, Normality of acid (HCL) = 0.1 N, Sample weight = 1.0 g

Carbohydrate

Carbohydrate content was determined by subtracting from 100 the sum of the percentage moisture, ash, protein, fat and fiber. The remainder value gives the carbohydrate content of the sample.

% Carbohydrate = 100 - (% Moisture + % Ash + % Fat + % Protein + % Fibre)

Organoleptic analysis

Quality attributes (appearance, taste, aroma, and overall acceptability) of the *kunun-zaki* samples used in this research were evaluated by 25-man semi-trained panelists comprising of students of the Department of Food Science and Technology, Nnamdi Azikiwe University, Awka using a seven-point hedonic scale, where 1=like extremely, 2=like very much, 3=like slightly, 4=neither like nor dislike, 5= dislike slightly, 6=dislike very much, 7= dislike extremely.

Statistical Analysis

Data were subjected to analysis of variance (ANOVA) using Minitab 16.0 statistical software (Minitab Inc., State College, PA, USA) and they were characterized descriptively as means ± standard deviation. Statistically significant means were separated using Duncan Multiple Range test (DMRT) and Fisher pairwise comparisons (FPC). The significance level adopted was $p<0.05$.

RESULTS AND DISCUSSION

Table 1 shows the result of proximate analysis carried out on the *kunun-zaki* samples. The percentage ash contents of millet, sorghum, and combination of millet and sorghum were found to be within the range of 0.25±0.05 - 1.08± 0.13%. The control sample prepared from 100% millet had the highest ash content of 1.08± 0.13% while the control sample made from 100% sorghum had the lowest ash content of 0.25±0.05. From (Table 1), it was shown that the samples were significantly difference at $p<0.05$. The results however agree with the work done according to Otaru *et al.* (2013) and Essien *et al.* (2011). In a related study, Makinde and Oyeleke, (2012) reported increase in the ash contents of *kunun-zaki* enriched with extract of sesame seeds over the control sample without the sesame seeds. However (Ogbonna *et al.*, 2013) and Adelekan, (2013) obtained ash contents of higher values in their findings on *kunun-zaki* than those recorded in this study. The difference could be attributed to the different types of cereals used in the production of beverages in

Table 1: Proximate composition of millet, sorghum and combination of millet and sorghum.

Proximate Contents (%)	KM	KMD	KMS	KMSD	KS	KSD
Ash	1.08± 0.13^{a}	0.80± 0.05^{b}	0.58±0.08^{c}	0.37±0.03^{de}	0.25±0.05^{e}	0.43±0.03^{d}
Protein	1.52±0.20^{f}	2.10±0.35^{e}	2.80±0.35^{d}	4.08±0.54^{ab}	4.32±0.54^{a}	3.50±0.35^{c}
Crude fibre	1.38±0.13^{a}	0.95±0.05^{b}	0.72±0.08^{c}	0.52±0.03^{de}	0.43±0.03^{e}	6.63±0.06cd
Moisture	82.22±1.63^{d}	85.03±0.28^{c}	86.47±0.47^{b}	90.68±0.28^{a}	91.78±0.28^{a}	90.83±0.26^{a}
Carbohydrate	12.33±0.14^{a}	10.05±0.44^{b}	8.20±0.44^{c}	2.73±0.71^{f}	1.72±0.32^{e}	3.00±0.48^{d}

Values are mean scores ±standard deviation of the *kunun-zaki* samples. Values in rows with different superscripts letters are significantly different ($p<0.05$). **Keywords:** KM= Control (100% millet), KMD=90% millet: 10% date fruit, KMS=Control, 50:50% millet and sorghum, KMSD= Combination of millet and sorghum with date fruit at 90:10%, KSD= Control; 100% sorghum, KSD= 90% sorghum: 10% date fruit.

Table 2: Sensory scores of *kunun-zaki* samples.

SAMPLES	COLOUR	TASTE	AROMA	MOUTHFEEL	GENERAL ACCEPTABILITY
KM	4.7±2.41^{e}	4.2± 2.25^{c}	4.7± 2.41^{d}	4.6± 2.37^{e}	4.7± 2.21^{d}
KMD	6.5± 0.85^{a}	6.4± 1.17^{a}	6.9± 0.99^{a}	6.3± 1.49^{b}	6.6±1.27^{ab}
KMS	6.1±2.38^{c}	5.3±2.00^{ab}	5.5± 2.51^{c}	5.4± 2.22^{d}	5.8± 2.04^{c}
KMSD	6.4± 1.17^{ab}	6.5± 1.08^{a}	6.1± 1.45^{b}	6.6± 1.43^{a}	6.4± 1.17^{ab}
KS	4.5±1.72^{d}	3.4± 1.84^{d}	4.5± 1.65^{e}	4.2± 2.00^{f}	4.2± 1.40^{e}
KSD	6.3± 1.57^{ab}	6.3±1.64^{a}	6.6± 1.17^{a}	5.9± 1.97^{c}	6.9± 0.88^{a}

Values are mean scores of three replicated samples ±standard deviation. Values in columns with different superscripts letters are significantly different ($p<0.05$). Keywords: KM= Control (100% millet), KMD=90% millet: 10% date fruit, KMS=Control 50:50% millet and sorghum, KMSD= Combination of millet and sorghum with date fruit at 90:10%, KSD= Control 100% sorghum, KSD= 90% sorghum: 10% date fruit.

the different studies. Different cereals types have abilities to contribute to the ash contents of *kunun-zaki* as a result of the differences in their ash compositions.

The control sample made from sorghum without addition of date fruit had the highest protein value of 4.32±0.54% followed by combination of millet and sorghum with date slurry of 4.08±0.54% and were not significantly difference at ($p<0.05$) while the control sample from millet had the lowest protein content of 1.52±0.02% as shown in (Table 1). The samples were not significantly difference at ($p<0.05$) between the *kunun* product which contain the date slurry and the control. The results indicated that *kunun* samples without date slurry had higher protein values. Essien *et al.* (2011) reported that loss of protein during the processing of the drinks may be responsible for the low protein content observed. Hamad and Fields, (1997) observed that high value of protein content is found in the germ and testa which are often sifted off during the preparation of *kunun* product. The crude fibers content in sample prepared from the control sample of 100% millet had the highest value of 1.38±0.13% compared to the lowest 0.43±0.03% obtained from sample made with sorghum without addition of date slurry. Although the values seemed to decrease with incorporation of date fruit slurry. This could be as a result of higher content of fiber contained in the millet than date slurry in accordance with the work done by (Belewu and Abodurin, 2006). The samples were not significantly difference at $p>0.05$. The values of the moisture content in all the samples had the range values of 82.22-85.03%, 86.47-90.68% and 90.83-91.78% respectively. There was no significant different in the moisture content of the control sample made from 100% sorghum and the sample processed with combination of millet and sorghum with addition of 10% date fruit. This was in accordance with the findings of the work done by (Ofudje *et al.,* 2016).

Organoleptic properties

The results of the sensory evaluation of the various samples obtained are shown in (Table 2). There were significant difference ($p<0.05$) among the samples in colour, taste and aroma, mouth feel, and general acceptability. KMSD was ranked highest by the panelists in terms of mouthfeel and the value obtained was significantly different ($p<0.05$) from others (Table 2). The *kunun-zaki* made from millet with addition of 10% date fruit (KMD) had the highest score in colour, taste and aroma. These results agree with the earlier studies by Oluwajoba *et al*., (2013) who reported three parameters of colour, taste and aroma of the ungerminated cereal drink higher than the germinated cereal drink. The sample processed from sorghum only (KS) had the lowest mean score in taste, aroma, mouth feel and

general acceptability. The *kunun-zaki* sample (KSD) was the most generally accepted with mean score of 6.9±0.88 and it was significantly different ($p<0.05$).

Conclusion

In this study, millet, sorghum and mixture of millet and sorghum were used as different raw materials for the production of *kunun-zaki* drinks which were all supplemented with 10% date fruits. Proximate analysis revealed increase in the protein and carbohydrate contents of the beverage and organoleptic properties from the inclusion of date fruit showed improvement in the taste and mouth feel of the samples.

REFERENCES

Adebayo A, Idowu C (2003). Mycotoxins in food in West African. *Journal of Biotechnology*. 2(2): 12-16.

Adebayo GB, Otunda GA, Ajao TA (2010). Physcio-chemical, microbiological and sensory characteristics of *kunun* prepared from millet, maize and guinea corn and stored at selected temperatures. *Advanced Journal of Food Science And Technology*. 2(1): 41-46.

Adelekan AO, Alamu AE, Arisa NU, Adebayo YO, Dosa AS (2013). Nutritional, microbiologial and Sensory Characteristics of malted soy-*kunu-zaki*: an improved traditional beverage. *Advances in biology*. 3: 389-397.

Akoma O, Jiya EA, Akumka DD, Mshelia E (2006). Influence of malting on the nutritional characteristics of *kunun zaki*, *Africa Journal of Biotechnology*. 5(10): 996-1000.

Al-Farsi M, Alasalvar C, Morris A, Baron M, Shahidi F (2005). Compositional and sensory characteristics of three native sun-dried date (*Phoenix dactylifera* L.) varieties grown in Oman. *Journal of Agricultural and Food Chemistry*. 53: 7586–7591.

Al-Shahib W, Marshall RJ (2003). The fruit of the date palm: its possible use as the best food for the future? *International Journal of Food Sciences and Nutrition*. 54: 247–259.

Association of Analytical Chemists (AOAC). Official method of analysis (18th edn). Association of Analytical Chemists. Washington DC. 2005.

Ayo JA, Umaianze G, Gaffa T (2004). Microbiological evaluation of *kunun zaki* and Zoborobo drink (beverage) locally produced and sold in a polytechnic community in Nigeria. *Nigerian Food Journal*. 22(1):119- 126.

El Hadrami A, Al- khayri JM (2012). Socioeconomics and traditional importance of date palm. Emir. *Journal of Food Agriculture* 24:371-385.

Elmahmood AM, Doughari H (2000). Microbial quality assessment of *kunun-zaki* beverage sold in Girei town of Adamawa state, Nigeria. *African Journal of Food Science*. 1: 11-15.

Essien E, Monago C, Edor EA (2011). Evaluation of the nutritional and microbiological quality of *kunun* (a cereal based non-alcoholic beverage) in Rivers state Nigeria. *International Journal of Nutrition and Wellness*. 10(2): 145-154.

Hamad AM, Fields, ML (1997). Evaluation of protein quality and available lysine of germinated and fermented cereal. *Journal of Food Science*.44: 456.

Makinde F, Oyeleke O (2012). Effect of sesame seed addition on the chemical and sensory qualities of sorghum based *kunun-zaki*. *African Journal of Food Science and Technology*. 3:204-212.

Masmoudi M, Besbes S, Blecker C, Attia H (2010). Preparation and characterization of jellies with reduced sugar content from date (*Phoenix dactylifera L.*) and lemon (*Citrus limon L.*) by-products *Fruits*. 65: 21–29.

Odunfa SA, Adeyeye S (1995). Microbiological changes during the traditional production of ogibaba. *A West African fermented sorghum gruel. Journal Cereal* Science. 3(4):173–180.

Ofudje EA, Okon UE, Oduleye OS, Williams OD (2016). Proximate, Mineral contents and Microbial Analysis of kunu zaki (A Non-Alcoholic Local Beverage) in Ogun state, Nigeria. *Journal of Advances in Biology and Biotechnology*. 7(1):1-8.

Ogbonna AC, Abuajah CI, Akpan MF, Udofia A S., (2013). A comparative study of the nutritional values of palmwine and kunu-zaki. *Annals Food Science and Technology*. 14:39-43.

Oluwajoba SO, Akinyosoye FA, Oyetayo VO (2013). Comparative sensory and proximate evaluation of spontaneously fermenting *kunun-zaki* made from germinated and ungerminated composite cereal grains. *Journal of Food Science and Nutrition* 1(4): 336-349.

Otaru AJ, Ameh CU, Okafor JO, Odigure JO, Abdulkareem, AS (2013). Development, carbonation and characterization of local millet beverage (*kunun*). *International Journal of Computational Engineering Research*. 3(4): 80-86.

Saafi EB, Trigui M, Thabet R, Hammami, M, Achour L (2008). Common date palm in Tunisia: chemical composition of pulp and pits. *International Journal of Food Science and Technology*, 43: 2033-2037.

Vayalil PK (2012). An emerging medicinal food. *Critical Review Food Science Nutrition*. 52(3):249-71.

Victor-Aduloju AT, Anyamene C, Ogbu KN, Ishiwu, C. N. (2018). Isolation and Identification of Probiotic Lactobacillus species from Traditional drink (*Kunun- zaki*) fortified with different thickener. *African Journal of Food Science*. 12(9):230-237.