Yogurt from Coconut and Tigernuts

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Abstract

Yogurt was produced from milk obtained from coconut and tigernuts, singly, or in combination with fresh cow milk, by fermentation using starter cultures of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* (1:1 v/v) at 300C for 12h, and analyzed for its chemical, proximate and organoleptical qualities. The results obtained show that the pH of the various products ranged from 3.9-4.3; titratable acidity (% lactic acid) from 0.5-0.75, and crude protein (%) from 2.66-3.78. Yogurt produced from whole cow milk did not differ organoleptically (P> 0.05) from those produced from coconut + cow milk and coconut in all quality attributes (appearance, mouth feel, taste, aroma and sensory overall acceptability) but differed significantly (p < 0.05) from the other samples in appearance and sensory overall acceptability. This study has shown that it is feasible to prepare acceptable yogurt-like product from coconut and tigernuts, which should be of economic significance since cow milk is relatively expensive and highly perishable.

Keywords: Coconut and tigernut yogurts, sensory qualities

Introduction

Traditionally, yogurt is fermented whole milk and is believed to possess nutritional and therapeutic properties (Reed, 1982; Hughes and Hoover, 1991). Attempt has been made to produce substitute for milk and milk products from legume (Hetrick, 1969; Steinkraus, 1976; Rao *et al.*, 1988; Terna and Musa, 1998). In the developing countries and indeed in the sub-Saharan Africa (except East Africa), the production of milk and milk products is limited, scarce and expensive (Fashakin and Unokiwedi, 1992). These shortages have in no small measure adversely affected the protein intake of both the old and the young.

Several legume-based milk and milk products have been developed in attempts to extend the supply of milk-like products, especially in areas where milk is in short supply. Since legumes are important sources of relatively inexpensive protein, introduction of imitation milk products from legumes may contribute to the alleviation of protein malnutrition (Rao *et al.*, 1988).

Lactic acid fermentation of legume based milks has been used as one of the approaches to prolong the shelf life of the products, create variety, improve the nutritional value and as well enhance the acceptability of the product. Yogurt-like products have been prepared by some workers from soybean (Terna and Musa, 1998), cowpeas and mung beans (Rao *et al.*, 1988). Fashakin and Unokiwedi (1992) reported the production of waragusi (a soft unriped cheese-like product from water-melon milk) an analogue of warankasi (unriped cheese product from cow milk). Since tigernut (family: Liliaceae) and coconut (*Cocos nucifers*, family: Palmae) grows extensively in Nigeria and are eaten as snacks usually for the pleasure of it, they may be excellent sources of raw materials for the development of dairy-like products. The objective of this investigation was to study the feasibility of using tigernuts and coconut for preparing a yogurt-like product.

Materials and Methods

Preparation of Tigernut and Coconut Milk

Tigernuts and coconut were purchased locally. The tigernut nodules were sorted, cleaned, washed, soaked in tap water (5 h), drained, and washed two to three times with water. The soaked nodules were then homogenized in a blender (Kenwood, Japan) with water (1:2 w/v) filtered through three layers of cheese cloth. The resulting milk-like supernatant (tigernut milk) was mixed with lactose (5.5%) and sucrose (3.5%) and heated 70°C for 30 min) with stirring and then cooled rapidly to 45°C.

Coconut milk was prepared by cutting the endosperm into pieces, washed and homogenized in a blender with water (1:2 w/v) and filtered through three layers of cheese cloth. The resulting supernatant (coconut milk) was sweetened and pasteurized as described for tigernuts.

Yogurt Preparation

The pasteurized tigernut and coconut milks and the combinations (3:2 v/v) of coconut + milk, and tigernut + milk previously cooled to 45°C, were inoculated with mixtures (1:1) of overnight cultures of *Lactobacilluis bulgaricus* and *Streptococcus thermophilus* at 2% level and incubated for 12 h at 30°C (Cooled Incubator, Gallenkamp Ltd., England). Yogurt prepared from whole cow-milk using the same cultures served as control.

Chemical Analysis

pH measurement was made with a standardized pH meter (pH meter model 7020, Electronic Ltd., England). Titratable acidity (TA, % lactic acid) was determined by titration of sample against 0.1N NaOH (Speck, 1984).

Proximate Analysis

Moisture, crude fat, protein and total ash were determined, by the AOAC (1980) methods, while the refractometric method described by Akinsanya (1998) was used to determine the sugar content of the yogurt and yogurt-like products as follows: 20ml of yogurt was mixed with 10ml of 10% lead acetate in a beaker, and,

filtered through Whatmans' paper No.4 into 100 ml volumetric flask. 2 spoonful of sodium hydrogen carbonate was added to the filtrate to precipitate excess lead and filtered. The filtrate was used for the refractometric determination of the sugar content using Abbe 60 Refractometer.

Sensory Evaluation

A 7-point hedonic scale was used to measure the sensory qualities (aroma, mouth feel/texture, taste, sensory overall acceptability) of the product (Larmond, 1977), using 10-member untrained panelist (comprising of lecturers, laboratory technicians and students of the Department of Science Laboratory Technology) who were familiar with yogurt. Coded samples were served to panelists with glass of water to rinse their mouth in between the tasting period. The scale used was 1, like extremely; 2, like very much; 3, like moderately; 4, neither like nor dislike; 5, dislike moderately; 6, dislike very much; 7, dislike extremely.

Statistical Analysis

Analysis of variance (Walpole, 1974) was used to compare mean values.

Results and Discussion

Chemical and Proximate Analysis

Yogurt is a fermented milk product whose typical flavour (sour taste) is attributable to the production of lactic acids, acetaldehyde, acetic acid and diacetyl from carbohydrate by the fermenting organisms (Reed, 1982). The results obtained in this study (Table 1) show that the crude protein (%) of coconut yogurt (3.78) was higher than cow milk yogurt (3.22) while tigernut yogurt has the least value (2.66). The combination of cow milk with tigernut or coconut improved the crude protein value (2.6 or 3.5) substantially. Similarly, the crude fat content (%) ranged from 3.2 (cow milk) to 4.5 (tigernut + cow milk). Reeds (1982) and Egan *et al* (1981) stated that commercially prepared yogurt should have the following minimal proximate compositions (%): protein, 3.5; fat, 3.25; and moisture content, 87.7. The results obtained in this study are in conformity with those recommended by these authors as well as those obtained by Terna and Musa (1998) in Soy-yogurt.

The addition of lactose to composite milks prior to fermentation was necessary to enhance the souring ability of the lactics, since, lactose is the fermentable sugar generally preferred by lactic acid bacteria. Additionally, the lactose (as added) probably influenced the sugar content of all the products which were in a comparable ratio as observed in this study (**Table 1**). The low pH (3.9-4.1) and the high TA (0.5-0.75) recorded in this study is a further reflection of the souring activity of the lactics and could explain the similarity in sensory attributes (taste and aroma) of all the products which did not differ significantly) ($p > 0.05$). Reed (1982) noted that a good quality yogurt should have a pH of 4.15 and TA (% lactic acid) of 0.5. The values obtained in this work are in agreement with these stated values. Furthermore, coagulation of milk became evident 4h following fermentation as the pH dropped to about 5.0 to 4.8.

Sensory Qualities

Stirring of the milk (coconut, tigernut or cow) during pasteurization (70°C for 30 min) was necessary to disperse the protein and starch evenly to avoid gelatinization of starch during heating (a phenomenon observed when tigernut milk was heated without stirring at the preliminary stage of the study). Pasteurization is believed to modify milk protein so as to enhance proper viscosity and gelatinization of the product (Reed, 1982), and, this could account for the uniformity and smoothness in body texture in all products as observed in this study, resulting to these sensory quality attributes (texture/mouthfeel) not being significantly different (**Table 2**). A suggestion to improve the viscosity of the tigernut yogurt by the addition of stabilizer was made by one of the tasters.

Overall, the results obtained in this study indicate that it is feasible to prepare acceptable yogurt-like products from coconut and tigernuts which should be of economic significance, since, cow-milk is relatively expensive and highly perishable. However, it will be worthwhile to add stabilizers like gelatin to these yogurt-like products to increase their smoothness and body/textures. Further work should be carried out to extend the shelf-life of these products.

Table 1. Chemical and proximate compositions of yogurt produced from tigernuts, coconut and cow milk.

	ANALYSES [1]						
	Chemical		Proximate Composition (%)				
Product (Yogurt)	pH	TA (%)	Moisture Content	Crude Protein	Crude fat	Sugar	Ash
Coconut (100%)	4.1	0.55	69.0	3.78	3.8	15.8	0.01
Tigernut + Cow milk (3:2 w/v)	3.9	0.65	78.0	2.80	4.5	14.5	0.10
Coconut + Cow milk (3:2 w/v)	4.0	0.75	70.0	3.50	3.5	14.6	0.20
Tigernut (100%)	3.9	0.50	74.0	2.66	4.1	16.2	0.20
Cow Milk (100%)	3.9	0.60	77.0	3.22	3.2	14.8	0.20

Each data is the mean of duplicate determinations.

Table 2. Sensory scores of Yogurt and Yogurt-like products prepared from milk, coconut and tigernut.

	Sensory Attributes[1, 2]				
Product (Yogurt	Appearance	Mouthfeel	Taste	Aroma	SOA[3]
Coconut (100%)	3.3b	3.3a	2.5a	2.8a	3.0ab
Tigernut + Cow milk (3:2 w/v)	3.5b	3.2a	2.5a	2.9a	2.7a
Coconut + Cow milk (3:2 w/v)	2.0a	2.1a	2.3a	2.4a	1.9a
Tigernut (100%)	3.8b	3.1a	3.4a	3.5a	3.4b
Cow milk (100%)	1.5a	3.0a	2.2a	2.5a	2.1a

1. Sensory scores are the mean value of 10-member panelist
2. Different letters within the same column are significantly different ($p < 0.05$)
3. SOA: Sensory overall acceptability

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