Pakistan Journal of Biological Sciences 5 (9): 970-973, 2002

Soybean Seed in Kunun Zaki Beverage Production

Gaffa, T., [1]I.A. Jideani and [2]I. Nkama
School of Technology, Federal Polytechnic, PMB 0231, Bauchi, Nigeria
[1]Biological Sciences Programme, Abubakar Tafawa Balewa University, Bauchi, Nigeria
[2]Department of Food Science and Technology, University of Maiduguri, Nigeria

Abstract: The role of soybean seed in kunun zaki production was investigated. The nutrient and sensory qualities of kunun zaki produced with varying concentrations of soybean were evaluated as well as that from other saccharifying agents. Increase in soybean seed concentration was found to increase crude protein and fat contents of the beverage from 3.19–8.86 % and 0.37–0.75 % respectively. The soybean product treated with warm water was preferred to that in which the seeds were slightly roasted. In all cases, kunun zaki produced with 4% (w/w) soybean seed was the most preferred to other concentrations. The product with soybean concentration above 4% was objectionable to consumers. Kunun zaki produced with incorporation of soybean was acceptable to the consumers just as that from the other saccharifying agents. The use of soybean seed in kunun zaki production as a saccharifying and enrichment agent is encouraged.

Key words: Kunun zaki, soybean, saccharogenic enzymes, enrichment, beverage

Introduction

Kunun zaki–a sweetened cereal based non-alcoholic beverage in Nigeria is prepared traditionally using millet, sorghum, or maize (Gaffa *et al*., 2002a). Although cereals are the major raw materials used in its preparation, other ingredients are also introduced such as spices to give taste to the final product (Onuorah *et al*., 1987). Some other groups of ingredients are also added that specifically aid in starch liquefaction/saccharification and include malted rice, malted sorghum, *Cadaba farinosa* and sweet potato paste (Gaffa and Jideani, 2001). The method of production is crude involving only household utensils and varies from locality to locality (Adeyemi and Umar, 1994). The consumption of the beverage is high particularly in northern Nigeria (Gaffa *et al*., 2002a) and is fast spreading all over the country as it costs less than the conventional carbonated drinks (Akpapunam *et al*., 1997).

As a cereal food, its nutrient content is deficient in protein and its proximate composition has been reported (Inatimi *et al*., 1987; Gaffa *et al*., 2002b). Since kunun zaki consumption is very high with some taking it three to four times daily and all age groups are involved, this might have some implications in the incidence of protein-energy malnutrition which is a major cause of infant mortality rate (Nkama and Malleshi, 1998). Some nursing mothers uses kunun gyada – a groundnut cereal based weaning food, but it is not very popular (Nkama *et al*., 1995). Soybean is a more popular high protein seed therefore a potential supplement for malnourished and protein deficient people, including many in Nigeria. The bean is readily available and was used for kunun zaki enrichment particularly the protein content. Moreover, soybean has been reported to contain some enzymes that can hydrolyze starch (Mikami and Morita, 1988) as the other ingredients aforementioned. In this study were introduced soybean seed in the preparation of kunun zaki and compared the nutrient contents and sensory qualities of the final product with other liquefying/saccharifying agents.

Materials and Methods

Place and duration of project: The experiments were conducted at the Science Technology and Food Science and Technology Departments, Federal Polytechnic Bauchi, Nigeria between January and August, 2001.

Materials: Soybean seed (TGX 844/29D) and *Sorghum bicolor* were bought from Bauchi State Agricultural Development Programme (BSADP) in Bauchi, Nigeria. Malted rice, sweet potato, *Cadaba farinosa* and ginger were obtained from Bauchi Central market. All ingredients were bought in their standard measures in bulk.

Preparation of soybean seed for kunun zaki production: Soybean seeds were weighed into 1, 3, 4 and 5 % (w/w) separately and used in the preparation of kunun zaki with sorghum bicolor as the main ingredient. The soybean seeds were prepared (Fig. 1) in two ways. One part was partially roasted over fire using a metal frying pan and the seed coat (testa) removed by pounding the seeds slightly in a mortar and pestle then winnowing. The second portion with the same weight ratios as the other portions were separately steeped in warm water for 2 h and the seed coat softened then removed with hand after cooling by rubbing between palms.

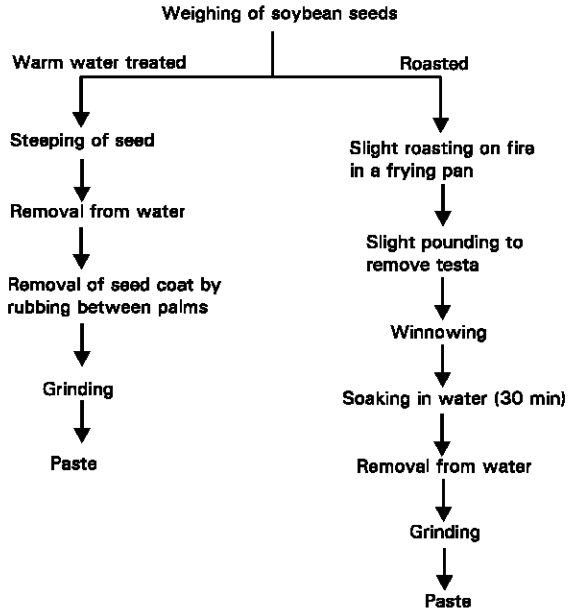

Fig. 1: Flow chart for roasted and warm water treated soybean paste preparation

Preparation of enriched kunun zaki with sorghum grains: The flow chart of the traditional production process (Fig. 2) common in Bauchi and States was followed. Sorghum grains (329 g) each were weighed into 8 different containers steeped in water for 12 h and drained. The grains with 1 % (w/w) ginger each as spice were washed with tap water three times to ensure thorough cleaning and ground into paste separately using a wet milling machine (disc attrition). To the ground paste, 700 ml of boiling water was added in each case to gelatinize the starch. This was allowed to cool (60-70°C) and each of the soybean paste was added to them separately, stirred to mix and left overnight for

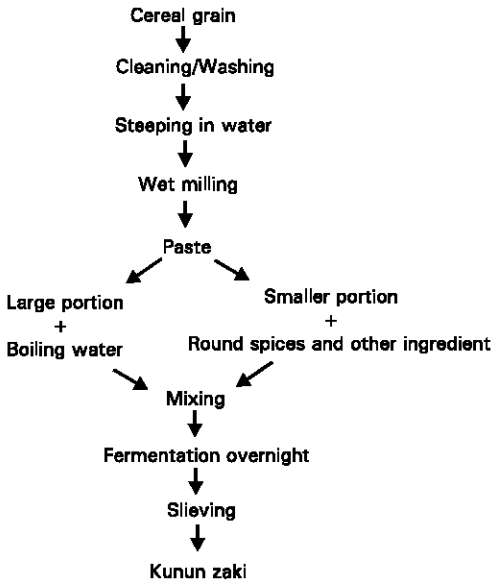

Fig. 2: Flow diagram of traditional kunun zaki production in Bauchi-Nigeria

saccharification/liquefaction. Sieving was done the next day using a laboratory mesh (Endecotts, No. 410, England).

Proximate analysis of kunun zaki enriched with soybeans: The moisture, crude protein, fat, total soluble solids and ash contents of the samples were determined using the standard methods (Anonymous, 1984). Carbohydrate content was determined by difference. Titrable acidity was determined following the method of Speck (1984).

Sensory evaluation of enriched kunun zaki: The sensory evaluations of the two types of soybean-enriched kunun were carried out. The techniques of Williams (1982) and Beckley and Kroll (1996) were employed. The kunun zaki produced from the enrichment studies was subjected to sensory evaluation using twenty-seven trained panelists. The panelists were intensively trained for three days before they sampled or tasted the kunun samples. They evaluated the products with respect to colour, sweetness, mouthfeel, flavour and overall acceptability. A nine-point scale was adapted where nine was the highest score and one the least score for each parameter. The average score for each parameter in each product was also determined.

Preparation of kunun zaki with other saccharifying/liquefying agents: The same traditional process adopted for production of the enriched kunun zaki was followed. The table of formulation is presented in (Table 1).

Table 1: Traditional kunun zaki beverage formulation

	Kunun zaki with			
Ingredients (g)	Malted rice	Sweet potato	Soybean	*C. farinosa*
Malted rice	90	-	-	-
Sweet potato	-	80	-	-
Soybean	-	-	40	-
C. farinose	-	-	-	37
Sorghum	1000	1000	1000	1000
Dry ginger	10	10	10	10
Kunun zaki (ml)*	6726	6501	6570	6633

* Represents the quantity of the products after sieving

Statistical analysis: Analysis of variance (ANOVA) was used to determine the degree of variation between samples and categories. The least significant difference (LSD) was calculated from the ANOVA and used in the grouping of elements within treatments into homogenous groups. In all cases, the level of statistical significance was set at 5 %. All methods of analysis were as described by Gacula and Singh (1984).

Results

Proximate composition of soybean enriched kunun zaki: Generally, the protein contents increased with supplementation. Statistical analysis on the proximate composition showed that there were significant differences ($p < 0.05$) between various percentages concentrations of soybean used in warm water treated and roasted samples except in ash content. However, in each parameter examined, there were no differences between the two treatments except in moisture content where the two values from the treatments differed significantly. The slightly roasted soybean product had higher moisture content than the warm water treated category (Table 2).

Table 2: Proximate composition of kunun zaki enriched with soybean (whole ground)

	Proximate composition (%)											
	CP		Fat		Ash		Moisture		CHO		TSS	
Concentration (%)	W	R	W	R	W	R	W	R	W	R	W	R
1	4.93± 0.11	4.59± 0.02	0.39± 0.01	0.42± 0.02	1.15± 0.01	1.13± 0.02	87.5± 0.02	88.0± 0.07	6.03± 0.03	5.88 ± 0.02	4.9± 0.02	4.5± 0.04
3	7.31± 0.06	6.97± 0.02	0.44± 0.02	0.41± 0.02	1.14± 0.01	1.11± 0.02	87.3± 0.02	88.1± 0.34	3.81± 0.04	3.41± 0.02	5.3± 0.04	5.0± 0.08
4	8.67± 0.02	8.16± 0.04	0.47± 0.04	0.44± 0.02	1.17± 0.02	1.11± 0.02	87.2± 0.03	87.8± 0.39	2.49± 0.02	2.49± 0.06	5.5± 0.02	5.0± 0.08
5	9.86± 0.03	9.52± 0.02	0.52± 0.02	0.49± 0.02	1.17± 0.03	1.13± 0.02	87.2± 0.02	87.9± 0.08	1.25± 0.01	0.96± 0.04	6.5± 0.03	5.8± 0.01
LSD (0.05)	0.11	0.04	0.04	0.024	NS	NS	0.031	0.09	0.05	0.053	0.045	0.10

CP- Crude protein; CHO- Carbohydrate; TSS- Total soluble solids; W- Warm water;
R- Roasted; NS- No significant difference at 5 %level

Table 3: Mean values of preference scores on kunun zaki enriched with soybean

Soybean concentrations (% w/w)	Colour	Flavour	Sweetness	Mouthfeel	OAA
Warm water					
1	7.56	6.26	5.37	6.04	5.60
3	7.15	6.37	5.52	6.11	5.81
4	7.63	6.45	5.89	6.10	6.55
5	7.65	5.88	5.81	6.15	5.44
Roasted					
1	7.26	5.11	5.07	5.33	4.96
3	7.15	5.07	4.89	5.15	5.30
4	7.30	5.22	5.26	5.37	6.11
5	7.11	5.15	5.22	5.18	5.63
LSD (0.05)	NS	NS	NS	NS	1.79

Table 4: Proximate composition of kunun zaki from different saccharifying agents

	Kunun zaki from			
Constituents	Malted rice	Sweet potato	Soybean	*C. farinosa*
Moisture (%)	89.48 ± 0.09	91.00 ± 0.21	87.77 ± 0.04	90.93 ± 0.11
Crude protein (%)	3.19 ± 0.03	3.70 ± 0.04	8.86 ± 0.05	3.45 ± 0.05
Crude fat (%)	0.43 ± 0.02	0.37 ± 0.01	0.75 ± 0.43	0.39 ± 0.03
Ash (%)	1.06 ± 0.18	1.30 ± 0.05	0.93 ± 0.03	1.21 ± 0.14
Carbohydrate (%)	5.84 ± 0.51	3.52 ± 0.45	1.69 ± 0.07	4.02 ± 0.33
Dry matter (%)	10.52 ± 0.21	8.90 ± 0.18	12.45 ± 0.11	9.07 ± 0.07
Soluble solids (%)	6.55 ± 0.11	7.00 ± 0.16	6.50 ± 0.43	6.50 ± 0.12
pH	4.78 ± 0.06	4.84 ± 0.08	4.92 ± 0.34	4.88 ± 0.10
Titrable acidity (%)*	0.05 ± 0.03	0.04 ± 0.04	0.04 ± 0.26	0.04 ± 0.05

*As lactic acid

Table 5: Mean sensory values of kunun zaki from different saccharifying agents

	Kunun zaki from*				
Parameters	Malted rice	Sweet potato	Soybean	*C. farinosa*	LSD (0.05)
Colour	7.76 ± 2.50	7.21 ± 1.29	7.48 ± 1.02	7.48 ± 0.95	NS
Sweetness	7.79 ± 0.86	6.14 ± 1.57	6.14 ± 1.33	6.93 ± 1.46	1.863
Flavour	7.00 ± 1.22	6.21 ± 1.42	6.07 ± 1.25	6.34 ± 1.74	NS
Mouth feel	7.48 ± 1.53	6.03 ± 1.40	5.97 ± 1.24	6.72 ± 1.60	2.019
Acceptability	7.69 ± 1.17	6.48 ± 6.48	6.45 ± 1.30	6.62 ± 1.57	1.951

NS- Not significant, * % saccharifying agents used as in Table 1

Sensory scores of kunun zaki enriched with soybeans: The 27 member trained panelists evaluated the products based on colour, sweetness, flavour, mouthfeel and overall acceptability. Statistical analysis showed that there were no significant differences ($p < 0.05$) between the mean scores in each treatment for different concentrations and in each parameter assessed (Table 3). The only exception to this was in overall acceptability of the kunun zaki supplemented with roasted soybean that differed significantly at the various concentrations. Kunun zaki was the most preferred at 4 % supplementation for both roasted and warm water treated soybean. On comparing the treatments statistically in each parameter assessed, it was found that there were no differences in colour. In rest of the parameters examined (flavour, sweetness, mouthfeel and overall acceptability), there were statistical differences and in each case, the kunun zaki supplemented with warm water was preferred over that from the roasted soybean.

Proximate composition of kunun zaki from different saccharifying agents: The proximate composition of kunun zaki using the different saccharifying agents at concentrations of 9, 8, 4 and 3.7 % (w/w) for malted rice, sweet potato, soybean and *Cadaba farinosa* respectively is given in Table 4. Generally, soybean at 4 % addition increased the protein content of kunun zaki from 3.19 to 8.86 %.

Mean sensory values of kunun zaki produced from other saccharifying agents: Kunun zaki produced with malted rice had the highest mean scores in all the parameters evaluated and that with soybean had the least except for colour rating. Statistical analysis on the mean values indicated that there were significant differences ($p < 0.05$) between the kunun zaki samples in sweetness, mouthfeel and overall acceptability (Table 5). In each of these cases with significant differences, the order of preference decreased as follows: malted rice, *C. farinosa*, sweet potato and soybean. There was no significant difference in colour and flavour.

Discussion

Proximate composition of enriched kunun zaki: The use of increasing concentrations of soybean seeds in kunun zaki raised the crude protein, fat and total soluble solids (TSS) values of the beverage (Table 2). The increase in crude protein and fat is because of the high contents of these two nutrients in soybean (44 % and 17 % respectively). From the increase in TSS of soybean enriched kunun zaki, it would appear that soybean protein components have enzymes that are capable of starch breakdown and the release of sugar. Soybean seeds have been reported to contain beta and alpha amylases that hydrolyses starches randomly at the reducing ends of the carbon chains to produce maltose, glucose and dextrins (Mikami and Morita, 1988) the beta amylases are responsible for these reactions.

The differences in values of each of the nutrients in the warm water treated and roasted samples might be due to the heat application in the roasted seed. This might have caused some physiological changes within the seed and consequently on the final composition of the kunun sample. In all cases, the nutrients in the roasted seed sample were less except for moisture contents. The slight roasting may have caused the seeds to imbibe more water than other treatments for this change to occur or else there is no immediate explanation for this.

The low content of carbohydrate in the enriched kunun zaki is expected since soybean is known to be low in carbohydrate (Lee *et al*., 1990). Low carbohydrate contents are not the major

problem in food as protein content. The need for strong recommendation of kunun zaki protein enrichment lies in the fact that every cell of the body is partly composed of protein. These cells are subjected to continuous wear and replacement. The proteins of the body are inevitably dependent on the proteins in food for their formation and maintenance (Johnson *et al*., 1996). It is necessary that the body obtain the minimum nutrient requirement daily. Enrichment provides the safest way that the desired nutrients are delivered to the individuals using familiar foods as delivery vehicles. Staple foods such as cereal grain products are considered appropriate vehicles for fortification (Block and Langseth, 1994).

Sensory evaluation of enriched kunun zaki: The overall acceptability result (Table 3) shows that incorporation of soybean in the beverage is welcomed. The slight creamy colour of the product with warm water treated product was still acceptable. Moreover this did not affect the flavour and mouthfeel as evidenced by the high scores in these parameters. Kunun zaki with roasted soybean was equally accepted but not as the former. The colour of the beverage was tending towards deep brown, which is unlike any kunun zaki known.

Proximate composition of kunun zaki from other saccharifying agents: The differences observed (Table 4) in the proximate composition of kunun zaki beverage treated with the other saccharifying agents were expected. The materials used differed both in chemical composition and quantities employed in the production process. All the beverages had high amount of moisture confirming their use as thirst quenching foods. The high amount of protein (8.86 %) from the beverage with soybean is as a result of the high contents of protein in the bean compared with other agents.

Sensory attributes of kunun zaki with different ingredients: Kunun zaki prepared from the different ingredients had slight differences in their sensory attributes (Table 5). There was however no difference in colour rating between the samples ($p < 0.05$). Consumers are already aware of differences in colour depending on the type of cereal employed in preparation of kunun and other agents that may be introduced. The addition of the agents at different concentrations in appropriate amounts does not seem to affect the flavour hence the lack of significant difference between their mean scores. The mean scores in sweetness varied between the kunun zaki samples. The beverage produced with malted rice had the highest score of 7.79. This is due to the variation in amount of alpha and beta amylases in each ingredient and the overall varied chemical composition of each ingredient. Another reason is due to inherent differences in the hydrolytic activity of each ingredient. These factors, particularly the proportion of enzymes in each ingredient, have profound influence on the amount of reducing sugars produced in the beverage. This is a likely factor affecting the sweetness, mouthfeel and the overall acceptability of the beverages.

References

Adeyemi, I.A. and S. Umar, 1994. Effect of method of manufacture on quality characteristics of kunun zaki, a millet based beverage. Nig. Food J., 12: 34-41.

Akpapunam, M.A., G.O. Bafidu and P.E. Maduagwu, 1997. Assessment of production practices and evaluation of product characteristics of kunun zaki produced in Makurdi metropolis. Paper presented at NIFST Annual Conference held at Uyo, Nov. 21-26.

Anonymous, 1984. Official Methods of Analysis. 14th ed. Association of Official Analytical Chemists (AOAC), Benjamin Franklin Status, Washington. D.C.

Beckley, J.B. and D. R. Kroll, 1996. Searching for sensory research excellence Food, Technol., 50: 61-64.

Block, G. and L. Langseth, 1994. Antioxidant vitamins and disease prevention. Food Technol., 51: 71-74.

Gacula, M.C. and J. Singh, 1984. Statistical Methods in Food and Consumer Research. Academic press, Inc. New York.

Gaffa, T. and I.A. Jideani, 2001. Sensory evaluation of different levels of *Cadaba farinosa* (Dangarafa) in kunun zaki and determination of its position among other saccharifying agents. J. Food Sci. Technol., 38: 405-406.

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

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

Inatimi, E.E.B., S.F. Abasiekong and I. Chiemaka, 1987. Kunun zaki and tsamiya–Non- alcoholic beverages prepared from sorghum grains. Chemical analysis for nutrient contents of fresh and aging samples. Nig. J. Biotechnol., 5: 21-23.

Johnson, I. E., P.A. Lachance, G.A. Loveille and J.I. Rader, 1996. Food fortification roundtable. Food Technol., 50: 86-90.

Lee, S.Y., C.V. Morr and A. Seo, 1990. Comparison of milk-based and soymilk-based yoghurt. J. Food Sci., 15: 532-536.

Mikami, B. and Y. Morita, 1988. Soybeans Beta Amylase. In: Handbook of Amylases and Related Enzymes, their Sources, Isolation Methods, Properties and Applications. The Amylase Research Society of Japan (Eds.). Pergamon Press, Oxford, pp: 87-89.

Nkama, I., I. Adamu and A. Jato, 1995. Studies on the preparation and nutrient composition of kunun gyada- a traditional groundnut-cereal-based weaning food. Food Nutr. Bull., 16: 238-240.

Nkama, I. and N.G. Malleshi, 1998. Production and nutritional quality of traditional Nigerian masa from mixtures of rice, pearl millet, cowpea and groundnut. Food Nutr. Bull., 19: 366-373.

Onuorah, S.I., A.A. Adesiyun and J.O. Adeyeye, 1987. Survival and multiplication of *Staphylococcus aureus* and *Escherichia coli* in a Nigeria cereal drink (Kunun zaki); Effect of spices and temperature. J. Food Agric., 1: 169-173.

Speck, M.L., 1984. Compendium of Methods for Microbiological Examination of Foods. American Public Health Association, Washington, D.C.,

Williams, A.A., 1982. Scoring methods used in the scoring analysis of foods and beverages at Long Ashton Research Station. Food Technol., 17: 163-175.