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Effect of Processing on Nutritional, Microbiological and Sensory Properties of Kunun-Zaki (A Sorghum Based Non-Alcoholic Beverage) Widely Consumed in Nigeria

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Abstract: This study was conducted to investigate the effect of processing methods on the Nutritional, Microbiological and Sensory Properties of Kunun-Zaki. Results revealed that kunun drinks processed traditionally usually takes up to 48hrs or more to be processed, however, the same kunun drink with better microbiological quality, can now be processed within six hours. More over, kunun drinks processed from the sieve kunun flour now retained more nutrients in terms of protein, %fat and titrable acidity than the traditionally processed drinks.

Key words: Kunun, non-alcoholic beverage, refreshing drink

Introduction

Kunun is the non-alcoholic fermented beverages widely consumed in the Northern parts of Nigeria. This non-alcoholic beverage is however becoming more widely accepted in several other parts of Nigeria, owing to its refreshing qualities. Beside the fact that the two dominants religious group, Christians and Muslims use it as a substitute for alcoholic ones and the fact that it is very nutritious and medicinal (Bestshart, 1982). Kunun is consumed anytime of the day by both adult and children as breakfast drink food complement, It is a refreshing drink usually used to entertain visitors appetizer and is commonly served at social gathering. While Onuorah *et al*. (1987) reported Kunun as being regarded as after meal drinks or refreshing drinks in rural and urban centers. Although there are various types of Kunun processed and consumed in Nigeria which include Kunun zaki, Kunun gyada, Kunun akamu, Kunun tsamiya, Kunun baule, Kunun jiko, Amshau and Kunun gayamba. However, kunun zaki was most commonly consumed.

According to Odunfa and Adeyeye (1985) the traditional processing of Kunu involves the steeping of millet grains, wet mill with spices (ginger, cloves pepper), wet sieving and partial gelatinization of the slurry, followed by the addition of sugar and bottling. Brief fermentation usually occurs during kunun processing. This briefly fermentation which usually occurs during steeping of the grains in water over a 8-48hrs period is known to involve mainly lactic acid bacteria and yeast (Odunfa and Adeyeye, 1985).

Sathe *et al*. (1981). hghilighted the significance of rheological characteristics in processing, quality control, sensory evaluation and structural analysis of kunun-zaki. Increasing temperatures reduced viscosity but did not alter the reheological characteristics of the product. The time of shear (up to 1hr) did not appreciatebly alter the viscousity.

Substantial nutrient losses occur during the various steps of Kunun-zaki processing. According to (Hamad and Fields (1979) steeping milling and sieving are the processing steps during which considerable nutrient losses take place. Much of the protein in cereal grains is located in the testa and germ which are usually sifted off during processing. Efforts are currently underway in Africa to modify the processing of Kunun-Zaki with a view to enhancing its nutritive value, shelf-life and possible theraupitic qualities. Dehydration of kunun by drum or tray-drying has been shown to prolong its shelf-life (Cook, 1994). Drum drying was however, reported to destroyed heat-sensitive nutrient in kunun (Chaven and Kadan, 1989). an appreciable loss in the available lysine content of kunun as a result of drum drying. The use of bacteriocin-producing Lactobacillus has also been used to improved the shelf-life of Kunun-extending it by 10 days (Chaven *et al*., 1988).

This indigenous processing of kunun-zaki involves the steeping milling and sieving of sorghum grain. However, with the modernization of processing technology, Kunun-zaki is now being processed using sorghum and millet grain flour. With this processing method, there is a significant reduction in the time of processing from 120hr to between 10-12 hrs. Hence the aim of this study is to investigate the effect of processing methods on the Nutritional, Microbiological and Sensory Properties of Kunun-Zaki.

Materials and Methods

The traditional preparation of kunun-zaki: The traditional preparation of kunun-zaki involves soaking of sorghum (400g) and millet (200g) in water for 3days followed by wet milling with the addition of spices

Table 1: The Nutritional properties of Kunun-zaki processed using different methods

Processing methods	Crude protein	Fat (%)	Total solid	Moisture content	Ash (%)	Carbo-hydrate (%)	P^H	Titrable acidity (g/100g)
Traditionally prepared Kunun-zaki	2.31[c]	3.55[b]	10.70[a]	85.30[a]	1.16[b]	83.55[a]	5.60[a]	0.22[b]
Kunu-zaki from Sieved Kunun flour	2.43[b]	3.64[a]	10.26[a]	85.74[a]	1.16[b]	83.53[a]	5.25[b]	0.28[a]
Kunu-zaki from Unsieved Kunun flour	3.63[a]	3.63[a]	10.12[a]	86.38[a]	1.21[a]	82.92[a]	5.65[a]	0.21[c]

Mean value with the same column followed by the same letter are not significantly from each other at $p<0.05$

(Ginger, 53.07g, Garlic, 25.00g, red and black pepper, 2.71g, cinnamon, 0.48g. clove 7.51g) and wet sieving to remove bran, hulls and germ. The pomace is retained on the sieve and later discarded as animal feed, while the filtrate is fermented (for 2 days) to yield kunun-zaki, which is a sour, white and starchy sediment. Prior to consumption the fermented filtrate will then be diluted with water to a solid content of about 8-10% and cooked, the resulting stiff gel is called Kunun-zaki (Odunfa and Adeyeye, 1985).

Processing of Kunun from sieved and unsieved Kunun Flour: Kunun from sieved and unsieved flour was prepared by dry milling of millet (200g) and sorghum (4000g) grains at the ration of 1:2 with an addition of the following spices (dried Ginger, 16.43g, Garlic, 25.00g, red and black pepper, 0.3g, cinnamon, 0.48g. clove 7.51g). Water was added to the dried flour to saturate the flour and allowed to settle for 6hr, however, for the sieved kunun zaki samples, the saturated flour were then sieved, before being allowed to settle for 6hr, the supernatant were then decanted while the slurry was retained. The slurry was divided into two portions, one of the portions ie 75% was then boiled in hot water, after which it was then mixed with remaining portion of the slurry (25%) these were then thoroughly mixed together. To this was then added sweetener (sugar) and the resulting slurry is now called kunun zaki.

Sensory evaluation: Sensory evaluation of kunun-zaki samples was conducted using a panel of 20 judges who are consumers' of the products at the Institute of Agricultural Research and Training, Obafemi Awolowo University (IAR&T/OAU) crop utilization centre. The judges scored the samples for colour, taste, texture, flavour and overall acceptability using a 9-point hedonic scale where '9' represented 'like extremely' and '1' represented 'dislike extremely (Larmond, 1977).

Isolation of microbe associated with Kunun zaki drinks: Ten fold dilutions of each kunun samples were made using peptone water. Appropriate dilutions were made and 0.1 mL of the diluted samples were pour plated in triplicate plates on Plate Count Agar (PCA) for viable count, Eosin Methylene Blue (EMB) for *Escherichia coli* count, Manitol Slat Agar (MSA) for Staphylococcus count and Briliant bile broth (BGBB) for coliform test. Sabourand Dextrose Agar, with Chloramphenicol (250mg/100ml) was used for fungi, while for yeast count he medium was adjusted to P^H 3.5 with tartaric acid. All plates were incubated for 48hours at 30°C except for sabourand Dextrose Agar that were incubated at 26°C for 6 days Colonial counts were made using digital illuminated colony counter (Gallen kamp model).

Pure cultures of each isolates were obtained by streaking the specific colonies on suitable media and incubated appropriately, these were then maintained in an agar slants in McCarthney bottles.

Identification of the microbial isolates: Identification was on the basis of presence and characteristics of typical structures such as conidia and hypha (Barnett and Hunter, 1972). Isolation and identification of bacteria in prepared Kunun drinks samples were done using methods described by Harrigan and McCance (1976), ICSMF (1988), Collins and Lyne (1984), Adegoke *et al.* (1993).

The associated fungi were identified with reference to Frazier and Westhoff (1978), while the yeast were identified using the methods of Beech *et al.* (1986) and Lodder (1970). The identity of the microbes were further confirmed by comparison with existing cultures already identified by the Mycological Institute, Kew, London Obtained from the Institute of Agric. Research and Training, Moor plantation Ibadan, Nigeria. The P^H of the samples were determined using P^H meter (Tritrimeter U9N model) The moisture content and the titratable acidity were determined as described by Egan *et al.* (1981).

Other analysis carried out on the Kunun drink samples include the % ash, total solid, protein, carbohydrates and ether extract. (AOAC, 1990).

The data collected were subjected to the analysis of variance and mean separation was performed using Statistical Analysis Software (Software SAS, 1993).

Results

The highest % crude protein was found in the Kunun zaki samples from the Unsieved kunun flour followed by kunun samples from sieve kunun flour, while the least % crude protein was found in Traditionally processed kunun samples (Table 1). The carbohydrate content of the processed Kunun drink samples ranges from 83.55 to 82.92%. There were no significant differences between the carbohydrates content of the traditionally processed kunun zaki and that processed using kunun

Table 2: The microbiological properties of Kunun-zaki processed using different methods

Processing methods	Total viable count (cfu/ml)	Coliform count (cfu/ml)	Mould (cfu/ml) count	Yeast count (cfu/ml) count	Lactic bacterial count (cfu/ml)
Traditionally prepared Kunun-zaki	81.67[a]	6.33[a]	Nil	22.00[a]	57.33[a]
Kunu-zaki from Sieved Kunun flour	12.00[b]	5.00[b]	Nil	18.00[c]	51.00[b]
Kunu-zaki from Unsieved Kunun flour	7.33[c]	3.67[c]	Nil	20.00[b]	37.67[c]

Mean value with the same column followed by the same letter are not significantly from each other at $p<0.05$

Table 3: Sensory evaluation of Kunun-zaki processed using different methods

Processing methods	Colour	Taste	Texture	Flavour	General acceptability
Traditionally prepared Kunun-zaki	7.60[a]	7.50[a]	7.10[a]	7.10[a]	7.80[a]
Kunu-zaki from Sieved Kunun flour	6.60[a]	6.90[a]	6.30[a]	6.30[ab]	7.80[a]
Kunu-zaki from Unsieved Kunun flour	5.80[b]	5.00[b]	5.00[b]	5.30[b]	6.00[b]

Mean value with the same column followed by the same letter are not significantly from each other at $p<0.05$

flour. The P^H of the traditionally processed Kunun zaki drinks were highest followed by kunun drinks processed from sieved kunun flour, while the least was found in kunun drinks processed from sieved kunun flour.

The Titratable acidity (TTA) found in the kunun drink samples ranges between 0.21% and 0.28g/100g. The highest TTA was however, found in by kunun drinks processed from sieved kunun flour, followed by that prepared traditionally, while the least was found associated with in kunun drinks processed from unsieved kunun flour. Result indicated that there was no significant diference between the % Total Solid found in traditionally processed kunun drink samples as well as those processed from sieved and unsieved kunun flour (Table 1).

The highest total viable count of 81.67×10^6 was found in the traditionally processed kunun drinks, followed by the kunun drink samples processed from sieved kunun flour (12×10^6) while the least total viable count of 7.33×10^6 was found associated with processed from unsieved kunun flour (Table 2). The yeast and lactic acid bacterial count were highest in the traditionally processed kunun drink samples followed by kunun drinks processed from sieved kunun flour, while the were found in kunun drinks processed from unsieved kunun flour. Coliform count were found to be highest in the traditional processed kunun drinks while the least count were obtained in kunun drinks from unsieved kunun flour. There were no fungi found associated with the kunun drink samples (Table 2).

As shown in Table 3, the traditionally processed kunun drinks was most preferred in terms of color, followed by kunun drinks from the sieved kunun flour while the least was found with kunun drinks from unseieved kunun flour. With regards to taste and texture, there was no significant difference between the kunun drinks traditionally processed and that from the sieved kunun flour, however, these were significantly different from the kunun drinks from the unseieved kunun flour. The result of general acceptability also revealed that the traditionally processed kunun drinks and the kunun drinks from the sieved kunun flour are more preferred compared to the kunun drinks from the unsieved kunun flour (Table 3).

Discussion

Result of the experiment indicated that the highest % crude protein was found in the Kunun zaki samples from the Unsieved kunun flour followed by kunun samples from sieve kunun flour, while the least % crude protein was found in Traditionally processed kunun samples. The result of the experiment indicates that Kunun processed from Unsieved flour retained most of the nutrients. According to (Hamad and Fields, 1979) considerable nutrient losses occurred during conventional processing of Kunun drinks, this is because much of the protein in cereal grains is usually located in the testa and germ which are usually sifted off during processing.

It was also found out from the result that the P^H of the traditionally processed Kunun zaki drinks and that obtained from the Unsieved kunun flour were highest followed by kunun drinks flour, while the least was found in kunun drinks processed from sieved kunun flour. Reasons might not be unconnected from the fact that fermentation of the sieved flour took place with less hindrance from the shaft which has been removed prior to fermentation. It is a known fact that fermentation which usually occurs during kunun processing which usually involves mainly lactic acid bacteria and yeast (Odunfa Adeyeye, 1985). Hence there will be more available surface for enzymatic activities in sieved kunun flour than both the unsieved kunun flour and that obtained through traditional methods.

Result of the experiment also revealed that the highest total viable count was found in the traditionally processed kunun drinks, followed by the kunun drink samples processed from sieved kunun flour, while the least total viable count was found associated with processed from unsieved kunun flour. The traditionally processed kunun drinks had the highest microbial load might not be unconnected with the long period of fermentation which might have exposed the fermented drinks to lots of microbial contamination as well as the

arrays of microbe involved in fermentation. The above might also explain why more yeasts; lactic acid bacteria were highest in the traditionally processed kunun drinks. Osuntogun and Aboaba (2004), had earlier reported the association of *Penicillium spp*, *Aspergillus spp Lactobacillus spp* and *Streptococcus sp* from Kunun drink samples obtained in Nigeria While Amusa (2007). reported several microbes such as *Lactobacillus plantarum*, *Bacillus sutilis*, *B. cereus*, *Streptococus feaceaum*, *S. lactis*, *Staphylococcus aureus*, *Micrococcus acidiophilis*, *Escherishia coli*, *Pseudomonas aureginosa Saccharomysces cerevisiae*, *Candida mycodema*, *Apergillus niger*, *Penicillium sp* and *Fusarium oxysporum* found associated with kunun drinks. However, this result indicated that no fungi, were found associated with the kunun drinks. The absence of fungi in the kunun is usually as a result of samples the use of clean disease/ fungal free cereals according to Amusa (2007). The presence of fungi in kunun drinks is as a result of the use of fungal infected/conterminated cereals since most of the fungi ever reported associated with the drinks are storage microflora of cereals.

The presence of coliform bacteria in all the kunun drink samples is not unexpected since the source of water used is tap water, coliforms as been reportedly associated with tap water popularly consumed in some towns in Nigeria (Adegoke *et al*., 1993). Amusa (2007) reported that the presence of coliforms in the hawked kunun drink samples were as a result of the use of contaminated water, containers, as well as dirty environment where the kunun samples were being processed and even hawked and that no coliform was found associated with the laboratory prepared kunun drink samples when sterile water was used.

In terms of preference, the traditionally processed kunun drinks was most preferred in terms of color, while in terms of taste and texture, there were no significant difference between the kunun drinks traditionally processed and that from the sieved kunun flour and however, these were significantly different from the kunun drinks from the unseieved kunun flour. It is clear that beside colour which often depend on the colour of the raw materials used, the taste and the texture of both the traditionally processed kunun drinks and that from sieved kunun flour were not significantly different from each other indicating similar preference. Also result of the general acceptability revealed that the traditionally processed kunun drinks and the kunun drinks from the sieved kunun flour are more preferred compared to the kunun drinks from the unsieved kunun flour.

The implication of the above is that kunun drinks processed traditionally usually takes up to 48hrs or more to be processed, however, the same kunun drink with better microbiological quality, can now be processed within six hours. More over, kunun drinks processed from the sieve kunun flour now retained more nutrients in terms of protein, %fat and titrable acidity than the traditionally processed drinks.

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