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NUTRITIONAL AND SENSORY QUALITIES OF SOYMILK-KUNNU BLENDS

Sowonola O. A.[1], Tunde- Akintunde T.Y.[2] and Adedeji F[1].*

T. Y. TUNDE AKINTUNDE

[*]Corresponding Author
[1]Federal College of Agriculture, PMB 5029, Ibadan, Nigeria
[2]Dept. of Food Science and Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria
toyositunde@yahoo.co.uk

ABSTRACT

Kunnu, a beverage popular among the Northern Nigerians has a low protein value because it is made from cereals. This may have a negative effect on the nutritional status of the people who drink it, especially on the growth rate of infants who are given kunnu as a weaning drink. This is because protein is an essential component of the balanced diet required for growth. Research work carried out on the improvement of the nutritional value of cereals, shows that the fortification of carbohydrate-rich foods with protein-rich foods improves its nutritious value. As a result of this, a study was carried out to fortify kunnu with soymilk and the effect on its nutritional and sensory properties was evaluated. Kunnu and soymilk were prepared and it was fortified with soymilk in the ratio 1:1, 2:1, 3:1 and 4:1, and the proximate composition (protein, fat, ash and moisture content), chemical composition (pH, specific gravity and sedimentation rate) and mineral content (calcium, magnesium, phosphorus and iron content) were determined. The pH, protein and mineral content increased as the amount of soymilk added. The pH value ranged from 4.8 to 4.3, while the protein content increased from 2.35 to 2.45%. The calcium and magnesium content also increased from 0.08 to 0.15% and 0.18 to 0.29% respectively. The fat and ash content, however, decreased respectively from 2.8 to 2.0, and 0.91 to 0.891 with an increase in addition of soymilk. The proximate, chemical and mineral content were significantly different at $P < 0.05$ while the sensory properties were not significantly different at the same level. The sensory properties (colour, taste, texture, flavor and general acceptability) were, however, observed to decrease with the increase in fortification level of soymilk. The results obtained show that the fortification of kunnu with soymilk will result in a more nutritious beverage, but it may have a low level of acceptance with the local populace.

Keywords: fortification, kunnu, soymilk, blends

FRENCH

RÉSUMÉ

Le Kunnu, une boisson populaire chez les Nigérians du Nord, a une basse valeur en protéines parce qu'il est fabriqué à partir de céréales. Ceci peut avoir un effet négatif sur l'état nutritionnel des personnes qui le boivent. Il peut avoir un effet négatif surtout sur le taux de croissance des enfants en bas âge à qui l'on donne du kunnu comme boisson de sevrage, étant donné qu'une protéine est une composante essentielle d'un régime alimentaire équilibré requis pour la croissance. Des travaux de recherche menés sur l'amélioration de la valeur nutritive des céréales montrent que la fortification d'aliments riches en hydrates de carbone par des aliments riches en protéines améliore sa valeur nutritive. Comme résultat de ceci, une étude a été menée en vue de fortifier le kunnu avec du lait de soja et l'effet sur ses propriétés nutritives et

sensorielles a été évalué. Le kunnu et le lait de soja ont été préparés et le kunnu a été fortifié avec du lait de soja dans la proportion 1:1, 2:1, 3:1 et 4:1. La composition rapprochée (la teneur en protéines, graisses, cendre et humidité), la composition chimique (pH, gravité spécifique et taux de sédimentation) et la teneur en minéraux (calcium, magnésium, phosphore et fer) ont été déterminées. La teneur en pH, en protéines et en minéraux augmentait au fur et à mesure que la quantité de lait de soja augmentait. La valeur du pH se situait entre 4,8 et 4,3, tandis que la teneur en protéines augmentait de 2,35 à 2,45%. La teneur en calcium et en magnésium a également augmenté de 0,08 à 0,15% et de 0,18 à 0,29% respectivement. Par contre, les matières grasses et la teneur en cendre ont baissé de 2,8 à 2,0, et de 0,91 à 0,891 avec une augmentation en plus du lait de soja. Les teneurs rapprochées, en matières chimiques et minérales, étaient très différentes à $P < 0,05$ tandis que les propriétés sensorielles n'étaient pas très différentes au même niveau. Cependant, il a été observé que les propriétés sensorielles (couleur, goût, texture, saveur et acceptabilité générale) baissent avec l'augmentation du niveau de fortification par du lait de soja. Les résultats obtenus montrent que la fortification du kunnu par du lait de soja aura comme résultat une boisson plus nutritive, mais qui peut avoir un niveau insuffisant d'acceptation auprès de la population locale.

Mots-clés: fortification, kunnu, lait de soja, mélanges

INTRODUCTION

Cereals are the most important source of the world's food and have a significant impact in human diet throughout the world. In India and Africa, cereal products comprise 80% or more of the average diet, 50% in central and western Europe, and between 20-25% in the U.S. [1]. The main cereals grown in Nigeria are maize, guinea corn, rice, millet and sorghum. These cereals can supply sufficient qualities of carbohydrate, fat, protein and many minerals, but diets consisting primarily of cereals are high in carbohydrate and deficient in vitamins and protein.

Millet is the staple food of millions of people in drier parts of Tropical Africa. Air-dried grains contain approximately 12.4% water, 11.6% protein, 5% fat, 67.1% carbohydrate, 1.2% fibre and 2.7% ash. However, its protein is low in methionine [1,2]. Millets are good sources of minerals eg calcium, iron, zinc, copper and manganese [3]. They are small-grained cereals, sometimes referred to as "poor man's cereals" because of the preference of other cereals by those with a choice. They are high in starchy components (61.5 - 89.1%) and thus serve as an energy food. Products from millet vary depending on peoples' taste and cultural preference. One of the common traditional products is kunnu, a non-alcoholic beverage made mainly from millet. It is of low viscosity and has a sweet-sour taste, milky cream appearance and is popular with

people in northern Nigeria [4]. It is generally consumed on its own by adults as a thirst quencher or serves as refreshment in some communities. It is sometimes used as a weaning drink for infants. However, since this drink is produced from cereals, its protein is incomplete and needs to be supplemented. To make up for amino balance, millet protein should be supplemented with legume protein. Soybean is a good substitute since it is a good source of protein (about 40%), edible oil of high quality that is cholesterol free (about 21%) and carbohydrate (34%) [5]. It is one of the most promising foods in Africa available to improve the diet of millions of people.

Researches have been carried out on the fortification of carbohydrate-rich foods with protein-rich food especially soybean, in order to improve their nutritional value. These improved carbohydrate foods have helped in correcting malnutrition in children and for maintenance and repair of adults' body tissues, with examples such as *soy-eba, soy-moimoi, soy-gari, soy-ogi* etc [6]. Soybean is also an excellent economical source of nutrients and the cheapest source of protein for rural households in a nutritional and economic comparative analysis with other major sources of protein like eggs, beef, milk and cowpea. Thus, it is a cost-efficient source of quality protein. Most anti-nutritional factors of soybean are eliminated by heat treatment [7]. It is also a good source of many required vitamins and minerals. Among cereals and other legumes, it has the highest protein content about 40%, whereas other legumes have 20-30% and cereals have a protein content of 8-15% [8].

Soy protein has been used and accepted as food ingredients to enhance the value of finished foods. Soybean and soy-foods have been identified with their protein content from a nutritional perspective and as such there is much interest among clinicians and researchers on their potential role in preventing and treating chronic diseases [9]. One of the products of soybean, which is to be used to fortify kunnu, is soymilk. This study is thus carried out to determine the effect of soymilk fortification on the nutritional and sensory properties of kunnu.

Methodology

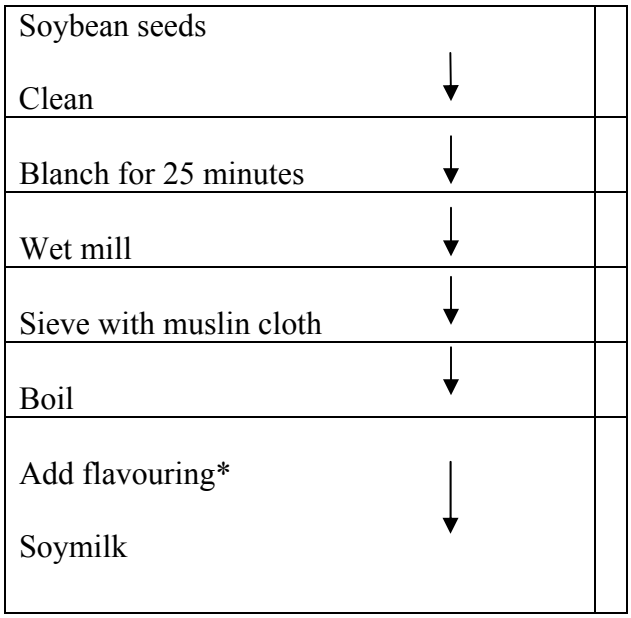
Soybean, pearl millet and spices were bought from a local market in Ibadan. Soymilk and kunnu samples were prepared, as shown in Figure 1 and 2, while the level of fortification is shown in Table 1. For soymilk preparation, the soybean seeds were manually cleaned and then soaked in boiling water for 25 minutes. The blanched seeds were then rinsed, milled with water and the slurry was sieved using a muslin cloth sieve. The filterate was boiled for 5 minutes with vanilla flavour and sugar added to give soymilk (Figure 1).

Kunnu was prepared by cleaning the millet seeds and soaking in water for 2 hours. The soaked seeds were wet milled and the slurry sieved with a muslin cloth. The filterate was fermented for 1 day, during which the slurry was allowed to settle and sediment. The supernatant liquid was decanted and the residue was mixed with water

and divided into two. Half of the residue was boiled and the second half was poured into it to produce Kunnu (Figure 2). The Kunnu beverage was fortified with soymilk at four levels; one part of soymilk was added to one part, two parts, three parts and four parts of Kunnu respectively.

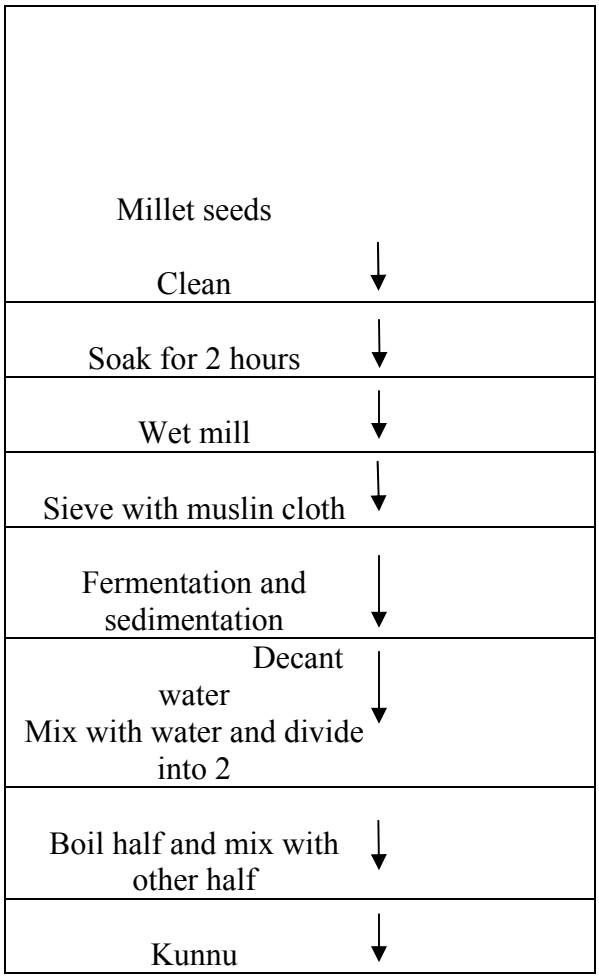
The samples were subjected to proximate analysis as well as calcium, phosphorus, iron and magnesium content according to AOAC [10]. Dried ground samples of 0.5g were weighed into a 75 ml digestion tube, 5 ml of the digestion mixture was added and placed in a fume hood. It was digested for 2 hours at 150^{o}C, and then cooled for 10 minutes after which 3 ml of 6N HCL was added. The mixture was digested for another $1^{1}/_{2}$ hours before it was cooled. The mixture was stirred after 30 ml of distilled water was added.

Figure 1: Flowchart for soymilk production



* (2 tablespoons vanilla flavour and 0.125g of sugar)

Figure 2: Flowchart for kunnu production



After cooling, the volume was made up to 75 ml mark and the tube was shaken. The mixture was then transferred to the auto analyses cups for the total mineral analysis.

The sensory qualities of the soymilk-kunnu blend; colour, taste, texture and flavour, were analyzed by ten panelists familiar with the taste of kunnu. The nine point hedonic scale was used to determine preference of panelists from 1-9 (1 - extreme dislike to 9 - extreme likeness). Statistical analyses were carried out using SAS software. Data was subjected to analysis of variance and Duncan's Multiple Range Test was used for comparison of means and the significance was accepted at $p > 0.05$.

Results

The nutritional component of the kunnu-soymilk samples are shown in Table 2 – 4 (proximate and chemical composition, mineral content and sensory properties). The protein content of the blends ranged from 2.42 to 2.78% with sample AC (kunnu:soymilk ratio is 1:1) having the highest value and AB (kunnu:soymilk ratio is 4:1) having the least value. The protein content of the samples were significantly different ($p > 0.05$) There was a decrease in fat and ash contents of all the blends as the amount of soymilk added increased and the fat and ash contents of the blends were significantly different.

Though soymilk had a higher pH value than kunnu, an increase in amount of soymilk added resulted in a decrease in pH of the resultant blend. The addition of soymilk to kunnu had a significant effect on the pH of the blends ($p > 0.05$). The iron and magnesium content of the blends increased significantly with increased addition of soymilk to kunnu. Higher mean values of colour, texture and flavour were obtained for samples with higher kunnu content. The general acceptability of the samples with higher kunnu ratios was also considerably higher than those with lower kunnu ratios.

Discussion

The protein content was observed to increase with increase in amount of soymilk added. This shows that addition of soymilk can be used to supplement the protein content of millet, thus increasing its nutritious content. This is in agreement with the general observation that an addition of legumes (soybean) to cereals (millet) gives a better protein value. The crude fat content of sorghum was however higher than that of soymilk but those of the mixes decreased with increase in soymilk. This indicates that the kunnu drink has a higher fat content than soymilk and thus an increase in soymilk added decreases the fat content, however the range 2.0 to 2.4% is still within the acceptable range of soymilk [11]. The sedimentation rate for the blends was generally higher than that of the control (kunnu) or soymilk.

The pH for the soymilk was higher than that of kunnu, while the addition of soymilk to kunnu gave a higher pH value. This implies that soymilk is less acidic than sorghum, and thus an addition of soymilk will increase its pH value. This shows that the kunnu-soymilk blends will be more acceptable to people with ulcers and other related problems than kunnu alone since it is less acidic. Generally the mineral content of the blends increased significantly with an increase in soymilk added to the kunnu. This concurs with the observation that soymilk is a source of many minerals and vitamins and can be used to upgrade the nutritional status of traditional foods [9]. This shows that soymilk addition to sorghum is an appropriate way of fortifying kunnu, since the mineral content becomes higher and thus the resultant drink is more nutritious.

The sensory properties, as shown in Table 4, are generally significantly different at $P < 0.05$, which indicates that the different blends of soymilk-kunnu have distinctively different tastes. All in all, the sensory properties of kunnu only were more acceptable than that of soymilk, while the sensory properties of the blends decreased with increase in the amount of soymilk added for fortification. This is an indication that the local palate is still not well accustomed to soymilk because of its beany taste. Therefore, though the presence of soymilk as a fortificant increases the nutritional quality of kunnu, the taste, flavour, etc of soymilk is still not well accepted by the local palate. Thus although the resultant blend is more nutritious, its sensory qualities make it less acceptable than kunnu alone.

Conclusion and Recommendation

This study showed that kunnu-soymilk blends could be used as a beverage for the adults and a weaning drink for children. The blends had higher protein and mineral content than kunnu, however, based on sensory data, the blends were not well accepted. This indicates that though the addition of soymilk could enhance the nutritional status of the kunnu, its level of acceptance may be low.

Table 1:

The level of fortification of kunnu with soymilk

Sample	Mixtures	Mixture ratio
AA	Kunnu	Control
AB	Kunnu + soymilk	4:1
AC	Kunnu + soymilk	3:1
AD	Kunnu + soymilk	2:1
AE	Kunnu + soymilk	1:1

Table 2:

Proximate composition of kunnu-soymilk blends

Samples	Dry Matter	Moisture content (%)	Protein content (%)	Fat content (%)	Ash content (%)
AA	11.69[b]	88.31[d]	2.35[f]	2.80[a]	0.91[a]
AB	11.51[d]	88.49[c]	2.42[e]	2.40[c]	0.88[c]
AC	11.00[e]	89.00[b]	2.56[d]	2.20[d]	0.83 [e]
AD	9.82[f]	90.18[a]	2.62[c]	2.10[e]	0.85[d]
AE	12.86[a]	87.14[e]	2.78[b]	2.00[f]	0.81[f]
Soymilk	11.56[c]	88.44[c]	3.54[a]	2.60[b]	0.89[b]

Table 3:

Chemical composition and mineral content of kunnu-soymilk blends

Samples	Sedimentation rate m/h	pH	Specific gravity	Calcium content (%)	Phosphorus content (%)	Iron content (%)	Magnesium content (%)
AA	6.5[c]	4.80[d]	1.034[b]	0.08[f]	0.31[b]	0.0021[f]	0.18[f]
AB	7.0[b]	5.10[c]	1.017[d]	0.12[c]	0.19[c]	0.0023[e]	0.22[e]
AC	8.0[a]	4.80[d]	1.023[c]	0.16[b]	0.21[d]	0.0027[d]	0.25[d]
AD	7.0[b]	5.50[b]	1.035[b]	0.14[d]	0.17[f]	0.0031[c]	0.27[c]
AE	6.5[c]	4.30[e]	1.052[a]	0.15[c]	0.22[c]	0.0037[b]	0.29[b]
Soymilk	5.8[d]	5.70[a]	1.017[d]	0.25[a]	0.48[a]	0.0039[a]	0.38[a]

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Table 4:

Sensory properties of kunnu-soymilk blends

Sample	Colour	Taste	Texture	Flavour	General Acceptability
A	8.4[a]	7.9[a]	8.1[a]	7.8[a]	8.6[a]
B i	6.8[b]	6.5[ab]	6.5[b]	6.5[ab]	6.9[b]
B ii	6.7[b]	6.0[ab]	6.7[b]	6.9[ab]	6.4[b]
B iii	6.1[b]	5.4[b]	5.8[b]	7.1[a]	5.9[bc]
B iv	5.2[c]	5.1[b]	4.4[c]	5.3[b]	4.8[c]

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