The Nutritional and Sensory Quality Characteristics of Kunun-zaki Produced with the Addition of Hydrolytic Enzymes from Malted Rice (Oryza sativa)


Department of Science Laboratory Technology, The Federal Polytechnic, P.M.B. 55 Bida 912001, Nigeria.
*Corresponding author

Abstract

Kunun-zaki was produced from millet (Pennisetum typhoidem), sorghum (Sorghum bicolor) or maize (Zea mays) with or without the addition of hydrolytic enzymes obtained from ground-malted rice (Oryza sativa FARO 37) and analyzed for its chemical and organoleptic quality attributes. The results obtained show that there were 33, 44, 66% increases in crude protein 52, 117 and 91% increases in sucrose contents in those products (ie kunun-zaki produced from millet, sorghum and maize respectively) in which the extracts from ground-malted rice were incorporated. A similar increase was observed in acidity, iron, calcium and phosphorous contents. Furthermore, the sensory attributes of kunun-zaki produced using extracts from ground-malted rice did not differ (p>0.05) from the other products in appearance, taste, texture and sensory overall acceptability but differed (p<0.05) in aroma, which could be attributed to the production of more organic acids in these products by the fermenting microorganisms. The result obtained in this study therefore suggests that it could be economical and nutritious to use malted cereal grains in the production of kunun-zaki.

Introduction

Kunun-zaki is a popular locally fermented non-alcoholic cereal beverage produced from sorghum, millet or maize, spiced (ginger, black pepper, clove) and sweetened with sugar (Aderemi and Umar, 1994). Studies by some workers show that kunun-zaki is rich in carbohydrate, B vitamin and minerals but low in protein (Ayo and Okaka, 1998).

In the production of kunun-zaki, two methods are employed. In one of the methods, the cereal is steeped in water for 24hrs, wet milled and sieved. The sediment obtained is divided into two unequal portions; one portion is cooked and then mixed with the uncooked portion (being the source of inoculum) and allowed to ferment for 8-10hrs (Efunweewe and Akoma, 1995). In the second method, a portion of the cereal is malted, dried, ground and then mixed with the uncooked portion. This mixture is then added to the cooked portion and stirred vigorously and allowed to ferment. The hydrolytic enzyme (amylase) in the malted cereal aids in digesting the thick slurry thereby converting the complex carbohydrate to simple sugars. The final product is usually sweet. Ayo and Okaka (1998) exploited the hydrolytic properties of the crude extracts of Cadaba farinosa in obtaining a similar sweet product.

A study on the glycemic effect of kunun-zaki on the blood glucose in non-diabetic persons by Awogbenga et al (1999) shows that kunun-zaki has similar response but lower glycemic index as compared with those of high energy drinks (glucose) suggesting that kunun-zaki would be beneficial to diabetic patients. The aim of the present work is to evaluate the nutritional and sensory quality attributes of kunun-zaki produced using the hydrolytic enzymes from malted rice grains.

Materials and Methods

Millet (Pennisetum typhoidem), sorghum (Sorghum bicolor), maize (Zea mays) and spices such as ginger (Zingiber officinale), black pepper (Piper sp) and clove (Eugenia sp) were purchased from Post Office Market Bida. Paddy rice (Oryza sativa FARO 37) was purchased from the National Cereal Research Institute Badejji, Niger State. These grains were sorted, cleaned and stored in cellophane bags.

Malting

A 500g of the paddy rice was washed with tap water and soaked in 1000ml of tap water (1:2 w/v) for 12hrs and then drained. The drained grains were couched by covering them with moist cloth for 3-4days at ambient temperature (25-30°C) to germinate. The dried malted rice were ground and packed in cellophane bags.

Production of kunun-zaki

Kunun-zaki was produced from millet, maize and sorghum respectively. The cleaned grains were steeped in tap water (1:2 w/v) for 24hrs, mixed with spices and washed in fresh tap water before wet milling. The resulting slurry (i.e. paste) was then sieved (mesh size: 350mm) in excess tap water. Following sedimentation, both the uncooked and cooked pastes (at 45°C) were mixed in an unequal ratio (1:3v/v) as described by Efunweewe and Akoma (1995), followed by further dilution with 3vol. water. This mixture was allowed to ferment for 8-10hrs (ambient temperature) to kunun-zaki, which was sweetened with sugar to taste.

The same procedure was adopted in the production of kunun-zaki using ground-malted rice grain. However, in the later, the ground-malted rice was mixed with the uncooked paste (1:4w/w) before being added to the cooked paste (i.e.
gelatinized starch at 45°C and stirred vigorously for about 5 min. This mixture was allowed to ferment for 8-10 hrs following which it was sieved (aseptically). Artificial sweetening agent was not added to this product.

**Chemical analysis**

The pH of the various samples was measured with pH meter (Model 7020 Electronic Ltd., England) after standardization with pH 4 and 7 buffers (BDH, England). Titratable acidity (TA % lactic acid) was determined by titration of 10 ml kunun-zaki against 0.1 N NaOH to phenolphthalein end point. Total soluble solids were determined in duplicates using Abbe 60 Refractometer and the result expressed as degree Brix (*Brix*).

Acidity (volatile) and specific gravity of the samples were determined as described by Pearson (1976) while ash, sugar (% sucrose) and protein content were determined according to AOAC (1980) methods.

Calcium and iron contents of the samples were determined with an automated atomic absorption spectrophotometer (Perkin-Elmer, model 2380). The samples and standard solutions were prepared according to the procedures of the AOAC (1980). Total phosphorus in the samples was determined with a Technician Autoanalyzer (AA 11) after incubation with molybdo-vanadate solution (AOAC, 1980).

**Sensory evaluation**

The sensory attributes (appearance, taste, texture, aroma and overall acceptability) of kunun-zaki produced from various cereals were evaluated by a 10-member panel, comprising of students and lecturers in the Department of Science Laboratory Technology using a 7 point hedonic scale; where 1 = like extremely, 4 = neither like nor dislike and 7 = dislike extremely (Larmond, 1977) to assess the level of acceptability of the products.

**Statistical analysis**

Mean differences in sensory quality were computed using analysis of variance (ANOVA).

**Results and Discussion**

The kunun-zaki produced with the addition of ground-malted rice to either millet, sorghum or maize as shown in Table 1 resulted in 33, 44, 63% increases in crude protein as well as 52, 117 and 91% increases in sucrose contents respectively. A similar trend was observed in the phosphorus, calcium, iron and ash contents (Table 1). The implication of rice increase in the quantity of hydrolytic enzymes (amylase, protease etc) present in them resulting in products that are more nutritive than those kunun-zaki produced without the addition of malted rice. Also, the higher sucrose contents of these products could possibly account for the higher acidity of these products as against those obtained from other treatments (Table 1). Similarly, the pH of the kunun-zaki during the production stage showed a marked decrease with concomitant increase in titratable acidity in all the treatments, however, these changes were more prominent in those substrates treated with extracts from ground-malted rice (Figures 1 and 2). Lactic acid bacteria fermentation has been shown by several workers to improve the nutritional quality of foods: there is increase in bio-availability of iron and other minerals (Anderson, 1988), phosphorus is released from phytate (Lopez et al. 1983) while thiamine and riboflavin are increased (Steinraus, 1983). Therefore, the results obtained in this present study agree with the findings of these workers.

The organoleptic quality of kunun-zaki produced using the combinations of cereal and ground-malted rice did not differ significantly (p>0.05) from other products in sensory attributes except in aroma (Table 2). It is likely that the higher acidity of these products (Table 1) possibly enhanced their aroma thereby making them preferable (Table 2). Ayo
Figure 1: Changes in pH of kunun-zaki during production.

Figure 2: Changes in TA of kunun-zaki during production.

and Okaka (1998) reported producing sweetened kunun-zaki by using crude extracts of Cadaba farinosa (a hydrolytic enzyme), which according to these workers digested the thick gelatinous starch of the cereal substrate used in the production to smaller units (maltose, glucose and dextrin).

Intense souring activity (evident by gas bubbles) was observed as fermentation progressed particularly at the 6th hour in those substrates previously treated with hydrolytic enzymes from ground-malted rice. A rapid breakdown (liquefaction) of the gelatinized starch was noticed when; the mixture of ground-malted rice plus uncooked and cooked paste was vigorously stirred together resulting in the production of sweet substrates. Other workers have advocated the use of an alternative sweetening agent for use in the production of kunun-zaki so as to reduce the rising cost of the product and as well as for health purposes (Ayo and Okaka, 1998; Awogbenga et al, 1999). This suggestion is confirmed by the results obtained in this study. We therefore conclude that it could be economical and nutritious to use malted cereal grains in the production of kunun-zaki.

References


