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Full Length Research Paper

Effect of steeping time of milled grains on the quality of Kunnu-Zaki (A Nigerian beverage)

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Millet grains were steeped in water for varying period of time during "kunun zaki" production in order to study the effect of the duration of steeping on the quality of "kunu zaki". Other processing factors were kept constant in the course of this study. Kunun zaki produced from millet grains steeped for 36 h was rated best in terms of sensory characteristics. The steeping period had no significant effect on the specific gravity of the produced "Kunun zaki". As expected the titratable acidity and pH were inversely proportional, with the latter decreasing and the former increasing during the fermentation-steeping period. The protein content increased between 12 and 48 h steeping time. During the steeping period, the carbohydrates decreased rapidly in the first 12 h. However, the rate of carbohydrates decrease reduced beyond the first 12 h. This may be due to the decrease in the rate of fermentable sugars.

Key words: Kunun-zaki, millet, steeping, quality, pH, titratable acidity, sensory.

INTRODUCTION

The soft drink segment of the Nigerian beverage industry is heavily dependent on imported raw material and Nige-ria is presently passing through a developmental stage in which there is a strong emphasis on local sourcing of raw materials. This awareness has transformed into a general interest in commercial processing of indigenous foods in order to conserve the scarce foreign exchange by limiting importation of raw materials. Cereals are the major local raw materials in the production of beverages in Nigeria which include Pito, Burukutu, local gin and Kunnu-zaki. Cereals are eaten in large quantities and are the main sources of both major and minor nutrients (Adeyemi and Umar, 1994). Due to their high viscosity on cooking when made into gruel, large amount of water is used during preparation to obtain the right consistency; this obviously decreases the nutrient density (Mosha and Svanberg, 1983). Kunnu-zaki is a traditional non-alcoholic fermented beverage widely consumed in the northern part of Nigeria. It is however becoming widely consumed in the southern parts among low and middle income workers who cannot afford industrially produced beverages like Coca-cola, Pepsi etc. Its popularity is due to its characteristic sweet-sour taste, its refreshing quality as well as the creamy or milky appearance and also its flowing consistency.

Adeyemi and Umar (1994) described the traditional process for the manufacture of kunnu-zaki which involves steeping of millet grains, wet milling with spices (ginger, cloves, and pepper), wet sieving and partial gelatinization of the slurry, followed by addition of sugar to taste and bottling.

As a cereal product - Kunnu-zaki can supply carbohy-drates, proteins, fats, minerals and vitamins if the nutrients are not destroyed by over processing (Chapman and Cater, 1976). According to Hamad and Fields (1979) there is significant increase in the relative nutritive value of several cereals after natural fermentation. Fermen-tation in the case of kunnu-zaki is by lactic acid bacteria and yeast (Adeyemi and Umar, 1994). Unlike other traditional cereal-based alcoholic beverages, information is scanty on the manufacturing process, quality and rheological characteristics of kunnu-zaki. In its traditional manufacture, the basic processes are not standardized and levels of ingredients such as spices and sweetener are not quantified.

One of the unit operations that vary from one processor to the other is the steeping period. The effect of these variations on the quality of kunnu-zaki is yet to be inves-

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tigated. The objective of this work was to study the effect of steeping time on the Physico-chemical, nutritional quality and consumer acceptability of the kunnun-zaki

MATERIALS AND METHODS

The materials used are millet (*Pennisetum typhoides*), spices-ginger (*Zingiber officinale*), Black pepper (*Piper niger*), Red pepper (*Capsian annum*) and cloves (*Syzygium aromaticum*), and granulated sugar.

These materials were obtained from local markets in Abeokuta, they were cleaned and sorted.

Preparation of Kunnu-zaki

500 g of dehulled millet grains were cleaned and sorted, weighed and steeped in 1000 ml of water at room temperature for 48 h. The same procedure was repeated four times after steeping each sample was milled with 3.25 g ginger, 0.25 g cloves, 1.25 g red pepper and 0.25 g black pepper .The resulting slurry was sieved using a sterile sieve until all the starch is extracted, the shaft were then discarded. The filtrate was allowed to settle, the supernatant decanted and the sediment was divided into 2 parts (ratio 3:2). The larger portion was cooked by the addition of 500 ml boiling water for 5 min while 500 ml cold water was added to the second part. The two slurries were thoroughly mixed and sweetened with 50 g granulated sugar (i.e. 10% sugar w/w millet used).

Proximate analysis

Moisture content

The moisture content was determined according to (AOAC, 1990) method.

Ash content determination

The ash content was determined according to (AOAC, 1990) method.

Crude fibre determination

2 g of the sample was accurately weighed into a fibre glass and 100 ml of 0.255 N H_2SO4 was added. The mixture was heated under reflux for 1 h with the heating mantle. The hot mixture was filtered through a fibre sieve cloth. The filterate obtained was thrown off and the residue was returned to the fibre glass to which 100 ml of 0.31 N NaOH was added and heated under reflux for another 2 h. The mixture was again filtered through a fibre sieve cloth and 10 ml of acetone was added to dissolve any organic constituent. The residue was washed with about 50 ml hot water twice on the sieve cloth before it was finally transferred into the crucible. The crucible and the residue were oven dried at 105ºC overnight to drive off moisture.

Fat determination

Gravimetric Rose-Gottlieb method as described by Pearson (1981) was used.

Protein determination

The protein content of the sample was determined by using formal titration method as described by Pearson (1981).

pH determination

The pH was measure using Electrometric pH meter (Genway, 4590). This was calibrated by the use of prepared buffer solutions of accurately known pH (pH 4 and pH 9). 30 ml of the sample was measured into a curvette and the glass electrode of the pH metre was dipped into the sample.

Total titratable acidity

The titratable acidity of the product was measure by direct titration as described by Pearson (1981).10 ml of the sample was pipetted into each of two beakers labeled C and S. To the colour control beaker, 1 ml of rosanilline solution was added and stirred. To sample beaker S, 1 ml of phenolphthalein indicator was added and titrated with 0.1 M NaOH, with continuous stirring until the colour matched the pink colour of C. The acidity was calculated as the lactic acid (percent m/v).

Specific gravity determination

The specific gravity of each sample was determined using the picnometer - specific gravity bottle. The bottle was washed, rinsed and dried. The empty bottle was weighed and mass recorded as M. It was filled with sample and weighed, mass recorded as M_1. The bottle was emptied, rinsed and filled with water and weighed, mass recorded as M_2. The specific gravity was calculated

Sensory evaluation

The four different kunun zaki steeped for varying period of time were subjected to sensory evaluation. A total of twenty untrained panelist drawn from the University of Agriculture, Abeokuta based on their familiarity with the product were used for the evaluation. The parameter evaluated includes taste, colour, flavour, sweetness and overall acceptability. The coded samples were served in clean transparent plastic bottles at room temperature ($25^{O}C$) in individual booths with adequate florescent lights. Sample presented to the panelists was at random and one at a time. The panelists were given enough water to rinse their mouths between each sample. The nine-point Hedonic scale (Larmond, 1977) was used for the evaluation and the resulting data were analyzed using analysis of variance (ANOVA) to establish significant differences among treatment. Duncan multiple range test was used to separate means where significant differences existed (Duncan, 1955).

RESULTS AND DISCUSSION

Sensory Evaluation

The mean sensory scores for mouth feel, colour, taste, flavour, sweetness and over all acceptability of kunun zaki samples prepared from millet grains steeped for varying period of time are given in Table 1. The highest mean values of preference were obtained from 36 h steeping. The analysis of variance revealed no significant difference in all the samples in terms of mouth feel, flavour and sweetness at 5% probability level. However, sample steeped for 36 h was rated highest in mouth feel and flavour. Relatively equal rating of the samples in terms of sweetness and flavour were probably as a result

Table 1. Mean of sensory scores.

Parameters	Duration of Steeping							
	12 hours		24 hours		36 hours		48 hours	
Mouth feel	5.45[a]	1.9	6.20[a]	1.3	6.20[a]	1.29	5.45[a]	1.76
Overall acceptability	5.65[b]	2.0	6.65[ab]	1.7	6.80[a]	0.9	6.35[ab]	1.3
Colour	6.00[b]	2.0	6.65[ab]	2.0	7.40[a]	1.1	7.25[a]	1.2
Taste	5.45[b]	1.6	6.40[ab]	1.6	6.70[a]	0.9	5.95[ab]	1.7
Flavour	5.75[a]	1.6	6.40[a]	1.2	6.20[a]	1.7	5.70[a]	1.7
Sweetness	5.90[a]	1.9	6.05[a]	1.9	6.85[a]	1.1	5.90[a]	1.4

[1]Values are mean standard deviation of 20 participants

[2]Mean along the same row with different superscript are significantly different from each other at 1% probability level.

Table 2. Proximate composition of Kunun-zaki on dry basis.

Parameters	Duration of Steeping							
	12 hours		24 hours		36 hours		48 hours	
Crude protein	5.16d	0.003	5.78c	0.005	5.86b	0.007	6.35a	0.002
Fats content	19.02c	0.009	22.67b	0.002	24.08a	0.001	24.13a	0.005
Ash content	2.20a	0.002	2.19a	0.007	2.17b	0.007	2.13c	0.007
Carbohydrates	73.59a	0.007	69.38b	0.003	67.84c	0.009	67.44d	0.003

Mean along the same row with different superscript are significantly different from each other at 1% probability level.

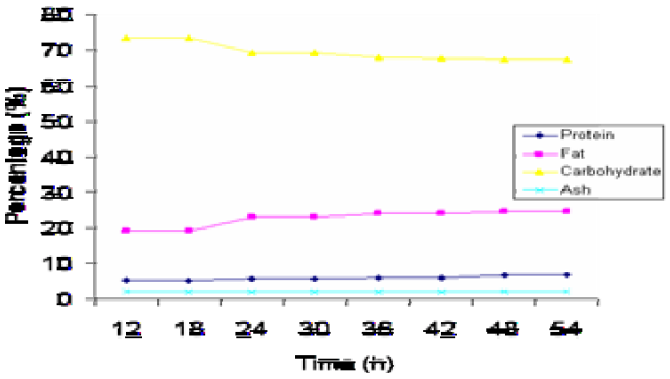

Figure 1. Variation in protein, fats, carbohydrates and ash contents of Kunun-zaki with different steeping time.

of equal amount of sugar and spices added to each sample after fermentation, during the production to ensure that there is no variation in the factors of production other than the steeping time. There were significant differences in the colour of the samples at probability level of 5%, with samples steeped for 36 and 48 h rated relatively equal and better. There were no significant differences in the taste and over all acceptability; however from the mean separation, 2 homogenous sub-sets were obtained with sample steeped for 36 h rated highest (best) in taste and overall acceptability.

Proximate composition

Table 2 shows the proximate composition of kunun zaki on dry basis. The result of the analysis of variance revealed significant difference between the values of crude protein, fats, ash and carbohydrates contents obtained for each steeping time.

A plot of the variation in crude protein, carbohydrates, fats and ash contents with steeping time was made (Figure 1). Kunun zaki steeped for 12 h contains 5.2% protein, while that of 36 h has 6.4% protein. In general, a gradual increase was observed in trend of protein with steeping time. This agrees with the report of Hamad and Fields (1979), Au and Fields (1981), Kazanas and Fields (1981), that there was significant increase in the relative nutritive value of proteins after natural fermentation (occurring during steeping). Kazanas and Fields (1981) also reported increase in average nutritive value of proteins by 10.67% lysine and iso leucine increase from 8.60 to 10.50 mg/g and Nitrogen from 8.33 to 109.58 mg/g after fermentation. Suberu (2001) also reported that a gradual increase in total soluble proteins of kunun zaki accompanied natural fermentation.

Figure 1 also shows the variation in carbohydrates with steeping time. 73.6% was reported in the product steeped from 12 h while 69.4% was recorded for 24 h. The rapid decrease was probably as a result of decrease in starch content during fermentation according to Usha et al. (1996) and high consumption of sugar by microbes

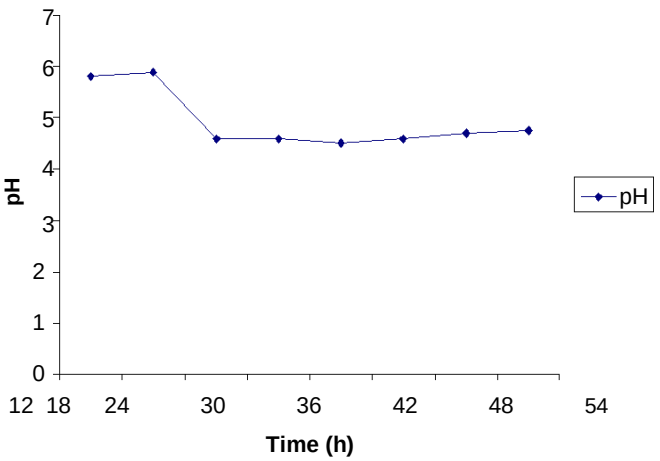

Figure 2. Variation in pH of Kunun-zaki with different steeping time.

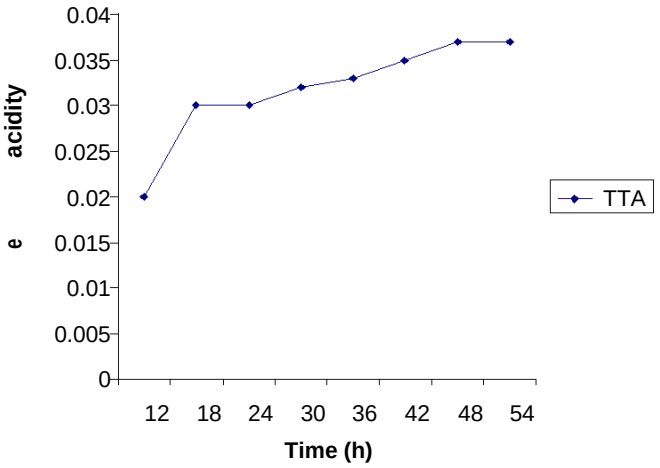

Figure 3. Variation in Total Titratable Acidity Kunun-zaki with different steeping time.

which are mainly active at this stage. Carbohydrates recorded for the subsequent steeping time decrease at a lower rate. Consumption of sugar in the production of organic acids was probably slower due to the feedback inhibition of the microbes by accumulated acidity.

The variation in fats content with steeping time was also demonstrated in Figure 1. From 12 h of steeping time there was a gradual increase in fats content of the products.

The ash content with corresponding steeping time was also recorded in Figure 1. The ash content of product steeped for 12 h was 2.2%, for 24, 36 and 48 h lower value were obtained.

Figure 2 shows the value for pH, titratable acidity and specific gravity of the kunun zaki steeped for different period. The result of analysis of variance indicates that there was a significant difference between the values.

Decrease in pH was a result of increasing hydrogen ion content probably due to the microbial activity on the carbohydrates and other food nutrient to produce organic acids. The range agrees with the report of Adeyemi and Umar (1994).

Analysis of variance of the results of the titratable acidity shows that there was a significant difference at ($p<0.05$) between the values in general; there was increase in titratable acidity with increasing steeping time. 0.0154% was obtained at 12 h steeping, 0.0262% at 24 h and 0.0340% at 48 h (Figure 3).

Conclusion

The relationship between the physical, chemical properties and nutritional parameters of kunun zaki and the steeping time of the millet grains was described. There were significant differences in the colour of the samples at probability level of 5%, with samples steeped for 36 and 48 h rated relatively equal and better. It can be concluded that In conclusion section, the relationship between the physical, chemical properties and nutritional parameters of kunun zaki and the steeping time of the millet grains was described. It can be concluded that Kunun zaki from millet grains steeped for 36 h produced the best sensory and nutritional characteristics.

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