

Full Length Research Paper

Physicochemical and sensory qualities of spiced soy-corn milk

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Soy-corn milk type was produced from a blend of soybean milk and corn milk extract at a ratio of 3:1. The soy-corn milk type was spiced with ginger and garlic extract respectively to improve the taste. Total dissolved solid (TDS), total titrable acidity (TTA) specific gravity (SG), apparent colloidal stability, pH and sensory evaluation of the spiced soy-corn milk type were determined. The results show that the specific gravity of all milk types was not significantly ($P>0.05$) different from each other. The spiced milk types were relatively stable under refrigerated condition for 72 h while corn milk, soy-corn milk was not stable even under refrigeration. There was no significant ($P>0.05$) difference in the pH of the milk type at preparation and the value ranged between 6.8 and 6.5. The spiced milk types became more acidic after 24 h. Spicing improved the colloidal stability of the soy-corn milk type and its acceptability to the consumer, but has no significant difference ($P>0.05$) on the other physicochemical properties investigated.

Key words: Corn milk, soybean milk, soy-corn milk, colloidal stability.

INTRODUCTION

Maize, also known as corn (*Zea mays* L) a common staple tropical crop is mainly starch with very low protein and poor amino acid profile. For corn to be efficient in ameliorating malnutrition, it must be supplemented with high grade protein. Soybean (*Glycine max*) can provide a useful complement to cereals and tubers to give a balanced diet that could prevent protein energy malnutrition (PEM). The protein content of soybeans is particularly high though low in the sulphur containing amino acids. Soymilk is a potential substitute for cow's milk, and could be used for solving malnutrition problems in developing countries (Wei et al., 1985). Iwe and Agu (1993) reported the use of natural flavourants to improve soymilk acceptability. Owing to soymilk's immense health benefits, research targeted at improving its acceptability should be undertaken. Omueti and Ashaye (1998) reported that soy-corn milk was more acceptable than soymilk.

Spices have been used all over the world through history and for many centuries, have been an important trading commodity. They are used in food preparation whole, crushed or powdered. They generally have a strong aromatic flavor. Garlic (*Allium sativum* L.) is the second most widely cultivated *Allium* after onion. Raw garlic no doubt has the ideal flavor and provides desirable textural and water retaining properties when incorporated into food product, bulk of raw garlic is water and lacks flavor and aroma. Garlic is used practically all over the world for flavouring various dishes (Pandey, 2001). The spice ginger is obtained from the underground stems or rhizomes of *Zingiber officinale* (Rosc.), an herbaceous tropical perennial belonging to the family Zingiberaceae. The whole plant is refreshingly aromatic, but it is the underground rhizome, raw or processed, that is valued as spice. Fresh ginger is outstanding for flavouring as it contains the full note of the spice compared to other products from it (Vasala, 2001).

The aim of this work was to produce spiced soy-corn milk by the addition of garlic and ginger and to determine

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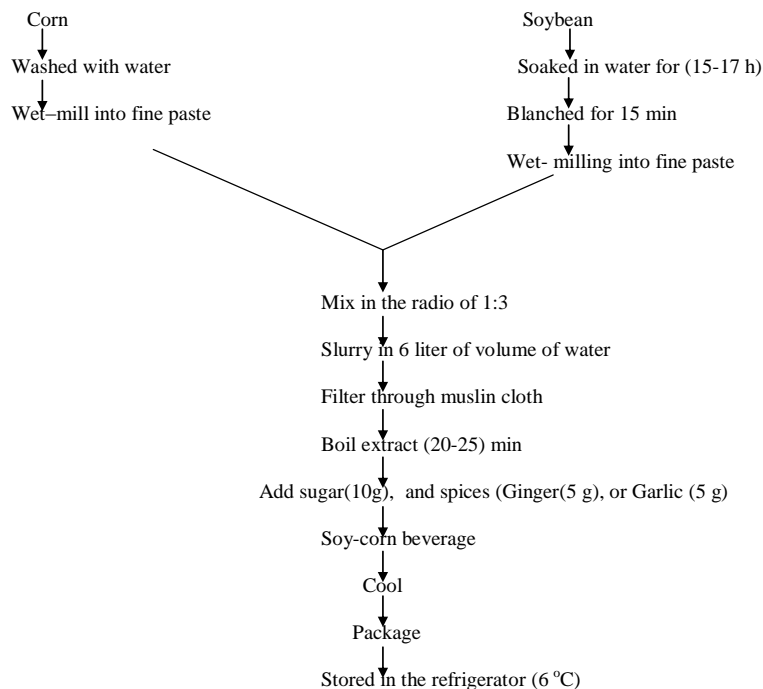


Figure 1. Flow diagram for the production of spiced soy-corn milk.

the physicochemical and sensory quality of the spiced soy-corn milk, aiming to improve the acceptability and hence diversity of the food resources of low-income families, especially in developing countries.

MATERIALS AND METHODS

The soybeans, maize (or corn) and spices were bought from Ikoko market in Owo, Ondo State, Nigeria.

Preparation of spiced milk types extracts.

Freshly harvested maize grains (1 kg) were separated from the corm and cleaned to remove silk hairs and other extraneous materials. The grains were wet milled into fine paste and filtered through muslin cloth to obtain the corn milk.

Healthy and unbroken soybean seed were soaked overnight (16 to 17 h) drained and added directly into boiling water. The soybeans were allowed to boil for 15 min after which they were transferred into cold tap water, dehulled and drained. A mass (1.5 kg) of the seeds were milled. The soymilk slurry was mixed with water and sieved using muslin cloth to get the filtrate which is soymilk. The soymilk was boiled for 20 to 25 min and cooled at room temperature to $(30 \pm 1^\circ\text{C})$. The filtrate from corn grains and soybeans cotyledon was measured separately in a ratio of 1:3 (corn to soybean). The mixture was carried out according to the method of Omueti and Ajomale (2005) slightly modified by the addition of spices (Figure 1).

Chemical analysis

Total dissolved solid (TDS), total titrable acidity (TTA) and pH were determined according to the method described by Egan et al. (1981). Apparent colloidal stability was measured by the method of Omueti and Ashaye (1998). Specific gravity determination was done according to the AOAC (1990) method.

Sensory evaluation

The sensory qualities of the soymilk, soy-corn milk, corn milk, soy-corn ginger milk and soy-corn garlic milk namely appearance, taste, flavour, thickness and overall acceptability, were analyzed by 10 panellists familiar with the taste of soymilk. The nine point hedonic scale was used to determine preference of the panellists from 1 to 5 (1 – dislike to 5-extreme likeness).

Statistical analysis

An analysis of variance (ANOVA) was performed on the results for each quality variable to determine the significance of each treatment. Means were compared by the least significance difference (LSD) test; significance was indicated at $P > 0.05$.

RESULTS AND DISCUSSION

The result of the chemical attributes of the various milk types is presented in Table 1. The ginger and garlic spiced soy-corn milk variant had a total solid content of 8.58 and 8.40%, respectively; this value was not significantly different ($P > 0.05$) from the total solid content reported for soymilk and soy-corn milk (9.44 and 9.48%, respectively). These values were comparable to the value reported by Omueti and Ajomole (2005) where a total solid content of soymilk and soy-corn milk were reported as 8.84 and 9.48%, respectively. The total solid content measured for soy-corn milk in this work was higher than that reported by Omueti and Ajomole (2005) and this could be due to higher level of suspended particles in the soy-corn milk types (Nelson et al., 1976).

Table 1. Attributes of various soy-corn milk types.

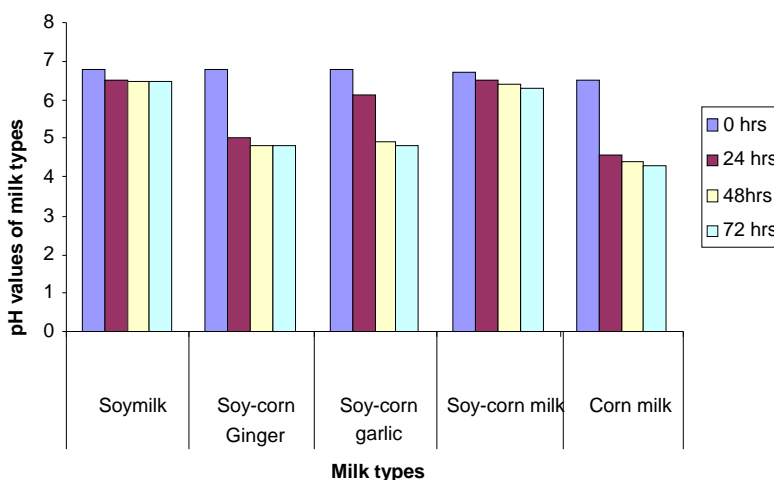
Milk type	Total solid (%)	Total acidity	Specific gravity
Soymilk	9.44 ^a	0.016 ^b	1.02 ^a
Soy-corn ginger	8.58 ^a	1.011 ^a	1.02 ^a
Soy-corn garlic	8.40 ^a	1.015 ^a	1.02 ^a
Corn milk	1.00 ^b	1.014 ^a	1.03 ^a
Soy-corn milk	9.48 ^a	1.015 ^a	1.01 ^a

Values are average of three determinations. Values with the same letter in the same column are not significantly different ($p = 0.05$).

Table 2. Duration of refrigerated storage on apparent colloidal stability (mL) of various soy-corn milk types.

Time (h)	Soymilk	Soy-corn ginger	Soy-corn garlic	Soy-corn milk	Corn milk
0	15.00 ^a	15.00 ^a	15.00 ^a	15.00 ^a	15.00 ^a
24	14.70 ^a	14.90 ^a	14.80 ^a	12.30 ^b	13.00 ^a
48	14.50 ^a	14.80 ^a	14.70 ^a	8.59 ^b	13.00 ^a
72	14.50 ^a	14.60 ^a	14.60 ^a	8.59 ^b	12.70 ^a

Values are average of three determinations. Values with the same letter in the same column are not significantly different ($p = 0.05$).

**Figure 2.** pH of various soy-corn milk type under refrigerated storage.

The total acidity of the ginger and garlic spiced milk types were found to be 1.01 and 1.02, respectively. These values were higher than the values reported for soy-corn milk (0.063 and 0.057 in white and yellow maize, respectively) by Omueti and Ajomole (2005). Shojaei and Yoidoilahi (2008) reported a total acidity of 0.16 and 0.15 for pasteurized and ultra-heated temperature milk respectively. The acidic nature of ginger and garlic could be responsible for the higher total acidity of the spiced soy-corn milk types.

The specific gravity of all the milk types were not significantly different ($P > 0.05$). This result could be attributed to uniform dispersion of solutes. The values were comparable to the value reported by Omueti et al. (2000) in nutritional evaluation of home-level prepared soy-corn milk.

The result of the colloidal stability of the milk types under refrigeration is presented in Table 2. The apparent colloidal stability of all milk types decreased when stored under refrigerated condition for 72 h, however, with the exception of soy-corn milk the decrease was not statistically significant ($P > 0.05$) from the value measured at 0 h. This significant decrease in colloidal stability of soy-corn milk within 72 h under refrigerated condition, was also observed by Omueti and Ajomole (2005) where the colloidal separation of the product was reported.

The result of the pH of the samples under refrigeration for 72 h is presented in Figure 2. There was no significant difference ($P > 0.05$) in the pH of the milk type at preparation, while the value ranged between 6.8 and 6.5 which is within the standard (Shojaei and Yodollahi 2008). The spiced

Table 3. Sensory score of various soy-corn milk types.

Milk type	Appearance	Taste	Flavour	Thickness	Overall acceptability
Soymilk	3.4 ^a	3.7 ^a	3.5 ^a	3.1 ^a	3.9 ^a
Soy-corn ginger	2.9 ^a	3.3 ^a	3.1 ^b	3.2 ^a	3.3 ^b
Soy-corn garlic	3.0 ^a	2.7 ^a	2.7 ^b	2.9 ^a	2.4 ^c
Corn-milk	2.2 ^b	2.3 ^b	2.4 ^b	3.2 ^a	2.3 ^c
Soy-corn milk	3.6 ^a	3.3 ^a	3.5 ^a	2.9 ^a	2.5 ^b

Values are average of three determinations. Values with the same letter in the same column are not significantly different ($p = 0.05$).

The spiced milk types became more acidic even after 24 h. This may be due to the presence of high level of acidic amino acids in corn and the acidic nature of the spices.

Taste panelists gave significantly lower ($P > 0.05$) sensory score to corn milk in appearance, taste, flavour and overall acceptability while soymilk was rated best in all the sensory parameters; soy-corn milk type tasted better than the corn milk types meanwhile addition of ginger improved the sensory quality of the soy-corn milk while taste panelist rated the garlic spiced corn milk very low (Table 3).

Conclusion

Spicing improves the colloidal stability of the soy-corn milk type and its acceptability to the consumer.

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