Pakistan Journal of Nutrition 9 (10): 1034-1038, 2010
ISSN 1680-5194

Nutritional Evaluation of Millet-beniseed Composite Based *Kunun-zaki*

J.A. Ayo[1,2], O.G. Onuoha[2], D.S. Ikuomola[1], Y.O. Esan[1], V.A. Ayo[2] and I.G. Oigiangbe[2]
[1]Department of Food Science and Technology,
Joseph Ayo Babalola University, Ikeji-Arakeji, P.M.B. 5006, Ilesa, Osun State, Nigeria
[2]The Federal Polytechnic, P.M.B. 0231, Bauchi, Nigeria

Abstract: *Kunun-zaki* was prepared using millet as the base and supplemented with beniseed at varied level (0-50%). The effect of added beniseed on the physio-chemical (moisture, ash, protein, fat and carbohydrate), sensory (colour, taste, odour/aroma, mouth feel and general acceptability) and microbial qualities were evaluated. The added beniseed decreased the moisture, ash and carbohydrate composition from 86.23-85.03, 0.33-0.22 and 10.21-7.23%, respectively with increasing concentration (0-50%), while fat and protein increased from 1.03-2.03% and 2.21-5.44% respectively with increasing concentration (0-50%). The added beniseed paste had a high positive correlation coefficient (r = 0.75-0.95) with the increase in the protein, fat and energy content. There were significant differences in the assessed sensory qualities (colour, odour, taste, texture) at 20% and above added beniseed paste which corresponds with 3.32%, 1.26% and 64.06 kcal of protein, fats and energy content respectively. At this acceptable level the protein content of the products has been improved by 50% if digested and absorbed.

Key words: Nutritional, evaluation, millet-beniseed composite, *Kunun-zaki*

INTRODUCTION

Kunun-Zaki is a traditional beverage made from grains such as millet (*Pennisetum spp*), Sorghum bicolor, maize (*Zea mays*) etc. *Kunun-zaki* is the most popularly consumed non-alcoholic drink in Nigeria, taken for its thirst quenching property and used for entertainment at homes and during unique ceremonies like Salah and Christmas. Major types of *kunun zaki* include: *Kunun zaki, kunun gyada, kunun akamu, kunun tsamiya* and *kunun baule* (Gaffa, 2000).

Research has shown that cereal could be used in composite form in the production of *Kunun zaki* but millet and sorghum grains are the most commonly used basic raw material. The preferred ratio of mixing is 1:2 (w/w) sorghum/millet. The traditional production process involves steeping the grains in local house hold utensils such as buckets, drums, calabashes or earthen ware vessels (Adeyemi and Umar, 1994). The steeping duration depends on the cereal used but may vary between 12-72 h for millet/sorghum and maize respectively (Gaffa, 2000). Grinding of the steeped grains mixed with species (ginger, clove, red and/or black pepper) is done with local milling machine and part of the slurry (3/4 volume) is gelatinized with boiling hot water (Onuorah *et al*., 1987a). The remaining part of the slurry (1/4 volume) ungelainized containing liquefied agents (sweet potato tuber paste, malted rice, extract of *Cadaba farinosa* stem) is mixed with the gelatinized portion when the temperature is about 60-70°C. The mixture is altogether left overnight at room temperature for chance fermentation and filtered using local sieve the next morning. The filtrate, *Kunun-zaki* is consumed as a beverage with or without addition of sugar as a sweetener. The whole process lasts about 24 h. The nutrient content and microbiological quality of this product had been reported (Gaffa *et al*., 2002b; Onuorah *et al*., 1987b). The consumption rate of the beverage has also been studied (Gaffa *et al*., 2002a). The gross chemical composition of *Kunun-zaki* is 87.85-89% moisture content, 9.84-12% carbohydrate, 1.56-3% protein, 0.10-0.30% fat and 0.61-0.75% ash (Adeyemi and Umar, 1994; Badifu *et al*., 1999) indicating that the drink is low in protein.

Owing to the high demand for this product and the high consumption rate, it is thought that the present traditional production process is outdated, inefficient, time consuming and with product quality varying between batches. In this present study, attempts have been made to improve on the traditional production process with the hope of maintaining nutrients and improving microbiological quality of the final product. The nutrient and sensory qualities of *Kunun-zaki* from new process has been analyzed and compared with the traditional process.

Problems associated with *Kunun-zaki* production include non-uniformity in the production method, poor sanitary conditions and short shelf-life of the product. The low protein content of *Kunun-zaki* and its general acceptability should be a thing of concern.

This work is aimed at producing a high qualitative *Kunun-zaki* in terms of nutrients using locally available and less used raw materials as beniseed. The objective of the research which includes: Production of beniseed-millet composite *Kunun-zaki* of varied, substitution using beniseed grain (5-50%), evaluating the nutrient content by determining the chemical composition,

Corresponding Author: J.A. Ayo, Department of Food Science and Technology, Joseph Ayo Babalola University, Ikeji-Arakeji, P.M.B. 5006, Ilesa, Osun State, Nigeria

evaluating the sensory quality (taste, colour, odour/aroma, texture and general acceptability) and microbial analysis of the products.

MATERIALS AND METHODS

The millet *(Pinnesetum nigritarum)*, beniseed *(Seamum indicum)* red pepper *(Capsicum anuum)*, sweet potatoes *(Ipomoea batatas)*, ginger (*Zingiber officinale)*, and sucrose were purchased at Muda Lawal market in Bauchi state.

The millet rains were steeped in water (at 30°C for 12 h), washed, wet milled with added spices (clove, ginger, red pepper) and divided into unequal parts (1:4). The larger parts (3/4) was gelatinized (by addition of hot water, 1:3 of paste to hot water), cooled to 40°C and added to the ungelatinized portion, mixed thoroughly, supplemented with benised (5, 10, 15, 20, 25, 50%), fermented (left for 12 h), filtered (cloth sieve), sweetened(addition of 4% sucrose) and packed (Fig. 1, Table 1) ready for analysis.

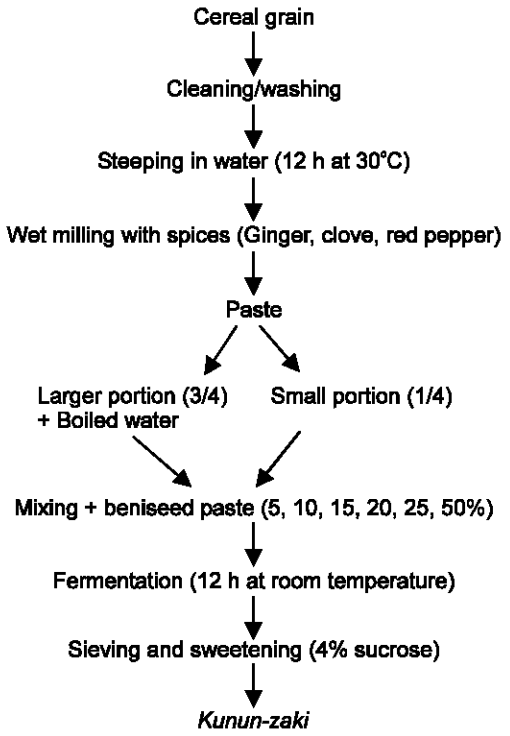

Fig. 1: Innovation in the traditional *Kunun-zaki* production process

Table 1: Recipe for improved *Kunun zaki* production

	Samples in grams (g)					
Materials	A	B	C	D	E	F
Millet	100.0	90.0	85.0	80.0	75.0	50.0
Beniseed	0.0	10.0	15.0	20.0	25.0	50.0
Clove	0.5	0.5	0.5	0.5	0.5	0.5
Ginger	4.0	4.0	4.0	4.0	4.0	4.0
Chilli pepper	0.5	0.5	0.5	0.5	0.5	0.5
Sweet potato	15.0	15.0	15.0	15.0	15.0	15.0
Sugar	10.0	10.0	10.0	10.0	10.0	10.0

The chemical composition (moisture, protein, fats, ash and carbohydrate), microbial and sensory quality of the products were analyzed (AOAC, 1990; Jidean and Jideani, 2006; Lamon, 1977).

Sensory evaluation was carried out on each coded products. Assessed qualities include: colour, taste, odour and aroma, after mouth feel and general acceptability. Twenty (20) untrained panelists were selected at random from Department of Food Science and Technology, Federal Polytechnic, Bauchi. Evaluation was based on the above named quality parameters and were assessed accordingly. A nine (9) point Hedonic scale was used (1 and 9 for extremely like and extremely dislike, respectively). Coded samples of the same sizes and at the same temperature (30°C) were served in transparent glass cup to judge in each panel cupboard under fluorescence light. Data collected were subjected to analysis of variance at $p \leq 0.05$ (Lamon, 1977).

RESULTS AND DISCUSSION

The effects of added beniseed paste to millet based *Kunun zaki* are summarized in Table 2, 3 and 4.

Effect of added beniseed paste on chemical composition of *Kunun zaki*: The moisture content of the *Kunun-zaki* generally decrease from 86.23-85.08% with increase in percentage added beniseed paste (0-50%). Thus 100% millets based *Kunun-zaki* had the highest moisture content (86.23%) while the least (85.05%) value was obtained for sample containing 15% beniseed. The generally high moisture content agrees with the finding of Enegbede (1999) and Sopade and Kassum (1992) that *Kunun-zaki* generally contain 85.8% moisture. The moisture content of any food could be an index of its water activity. Frazier and Westhoff (1976), reported that bacteria requires more moisture than yeast and yeast than mould. This implies that spoilage organisms likely to survive in this could be major causes of the short shelf-life of *Kunun-zaki*. The ash content decreased from 0.33-0.22% with increasing beniseed concentration (Table 2). The *Kunun-zaki* sample with 0% beniseed content the highest ash content of 0.33% while that of 50% had the least with 0.22%. The amount of ash content compared with the work done by Sopade and Kassum (1992), that *Kunun-zaki* contain 1.5% of ash content. This might had probably resulted from the fact that beniseed is rich in mineral.

The crude fat of the *Kunun-zaki* increased from 1.03-2.03% with the addition of beniseed (0-50%) as stated in the Table 2. The *Kunun-zaki* sample with 50% beniseed had the highest fat content (2.03%) while that of 0% beniseed had the least fat content (1.03%). This result agrees with the findings of Sopade and Kassum (1992), that *Kunun-zaki* has a fat content of 1%. The increased concentration of beniseed from 0-50% could

Table 2: Effect of added beniseed on the chemical properties of *Kunun zaki*

Material		Physicochemical properties (%)					
Beniseed	Millet	Moisture content	Ash	Fat	Protein	Carbohydrate	Energy (kcal)
0	100	86.23	0.33	1.03	2.21	10.21	58.95
5	95	85.98	0.26	1.07	2.64	10.05	60.39
15	85	85.65	0.24	1.25	2.72	9.94	61.89
20	80	85.32	0.24	1.26	3.32	9.86	64.06
25	75	85.21	0.22	1.29	4.08	8.80	63.13
50	50	85.08	0.22	2.03	5.44	7.23	68.95

Table 3: Sensory quality of millet-beniseed based *Kunun zaki*

Material (%)		Sensory quality				
Beniseed	Millet	Color	Taste	Odour	After mouth feel	G. Acceptability
0	100	7.6^{a}	7.9^{a}	7.75^{a}	8.0^{a}	8.0^{a}
5	95	6.9^{a}	6.95^{ab}	6.95^{ab}	6.8^{ab}	7.0^{ab}
15	85	7.2^{a}	6.9^{ab}	6.65^{ab}	6.25^{bc}	7.0^{ab}
20	80	7.05^{a}	6.10^{b}	6.15^{bc}	5.9^{cd}	5.85^{b}
25	75	6.55^{a}	5.25^{c}	5.25^{cd}	5.35^{d}	4.90^{d}
50	50	5.65^{b}	3.85^{d}	4.50^{d}	3.95^{e}	4.05^{c}

Average mean score equal to or greater than the corresponding L.S.D along the same column are significant difference, $p \leq 0.05$.
LSD = Least Significant Difference

Table 4: Microbial load of the products

Beniseed (%)	Millet	pH	Total microbial count	Bacterial count	Characteristics	Microorganisms
0	100	3.66	1.2×10^{5}	1.2×10^{3}	Bluish green flucose malted mycelia, conidiosphore bearing phialides (flask shaped) that produce spore	*Aspergillus*
5	95	3.37	2.0×10^{5}	1.4×10^{3}	Green/black mycelia, spore on flask shaped sterigmata	*P. digitatum*
15	85	3.46	2.0×10^{5}	1.5×10^{3}	Small dryshining mucoid colourless opaque, G^{+},LF colonies on MC	*Streptococcus pyogenes*
20	80	3.33	2.0×10^{5}	1.5×10^{3}	Round white colonies in chain	*Staphilococcus*
25	75	3.32	2.0×10^{5}	1.6×10^{3}	Short rods in single and two branch colonies with space in middle	*Lactobacillus*
50	50	3.39	2.1×10^{5}	1.6×10^{3}	Small dry shining mucoid colourless opaque G^{+}, LF colonies on MC	*Streptococcus pyogenes*

have resulted in the high fat content of the *Kunun-zaki* due to the high fat content of the added beniseed. This agrees with the reported work of Oresanya and Koleoso (1990), that beniseed is very high in fat content (57.15-63.40%).

The crude protein content of *Kunun-zaki* produced increased from 2.21-5.44% with addition of beniseed (Table 2). The *Kunun-zaki* sample with 50% beniseed level had the highest protein content (5.44%) while that of 0% beniseed level had the least protein (2.21%). The general high protein content agree with the findings of Douglas and Glenn (1982), that beniseed is very rich in protein, therefore could boost the protein content of *Kunun-zaki*.

The carbohydrate content in *Kunun-zaki* is found to be higher at 0% beniseed (10.21%) while the sample with 50% had the least carbohydrate content (7.23%) with addition of beniseed (Table 2). The result agrees with the findings of Sopade and Kassum (1992), that *Kunun-zaki* contain 12.2% of carbohydrate. It indicated that, the nitrified material (beniseed) which contains relatively lower carbohydrate could have affected the carbohydrate content in the *kunun-zaki* by reducing its contents and increases the protein of the *Kunun-zaki*.

Effect of added beniseed paste on the sensory quality of *Kunun zaki*: The average mean scores of colour decreased from 7.60-5.60 with increasing percentage of added beniseed (0-50%) as shown in Table 3. Statistical analysis show no significant difference between 0-25% but there was significant difference in colour at above 25% beniseed, p = 0.05. The colour changes with increasing concentration of beniseed added could be due to the golden yellow colour of added beniseed which defer from normal colour of locally produced *Kunun-zaki* (Oresanya and Koleoso, 1990).

As the concentration of the beniseed increased from 0-50%, the average mean score for taste decreased from 7.9-3.85. There were no significant difference in the average means scores of taste on addition of beniseed at less than 15%, p = 0.05. The effect of beniseed on *Kunun-zaki* of above 15% could be as a result of

the inherent bitter taste of beniseed. This result agrees with the findings of Douglas and Glenn (1982), that beniseed have a slight bitter taste.

The result of the average mean score of the odour/aroma of the *Kunun-zaki* decreased from 7.75-4.5 with increasing level (0-50%) of added beniseed. There was no significant difference at less than 15% added beniseed, p = 0.05. This result agrees with the findings of Douglas and Glenn (1982), that beniseed (sesame) have an inherent off flavor.

The average mean score of texture decreased from 8.0-3.95 with the concentration of beniseed (0-50%) as shown in Table 3. This could be as a result of the texture of the beniseed which is not as fine as that of *Kunun-zaki*. This result agrees with the finding of (Sweiss, 1983), that beniseed is rich in fibre (6.3-8.6%).

The average mean score of general acceptability decreased from 8.0 to 4.05 with increase in concentration of beniseed (0-50%) as shown in Table 3. The sample with 0% beniseed (100% millet) had the highest acceptability (8.0%), while sample with 50% beniseed proportion had the least acceptability (4.05%).

Effect of added beniseed paste on the Microbial quality of *Kunun zaki*: The effect of the added beniseed on the *Kunun zaki* is summarized in Table 4. The total microbial count and bacterial count increased from 1.2 x 10^5 to 2.1 x 10^5 and 1.2 x 10^3 to 1.6 x 10^3 cfu with the percentage added beniseed paste.

Microbial isolates obtained from the *Kunun-zaki include; Streptococcus* species, P*ennicillium digitatum, Lactobacillus leichmanni*, *Lactobacillus fermentum* and *Aspergillus*. The presence of *Lactobacillus leichmanni and* Lactobacillus fermentum could be due to the fermentation process as confirmed by early researcher (Akoma *et al*., 2006) while the presence of *Aspergillus spp*. suggest contamination for leguminous grains. However, the level of total microbial count is still lower than the maximum acceptable count of 1.0 x 10^7 cfu the beverage (Kolawole *et al*., 2007). The generally high moisture content of *Kunun-zaki* could encourage microbial spoilage if not properly treated. The adoption of pasteurization and appropriate packaging is hereby suggested.

Conclusion and recommendation: The research work has shown that addition of Beniseed paste did increase the protein and fat content of *Kunun-zaki*. However, the acceptability was mostly preferred at 20% and below which corresponds with an increase in the protein content (50.22%) and fat content (22.3%). This can be said to be a great improvement in the nutrient content if it can be digested and assimilated to the body. The relative high fat content though could improve the nutrient, but can pose problem as it coulds encourages rancidity in the product. The use of defatted beniseed is therefore encouraged.

REFERENCES

AOAC, 1990. Association of Official Analytical Chemists, Official Methods of Analysis. Sidney Williams (Ed.). 14th edition, Arlington. Viginia.

Adeyemi, I.A. and S. Umar, 1994. Effect of method of manufacture on quality characteristics of Kunun-zaki, a millet based beverage (NIFST). Nig. Food J., 12: 36-38.

Akoma, O., E.A. Jiya, D.D. Akumk and E. Mshelia, 2006. Influence of malting on the nutritional characteristic of Kunun-zaki. Afr. J. Biotechnol., 5: 996-1000.

Badifu, G.I.O., I.C. Anounye and C.U. Inyang, 1999. Development and stability of spiced soy-millet flour for the preparation of Soy-kunun-zaki. A non-alkoholic Beverage J. Applied Sci. Manage., 2: 93-97.

Douglas, M. and D.D. Glenn, 1982. Food and Food production Encyclopedia. 1st Edn., Van Most Rand, Reinhold, pp: 131-592.

Enegbede, O.L., 1999. Comparative Sensory Evolution on the Production of Kunun-gyada from different Cereals. HND Thesis. Federal Polytechnic, Bauchi, pp: 3, 8-11.

Frazier, W.C. and D.C. Westhoff, 1976. Food Microbiology. McGraw Hill Book Company, NewYork.

Gaffa, T., I.A. Jideani and I. Nkama, 2002a. Traditional production, consumption and storage of Kunun-a non alcoholic cereal beverage. Plant Food Human Nutr., 57: 73-81.

Gaffa, T., I.A. Jideani and I. Nkama, 2002b. Nutrient and sensory qualities of *Kunun-zaki* from different saccharifying agents. Int. J. Food Sci. Nutr., 53: 109-115.

Gaffa, T., 2000. Improving Traditional Kunu Production and its Storage Stability. Ph.D Thesis. Biological Science Programme, Abubarkar Tafawa Balewa. University of Bauchi-Nigeria.

Gaffa, T., I.A. Jideani and I. Nkama, 2002. Traditional Production, Consumption and Storage of Kunu a non Alchoholic cereal beverage. Plant Food Human Nutr., 57: 73-81.

Jideani, V.A. and I.A. Jideani, 2006. Laboratory Manual of Food Bacteriology. Amana Press, pp: 94, 114, 151 -155, 177.

Kolawole, O.M., R.M. Kayode and B. Akinyo, 2007. Proximate and microbial analysis of burukutu and pito produced in Ilorin, Nigeria. Afr. J. Biotechnol., 3: 587-590.

Lamon, 1977. Comparison of traditional and modern, food ration system. Information, 29: 785-804, Sage London.

Onuorah, S.I., A.A. Adesiyun and J.O. Adekeye, 1987a. Ocurence of staphylocucci and utensils used in its preparation in Samaru-Zaria. J. Food Agric., 1: 31-34.

Onuorah, S.I., A.A. Adesiyun and J.O. Adekeye, 1987b. Survival and multiplication of *Staphylococcus aureus* and *Escherichia coli* in a Nigerian cereal drink (kunun-zaki): Effect of Spices, pH and temperature. J. Food Agric., 1: 31-34.

Oresanya, M.O. and O.A. Koleoso, 1990. Beniseed Processing and Utilization. An Animal Report Submitted to the Federal Institute of Industrial Research, Oshodi (FIIRO) Lagos.

Sopade, P.A. and A.L. Kassum, 1992. Rheological characterization of Nigerian liquid and semi-liquid foods. Kunum zaki and Kunum gyada. Nig. Food J., 10: 23-33.

Sweiss, 1983. Complete studies of the crude extract of sesame seed. Scientific Res. Essay, 4: 584-589.