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Effect of processing on the physicochemical and organoleptic properties of imitation milk from cowpea/maize blends

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Abstract

A method for the preparation of cowpea and cowpea-maize milk was described. Cowpea-maize milk was prepared at 10% (10g cowpea+90g maize), 20% (20g cowpea+ 80g maize) and 40% (40g cowpea + 60g maize) on wet matter basis. Yield percent extracted cowpea-maize milk ranges from (90-99.44%) and compares favourably with cowpea milk (94.87%).

There was a spontaneous decrease in the level of colloidal particles in the samples. Protein (17.45%), ash (3.60%), Ca (0.25%) and K (0.95%) of cowpea milk was significantly higher than other samples.

Organoleptic properties indicate that cowpea milk was significantly higher than other samples in taste and texture. There was also no significant difference in all the milk samples at ($p < 0.05\%$) in colour and general acceptability.

Introduction

Milk is rich in nutrients, therefore it helps to improve the nutritional status of the people in general. It also plays a role in the reduction of protein deficiency related diseases such as Kwashiorkor and Marasmus (Chamberlain 1989). In developing countries like Nigeria the problem of malnutrition has been on the increase. This is not unrelated to the high cost of protein rich foods from the animal origin such as milk and meat. A lot of people put emphasis on carbohydrate based foods because they are cheap.

Maize is a cheap and readily available food product, is very rich in nutrients and relatively high in methionine and cystine, and low in lysine and tryptophan. (Asiedu 1989, Oyenuga 1968 and Ashaye 1992). Maize has also been actively used in fortification processes.

Cowpea is also a cheap and readily available product and its consumption pattern in Nigeria is very encouraging (Dolvo *et al* 1984, Uwaegbute 1989). It is rich in protein, especially in some sulphur aminoacids that are deficient in maize such as lysine and tryptophan and nutrients. It has also been used in fortification processes (Dolvo *et al*. 1984, Singh and Rachie 1985).

Combination of maize and cowpea in the production of imitation milk will bring about amino-acid complementability effect. The objective of this work is to assess the effect of processing the physicochemical and organoleptic properties of imitation milk from cowpea/maize blends.

Materials and methods Raw materials

White maize (TBZ-SRW) and cowpeas (Ife brown) were collected from the Institute of Agriculture, Research and Training- Moor plantation, Ibadan.

Sample preparation

Cowpea milk

Cowpea grain was steeped in water for 30 minutes at room temperature (**fig 1**). The steeped water was then decanted and the water remaining on the surface of the beans was carefully removed from the surface with a dry towel. The steeped beans were then wet milled and filtered with a cheesecloth using 500mls of water. It was then pasteurized for 30 minutes.

Cowpea-maize milk

This was prepared by steeping cowpea in water for 30 minutes at room temperature (**fig 2**). After steeping, the water was decanted and the water remaining on the surface of the beans was carefully removed from the surface with a dry towel. Maize was also steeped in water for 6 hours to soften it. The steep water was also decanted after steeping and water remaining on the surface of the grain was carefully removed with a dry towel.

They were then fortified on wet matter basis at 10% (10g cowpea + 90g maize), 20% (20g cowpea + 80g maize), and 40% (40g cowpea + 60g maize) levels and ground independently with 500ml of water and filtered using a cheesecloth. The cowpea-maize milk was then pasteurized for 30 minutes and cooled.

Chemical analysis Colloidal stability

Colloidal stability of the milk was determined using modified methods of Nelson *et al* (1976). Liquid samples were placed in graduated tubes placed in racks in the refrigerator undisturbed at temperatures of 3.3°C to 4°C. Changes in apparent colloidal stability were indicated by levels of visible lines of demarcation between the settled and remaining portion of the milk solution. This was measured in cm and monitored for 7 days and percent retention of unseparated liquid mixture level was calculated.

Chemical composition

Chemical composition was determined by A.O.A.C 1990.

Organoleptic properties

Organoleptic properties were done by panelists used to taking milk. Samples were given to them in tasting booths in such a way that there would not be interference in their evaluation. Water was also provided for them to rinse their mouth. Ten panelists were used and analysis was on a nine point hedonic scale basis (1= extreme dislike and

9 = extreme likeness). (Larmond 1937).

Statistical analysis

Data were subjected to analysis of variance and the means were separated by Duncan multiple range test (Duncan 1955).

Results and discussion

Yield of milk

From [fig. 3](#) it is observed that the yield of 10% cowpea-maize milk was highest and 40% cowpea-maize milk was the lowest. The difference could be due to method of processing.

Colloidal stability of milk samples

From [fig. 4](#) it is seen that there was spontaneous decrease in the level of the colloidal particles in all the samples as the days increased, and are stable in all the samples on the last 3 days. These differences could be due to selective diffusion of larger protein molecules into the milk medium. (Omueti and Shaye 1998).

Chemical composition of milk samples

The chemical composition of cowpea milk and cowpea-maize milk is presented in [Table 1](#). The chemical analysis indicates that the moisture content, (13.87%) crude protein (17.45%), ash (3.60%), Ca (0.25%) and K (0.95%) of cowpea milk was significantly higher than other samples at ($p < 0.05$). However, the Sodium content (1.95%) of 40% cowpea-maize milk was significantly higher than other samples at ($p < 0.05$). This difference can be due to the increased presence of cowpea in the milk. It is observed that there was a concomitant increase in protein, ash, Na, Ca, and K of all fortified samples as level of fortification is increased.

Organoleptic evaluation of milk samples

From [Table 2](#) it is observed that the milk samples were not significantly different from each other in colour and

general acceptability at ($p < 0.05$), but 20% cowpea-maize milk was significantly higher than other samples in flavour. The taste of cowpea milk and 20% cowpea-maize milk were not significantly different from each other at ($p < 0.05$). The texture of cowpea milk and 10% cowpea-maize milk are not significantly different from each other but are significantly higher than 20% and 40% cowpea-maize milk. Generally, the entire milk samples were not rejected.

Conclusion

It can be concluded that cowpea milk and 40% cowpea-maize milk showed better nutritional quality than the other fortified samples. Therefore, cowpea milk and 40% cowpea-maize milk could be used to reduce malnutrition related health problems.

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Fig.1. Preparation of cowpea milk.

Fig 2. Preparation of cowpea-maize milk

Fig. 3 Yield of milk samples

40% cowpea-maize milk

Fig. 4 Colloidal stability of milk samples

Table 1 Chemical composition of milk samples.

	%M.C	%D.M	%Protein	%Ash	%Na	%Ca	%K
Cowpea milk	13.87 ^a	86.13 ^d	17.45 ^a	3.60 ^a	0.23 ^d	0.25 ^a	0.95 ^a
10% cowpea-maize milk	11.77 ^b	88.23 ^c	6.65 ^d	0.84 ^d	0.27 ^c	0.15 ^b	0.34 ^c
20%cowpea-maize milk	11.51 ^c	88.49 ^b	7.00 ^c	1.39 ^c	0.29 ^b	0.15 ^b	0.40 ^b
40%cowpea-maize milk	11.44 ^d	88.56 ^a	11.23 ^b	1.96 ^b	1.95 ^a	0.15 ^b	0.41 ^b

Means in the same column followed by the same letter are not significantly different at $p < 0.05$.

Table 2 Organoleptic evaluation of milk samples.

	Colour	Taste	Flavour	Texture	General Acceptability
Cowpea milk	5.8 ^a	6.4 ^a	6.2 ^{ab}	7.1 ^a	5.7 ^a
10%cowpea-maize milk	6.7 ^a	6.1 ^b	5.2 ^b	6.7 ^a	5.2 ^a
20%cowpea-maize milk	6.2 ^a	6.5 ^a	6.9 ^a	5.3 ^b	6.2 ^a
40%cowpea-maize milk	5.9 ^a	5.0 ^b	6.2 ^b	5.2 ^b	5.6 ^a

Means in the same column followed by the same letter are not significantly different at $p < 0.05$