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Production and Evaluation of Composite Soymilk Yoghurt

Research Article

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Abstract

Composite soymilk yoghurt was produced from composite blends of cow skim milk: Soymilk in a ratio of 100:0% (Sample A), 0:100% (Sample B), 50:50% (Sample C), 60:40% (Sample D) and 40:60% (Sample E). Each composite blend milk samples was pasteurized at 85°C for 15 min, cooled and homogenized and inoculated with a mixed yoghurt starter culture of *Streptoccus thermophilus* and *Lactobacillus bulgaricus* at 45°C for 12hr and further pasteurized and homogenized. The proximate, physicochemical properties and sensory evaluation of the composite soymilk yoghurt samples were determined. The result of this study reveals that there was a significant decrease ($p>0.05$) in protein content from 4.2% (Sample A) to 2.95% (Sample D) as the level of soymilk substitution in the yoghurt increased from 40% (Sample E) to 60% Sample D. Titratable acidity of the control Sample A was very high, 1.24% Lactic acid however the titratable acidity of soymilk yoghurt (Sample B) was very low 0.51% lactic acid whereas the titratable acidity of the composite yoghurts (Samples C, D and E) were within the limits of a good yoghurt (0.85-0.90% lactic acid). The mean sensory scores of the yoghurt samples reveals there was a significant difference ($p>0.05$) in terms of taste, smoothness and overall acceptability between Sample A (control) and the composite soymilk yoghurt samples (Samples B, C and D) except for Sample E that was not significantly ($p<0.05$) different from Sample A. Therefore in the production of yoghurt, soymilk can be substituted up to 40% in normal cow milk yoghurt preparation without affecting the proximate, physicochemical and sensory properties of the yoghurt.

Keywords: Composite soymilk yoghurt; Skim milk; Titratable acidity; Yoghurt starter culture.

Introduction

Yoghurt is one of the oldest fermented milk products known in human history. It is produced by inoculating concentrated milk with a yoghurt starter culture consisting of a mixture of homofermentative lactic acid bacteria, *Strephococcus thermophilus* and *Lactobacillus bulgaricus* at 45°C until the pH of about 4.0 is attained and cooled rapidly to about 4°C [1]. Yoghurt is consumed for its refreshing and appealing flavour, biotherapy and versatility. However most of the industrialize yoghurt production utilize milk from cow. Cow milk gives yoghurt its unique characteristic [2].

Owing to ever increasing cost of cow milk, attempt is being made to find cow milk substitute for the production of yoghurt. Health is one of the biggest motivating factors in consumers' decision making process in the consumption of fruit juice and yoghurt products.

Soymilk has been found to have close similarities with cow milk and Kanda et al, 1976 successful use of soymilk in yoghurt production will not only improve the nutritional status of the poverty stricken masses but also reduce the fears associated with high blood cholesterol and lactose of avid consumers of cow milk [3-5].

Wide spread acceptability of soymilk by consumers is been hindered by the intrinsic beany flavor associated with soybean [6,7]. Thus in a bid to win consumers appeal, composite soymilk yoghurt was innovatively formulated and produced to meet the need of both the young ones who do not bother about cholesterol as well as the increasing number of lactose intolerance children and the adult consumers who want a healthy soymilk yoghurt that has a low cholesterol level; leading to a healthy active life and good taste with smooth texture [8,9].

This study therefore is aimed at producing and conducting sensory evaluation of the composite soymilk yoghurt that address the needs of the health conscious yoghurt consumers especially lactose

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intolerance and cardiovascular problems caused by the consumption of cholesterol based cow milk yoghurt as well as reducing the cost of yoghurt in the market.

Materials and Methods

Materials

Soybean, skim milk powder and granulated sugar, were purchased from a local market in Port Harcourt, Nigeria. Yoghurt starter culture was sourced from a market in Lagos. All chemical used were of their analytical grade, products of BDH Chemical Ltd. Pool. England.

Methods

Four (400 g) of soybean was soaked in 1200 ml of distilled water for 12 hours to obtain a bean to water ratio of (1:4). The soybean was blanched in 2L of boiling 0.05% $NaHCO_3$ in a cooking pot for 15 min. The blanched soybean was hand dehulled and the hulls removed by floatation. The blanched soybean cotyledons were then used for soymilk extraction (Figure 1).

Production of cow milk yoghurt: Cow milk yoghurt was produced using 150 g of skim milk powder and 40 g of granulated sugar dissolved and made up to one liter of boiled distilled water. The yoghurt production was based on Richard (2001) method as stated in (Figure 2) [1].

Production of composite soymilk yoghurt: Production of composite soymilk yoghurt was based on the recipe as shown in Table 1 where soymilk was blended with cow skim milk and processed according to Figure 3.

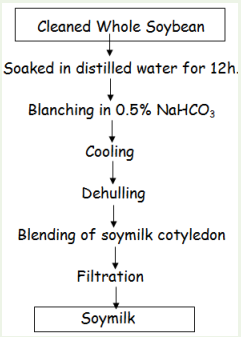

Figure 1: Flow chart for the production of soymilk.

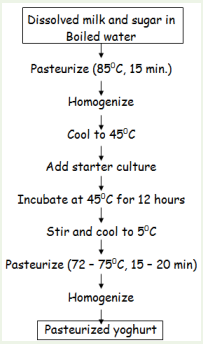

Figure 2: Flow chart for the production of cow milk yoghurt.

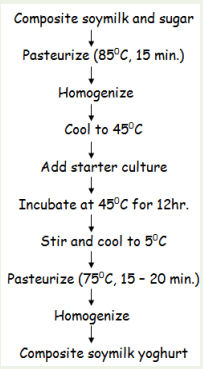

Figure 3: Flow chart for the production of composite soymilk yoghurt.

Table 1: Formulation of composite soymilk recipe.

	Blend Codes				
Ingredients	**A**	**B**	**C**	**D**	**E**
Cow Skim Milk	300 ml	-	150 ml	120 ml	180 ml
Soymilk	-	300 ml	150 ml	180 ml	120 ml
Sugar	40 g	40 g	40 g	40 g	40 g
Yoghurt starter culture	1.5 g	1.5 g	1.5 g	1.5 g	1.5 g

Note: A = 100% Cow skim milk; B = 100% Soymilk; C = 50% Soymilk: 50% skim milk; D = 60% Soymilk: 40% skim milk; E = 40% Soymilk: 60% skim milk.

Proximate analysis of yoghurt: Moisture, fat, crude protein, carbohydrate ash and crude fiber was determined by AOAC (2006) standard methods. While pH and titratable acidity was determined according to the method of Pearson (1991) [10].

Sensory evaluation of composite soymilk yoghurt: The yoghurt produced was evaluated organoleptically for color, taste, aroma, smoothness and overall acceptability. A twenty member panel consisting of students of the Department of Food Science and Technology was selected based on their familiarity with the consumption of yoghurt.

A 9 point hedonic scale was used to evaluate the organoleptic parameter of color, taste, aroma, smoothness and overall acceptability. Each sensory attribute was rated on the 9 point hedonic scale where 1 = dislike extremely, 5 = neither like nor dislike and 9 = like extremely.

Statistical analysis: The data obtained was subjected to analysis of variance (AVOVA).

Results and Discussion

The proximate composition of the composite soymilk is shown in Table 2 with sample A as control (skim milk yoghurt). There was a significant difference ($p>0.05$) in the protein content of sample A (skim milk yoghurt (4.29%) and that of soymilk yoghurt (sample B) (3.01%).

The table reveals that the protein content decreased significantly ($p>0.05$) from 4.2% (sample A, control) to 2.95% (sample D) as the level of soymilk substitution in the yoghurt increased gradually from 40% (sample E) to 60% (sample D).

The physiochemical properties of the composite soymilk yoghurt are shown in Table 3.

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Table 2: Proximate composition of composite soymilk yoghurt.

Sample Code	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Carbohydrate (%)
A	86.34^{b}	4.29^{a}	1.88^{a}	0.91^{a}	7.58^{a}
B	94.11^{a}	3.01^{c}	0.32^{c}	0.41^{c}	2.05^{d}
C	89.83^{a}	3.49^{b}	1.13^{b}	0.60^{b}	6.45^{b}
D	91.13^{a}	2.95^{c}	0.93^{b}	0.57^{c}	4.22^{c}
E	89.02^{a}	3.83^{a}	1.62^{a}	0.69^{b}	6.63^{b}

Note: A = 100% Skim milk yoghurt (control); B = 100% Soymilk yoghurt; C = 50% Soymilk: 50% skim milk yoghurt; D = 60% Soymilk: 40% skim milk yoghurt; E = 40% Soymilk: 60% skim milk yoghurt.
*__abc__ = Means with the same superscript within column do not differ significantly (p>0.05).

Table 3: Physicochemical properties of the composite soymilk yoghurt.

Sample Code	pH	Total Solid (%)	Titratable acidity % Lactic acid
A	3.02^{b}	13.66^{a}	1.24^{a}
B	4.98^{a}	5.89^{c}	0.51^{c}
C	3.81^{c}	10.17^{b}	0.88^{b}
D	3.79^{c}	9.87^{b}	0.78^{b}
E	3.71^{c}	10.98^{b}	0.91^{b}

Note: A = 100% Skim milk yoghurt; B = 100% Soymilk yoghurt; C = 50% Soymilk: 50% skim milk yoghurt; D = 60% Soymilk: 40% skim milk yoghurt; E = 40% Soymilk: 60% skim milk yoghurt.
*__abc__ = Means with the same superscript within the same column do not differ significantly (p>0.05).

The total solids of the yoghurt decreased significantly (p>0.05) from 13.66% for 100% skim milk yoghurt (sample A) to 5.8% for 100% soymilk yoghurt however as the level of soymilk substitution increases from 40% sample E to 100% sample B, the total solids decreased significantly (p>0.05).

Titratable acidity of the control yoghurt (sample A) was very high as expected whereas that of the soymilk yoghurt (sample B) was very low. Ukwo and Edima-Nyah (2015) reported that titratable of yoghurt samples decreases as the level of soymilk substitution increases [11].

The titratable acidity of the composite yoghurt (samples C, D and E) was within the limits of good yoghurt. Jay 1978 stated that the titratable acidity of good finished yoghurt should be in the range of 0.85-0.90% [12].

Lactic acid as index of titratable acidity is the main product of yoghurt fermentation, although minor products such as the butter flavour substance biacetyl are also produced [13]. The high value of the titratable acidity of sample A may be due to the fact that cow milk contains lactose which is broken down to lactic acid [14-18].

Table 4 shows the mean sensory scores of the composite soymilk yogurt. There was a significant (p<0.05) difference in all the sensory attributes between the cow milk yoghurt (sample A, control) and the soymilk composite yoghurt (sample B, C, D, and E) except for aroma. There was no significant difference (p>0.05) in the aroma between all the samples Eluchie et al. (2011) reported similar observation [14]. This could be attributed to the production of the yoghurt butter flavour substance biacetyl by the mixed starter yoghurt culture [13].

In terms of taste, smoothness and overall acceptability, there was a significant (p>0.05) difference between sample A (control) and the composite soymilk yoghurt (sample B, C, D) except for sample E that was not significantly different (p<0.05) from sample A. Thus in the production of yoghurt, soymilk can be substituted up to 40% in normal cow milk yoghurt preparation without affecting the proximate, physicochemical and sensory properties of the yoghurt.

Table 4: Mean sensory score of composite soymilk yoghurt.

Blend Codes					
Sample Code	Color	Taste	Aroma	Smoothness	Overall Acceptability
A	4.70^{a}	4.50^{a}	3.55^{a}	4.10^{a}	4.20^{a}
B	3.25^{c}	2.55^{c}	3.25^{a}	2.70^{c}	2.95^{c}
C	3.40^{c}	3.01^{b}	3.15^{a}	3.15^{b}	3.35^{b}
D	3.98^{b}	3.50^{b}	3.55^{a}	3.60^{b}	3.55^{b}
E	3.88^{a}	4.32^{a}	3.40^{a}	3.98^{a}	4.05^{a}

Key: A = 100% Skim milk yoghurt; B = 100% Soymilk yoghurt; C = 50% Soymilk: 50% skim milk yoghurt; D = 60% Soymilk: 40% skim milk yoghurt; E = 40% Soymilk: 60% skim milk yoghurt.
*abc = Means with the same superscript within the same column do not differ significantly (p>0.05).

Conclusion

Good soymilk composite yoghurt comparable to cow milk yoghurt can be produced by substituting soymilk up to 40% in the cow milk yoghurt formulation and still maintain the organoleptic qualities found in normal cow milk yoghurt.

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