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Evaluation of the Physico chemical composition of yoghurt prepared from dairy milk and soy milk

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ABSTRACT

Yoghurt is a fermented dairy product obtained by lactic acid fermentation of milk by the action of yoghurt starter bacteria. The Physico chemical composition of yoghurt prepared from dairy milk and soy milk were evaluated. Results revealed that values of specific gravity ranged from 1.02 to 1.04. Yoghurt from 100% soybean had the lowest value, while samples made with 60 % SM-90 % SM had the highest value of 1.04. Significant differences did not exist ($p>0.05$) between the samples. Yoghurt made from 100 % dairy milk had the highest total solid of 11.67, while 100 % soy milk had the least total solids of 5.96 %. The ash ranged from 2.70 for (50 % SM 50 % DM) to 8.67 for (100 % DM). There was no significant ($p>0.05$) difference among the samples tested for ash. The brix index ranged from 3.4 for (100 % DM) to 10.00 for (80 % SM 20 % DM). There was no significant ($p>0.05$) difference among the samples tested for brix. The acidity ranged from 0.40 (100 % DM) to 1.42 (100 % SM). There was no significant ($p>0.05$) difference on the samples tested for acidity. In conclusion the results from this research have revealed that sample B (100 % dairy milk yoghurt) was more acceptable than other blends of the yoghurt with respect to physico chemical properties, and viscosity of the sample.

Keywords: Physico chemical, composition, yoghurt, dairy milk and soy milk.

INTRODUCTION

The oldest evidence of soy milk production was from China where a kitchen scene proving use of soy milk was incised on a stone slab dated around AD 25–22 [1]. A traditional staple of Asian cuisine, it is a stable emulsion of oil, water, and protein [2]. Soy milk contains about the same proportion of protein as cow's milk [3] though the amino acid profile differs. Natural soy milk contains little digestible calcium as it is bound to the bean's pulp, which is indigestible by humans [4]. To counter this, many manufacturers enrich their products with calcium carbonate available to human digestion [5]. Unlike cow's milk, it has little saturated fat and no cholesterol. According to [6] like lactose-free cow's milk, soymilk contains no lactose, which makes it a good alternative for lactose-intolerant people. For patients without conditions that limit sugars they can consume, there is no evidence to support any sugar-related health benefit or detriment to consuming soy beverage instead of cow's milk [7].

Justification for the study

The following are some inherent setbacks that necessitated the study.

i. High cost of dairy milk, which is the major source of milk for yoghurt production.
ii. High cholesterol content in dairy milk

Considering these outlined limitations in the production and consumption of dairy yoghurt in Nigeria today, there is need to articulate an alternative source, which includes:

(a) Getting raw materials whose cost would be affordable to the small and cottage entrepreneurs.
(b) Considering the health benefit of plant protein

The Objective of research

The main objective of this work was to determine the Physico chemical

MATERIALS AND METHODS

Sources of materials

Soy beans, powdered milk, sugar, sodium benzoate, flavouring agent and starter culture were purchased from meat market, Abakaliki, Ebonyi State, Nigeria.

SAMPLE PREPARATION

Soy milk production.

To produce soy milk with uniform consistency and reduced particle size, 7.0 kg of dried soy beans grain was weighed and soaked in warm water (45°C) for 24hour. At interval of 8 hour, the warm water was drained off and replaced with a new one to reduce the beanie flavour of the soy beans grain. After soaking the dried soy beans overnight, the beans was de-husked, washed with water and poured into a blender with fresh water, which was blended thoroughly into a paste. Three litres of clean tap water was added and thoroughly mixed to give slurry. The soy bean milk was extracted by transferring the slurry to a clean white sieve cloth where filtration by suction took place. The beans dreg on the filter cloth was dried and used as livestock and poultry feed. The extracted milk was transferred into a pot and pasteurized at 85 °C for an hour and allowed to cool gradually to a temperature of about 42-45 °C. The yellowish wad appeared on the surface was scooped off using a clean spoon. The cooled homogenised milk was incubated with the already prepared starter culture. The mixture was stirred properly and kept to stand at a temperature of about 30-35 °C for 24 hour. After this period the yoghurt is produced. Sugar, flavour and preservatives are seldom added.

The yoghurt production

The yoghurt was prepared according to the procedure described by [3]. The milkwas first filtered using a clean cheese cloth. The milk was warmed to 43-45 0C and thereafter 6.5% sugar and 2.5% skimmed milk powder were added and stirred. The milk was further heated to 85 0C and was held at this temperature for 30 minutes with continuous stirring. After 30 minutes the milk was cooled to 42 0C after which it was inoculated with freeze dried thermophilic yoghurt starter culture and the amount to be used was based on the manufacturer's specifications. The milk was incubated for 4-6 hours after which the milk was refrigerated for 12 hours to stop the fermentation process. The set yoghurt was stirred by first breaking the curd and presented to panellist in white identical cups for sensory quality evaluation and acceptability determination.

The blends

The method described by [5] with slight modifications was adopted. The fresh soy yoghurt will be produced at different ratios, starting from the 100% un- blended milk sources (100 % DM and 100 %SM) respectively (where DM- represents dairy milk and SM- represents soy milk). For the blends, formulation ratios of 1000 ml of soy milk and 1000 ml of dairy milk was measured out for the proportion in which it is to be blended. 10mls of dairy milk was blended to 90 ml of soy milk, (representing 10 % DM and 90 %SM), 20 ml of dairy milk and 80 ml of soy milk (20 %DM and 80 %SM), 30mls of dairy milk and 70mls of soy milk,(30 %DM and 70 %SM), 40mls of dairy milk and 60mls of soy milk(40 %DM and 60 %SM), 50mls of dairy milk and 50mls of soy milk(50 %DM and 50 %SM), 60mls of dairy milk and 40mls of soy milk(60 %DM and 40 %SM),while 70mls of dairy milk and 30mls of soy milk represents (70 %DM and 30 %SM),80mls of dairy milk and 20mls of soy milk(80 %DM and 20 %SM), 90mls of dairy milk and 10mls of soy milk(90 %DM and 10 %SM). These blends was cultured, inoculated, and processed for yoghurt production, and labelled based on the percentage ratio of mixture of the processed milk sources.

Table1: Ratios of dairy milk / soy milk blends

S/n	Soy Milk (%)	Dairy Milk (%)
1	100	0
2	0	100
3	90	10
4	80	20
5	70	30
6	60	40
7	50	50
8	40	60
9	30	70
10	20	80
11	10	90

Chemical analysis determination of soy yoghurt samples.

Total Titre table Acidity (TTA)

The total titratable acidity of the yoghurt samples was determined according to [6] technique. Twenty grams of well homogenized sample was placed in a beaker, with the aid of 20ml pipette, which was titrated against 0.1 mol·l-1NaOH with phenolphthalein as indicator, until a pink colour shall be obtained. Titratable acidity was expressed as equivalent lactic acid g.100g-1. The percentage of lactic acid was used as a representative of titre table acidity according to the formula:

The titre table acidity (% of lactic acid) =

$$\frac{\text{titre value x molarity x 0.09}}{\text{Volume of sample (ml)}} \times \frac{100}{1}$$

Determination of $_{P}^{H}$ of the Sample

The pH of the sample was determined using a digital pH meter. The pH meter was switched on and allowed to warm up for 20 min. The pH was adjusted to neutral value by using distilled water at ambient temperature. The sample of the soy yoghurt was measured out and poured into a 100 ml conical flask, while the electrodes of the meter was cleaned, dried and dipped into the different samples and reading noted. After recording the pH of the first sample, the electrodes was re-washed with distilled water before being dipped into the second and subsequent samples until all the samples pH are determined.

Specific gravity

The specific gravity of the soy yoghurt sample was determined according to the method of described by [7]. The pyrometer bottle (specific gravity bottle) of 50 ml was thoroughly washed with detergent, water, petroleum ether, and rinsed with distilled water, then dried in an oven and allowed to cool in a desiccator. The weight of the sample is weighed using matler weighing balance of P^2 and recorded as weight of the empty specific gravity bottle, the empty specific gravity bottle was filled with distilled water and the weight taken before emptying the bottle, to be filled up again with the sample and weighed to get the weight. The specific gravity of the soy yoghurt sample analysed was calculated as follows.

$$\text{Specific gravity} = \frac{\text{weight of X ml of the sample}}{\text{Weight of X ml of the water}}$$

Ash content

The ash content of the soy yoghurt sample was determined according to the standard methods [8]. Two (2g) grams of sample was weighed and poured into the crucible W_1. The crucible with the sample was charred over a burnsen flame in a fume chamber. The charred sample with the crucible was incinerated at 550°C in a muffle furnace for about five hours (5hrs) when grey ash was obtained. The ash was cooled in a dessicator and reweighed W_2. The percentage ash was calculated as

$$\% \text{ ash} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

Total solid content

The total solid content of the soy yoghurt sample was determined according to the method described by [8]. About ten gram (10g) of the sample was weighed and poured into the petri dish to be dried at oven temperature of 100 °C to 105 °C, after drying to a constant weight. The weight of the sample was recorded. The total solid content was calculated as follow

$$TS = \frac{W_2 - W_1}{W_0} \times \frac{100}{1}$$

Where; W_2 is the weight of the petri dish and the sample before drying. (g)

W_1 is the weight of the empty petri dish (g)

W_0 is the weight of the sample used and it's expressed in percentage total solid Content. (g)

Refractive Index

The refractive index or the brix content of the sample soy yoghurt was determined using the method described by [9]. The abbes refractive meter was calibrated with distilled water in a light compensator; the sample was smeared on the lower prism of the refractor meter and closed. A light will be passed by the means of the angled minor while the self-elected light will appear in form of a dark background which was fine adjusted by moving the telescope tube until the black shadow appears on the central of the cross line indicator. The reading of the refractive index will then be read off the screen; also the brix index in percentage will be read at specific temperature.

Sensory Evaluation

A twenty man sensory panellist was arranged to carry out a sensory evaluation on each of the product blends produced. They are to determine the organoleptic acceptance of the products in terms of aroma, mouth feel, taste, appearance and overall acceptance. A 7 point hedonic scale was used whereby 7= highly accepted, 6= accepted, 5= moderately accepted, 4= neither accepted/ rejected, 3= moderately rejected, 2= rejected, 1= highly rejected. A product of similar recipe and configuration was used as the control for the evaluation. Mean sensory scores was analysed with analysis of variance (ANOVA) and means separated stundentized test according to the method of Ihekronye and Ngoddy, 1985.

Statistical analysis

The data obtained was analysed using analysis of variance (ANOVA) and means was compared by Duncan's Multiple Range test [5].

RESULTS

Physico chemical properties of soy yoghurt blends

Results presented in Table 2 are the physicochemical properties of yoghurt made from soy and dairy yoghurt blends

Table 2: Physico chemical properties of Soy yoghurt blends

SAMPLES %	SPECIFIC GRAVITY %	TOTAL SOLID %	ASH CONTENT %	BRIX INDEX %	TTA %
100Dairy milk	1.02 ± 0.07[a]	11.67±0.07 [a]	4.35± 0.13 [bc]	6.50±0.42 [d]	1.42±0.00 [a]
100 Soy milk	1.03 ± 0.01 [a]	5.96±0.06 [e]	8.67±0.08 [a]	3.40±0.42[e]	0.40±0.01 [e]
90SM 10DM	1.04±0.2 [a]	8.02±0.03 [b]	5.00±0.16 [b]	8.50±0.11[bc]	0.75±0.00 [d]
80SM 20DM	1.04±0.05 [a]	7.74±0.71[c]	3.50±0.48 [cd]	10.00±0.34 [a]	1.20±0.00 [bc]
70SM 30DM	1.04±0.01 [a]	7.25±0.11 [d]	3.60±0.30 [cd]	9.00±0.10[ab]	1.18±0.01 [bc]
60SM 40DM	1.04±0.01 [a]	7.20±0.04 [d]	3.10±0.30[d]	9.00±0.20[ab]	1.20±0.01 [bc]
50SM 50DM	1.03± 0.01 [a]	7.64±1.90 [b]	2.70±0.60[d]	7.50±0.20[cd]	1.22±0.02[b]

Data are means of triplicate samples ± standard deviation values with different superscript are significantly ($p<0.05$) different.A=100% Soymilk, B=100% Dairy milk, C=90 % Soy Milk + 10 % Dairy Milk, D=80% Soy Milk + 20% Dairy Milk, E= 70% Soy Milk +30 % Dairy Milk, F=60 % Soy Milk + 40 % Dairy Milk, G= 50% Soy Milk +50% Dairy Milk.

Results revealed that values of specific gravity ranged from 1.02 to 1.04. Yoghurt from 100% soybean had the lowest value, while samples made with 60 % SM-90 % SM had the highest value of 1.04. Significant differences did not exist ($p>0.05$) between the samples. Yoghurt made from 100 % dairy milk had the highest total solid of 11.67, while 100 % soy milk had the least total solids of 5.96 %. The ash ranged from 2.70 for (50 % SM 50 % DM) to 8.67 for (100 % DM). There was no significant ($p>0.05$) difference among the samples tested for ash. The brix index ranged from 3.4 for (100 % DM) to 10.00 for (80 % SM 20 % DM). There was no significant ($p>0.05$) difference among the samples tested for brix. The acidity ranged from 0.40 (100 % DM) to 1.42 (100 % SM). There was no significant ($p>0.05$) difference on the samples tested for acidity.

DISCUSSION

Physicochemical Properties

Ash content

In this study ash content of yoghurt from the soymilk blends presented in Table 2 showed that, decrease in soymilk decreases the ash content of the blend. Ash content of foods is important as they represent the total mineral content of foods and thus serves as an adjustable tool for nutritional evaluation [4]. This implies that the yoghurt with 90 % soymilk and 10 % milk has more minerals than other samples. This may be attributed to high mineral contents in soymilk. [5], while comparing the cow milk and soymilk, showed that cow milk contained less iron and calcium than soymilk.

Total solid

In this study total solid content of yoghurt from the samples presented in Table 2 showed that the total solid content of the samples decreased with decrease in soybean content. The decrease could be due to the decrease in concentration of soybean which has less suspended particles. [3] had similarly reported that total soluble solids increased with increase in concentration of the yoghurts. Higher values of total solid could be attributed to higher levels of suspended particles occasioned by dry matter particles in soy milk [8]. This is in line with the report of [5] who reported that different total solid value was expected due to difference in concentrations of the fortificant used. This is because of the suspended particles contributed by the soymilk which increase the concentration of the blend hence, higher value of total solid. The higher the total solid the more viscous the yoghurt should be. Dairy milk (100%) yoghurt should be less viscous, less thick and more easily pourable than others. A low amount of total solid could explain this observation[3].

Acidity

From Table 2, the acidity of the yoghurt from soymilk blends studied increased with decrease in soymilk content. This is line with the report of [3], who reported that titratable acidity of samples of yoghurt from soy milk blends increased with increasing cow milk content and decreased with increasing soymilk content. [5], noted that proteins present in the fortificant can act as buffers in food systems by their ability to release or accept free hydrogen atoms. Soybean being rich source of protein, exert some buffering action against the acidity of the yoghurt systems, hence its stability. Also high acidity may be an indication of longer keeping quality of the product.

Specific gravity

From Table 2, the specific gravity (SG) of the yoghurt from the soy milk blends decreased while viscosity increased with the increasing level of the dairy milk in the samples.The decrease in the specific gravity being significant to ($P < 0.05$).

CONCLUSION

The results have also revealed that sample B (100 % dairy milk yoghurt) was more acceptable than other blends of the yoghurt with respect to physico chemical properties, and viscosity of the sample. Incorporation of yoghurt at levels of 50% to 50% of the total sample mix for soy based yoghurt resulted in increased viscosity and decreased specific gravity of the resultant mix. All dairy milk mixes were pseudo plastic (non-Newtonian, time independent fluids with shear thinning behaviour). And the samples did not significantly differ from each other in this respect.

RECOMMENDATION

The fortification of yoghurt with soy solids using stabilizers is however recommended considering the iso flavones and mineral content in soymilk. The discovery of cheaper vitamins in plant protein as alternative to animal protein could solve problem of lactose intolerant individual and increased vitamins demand in developing countries considering their nutritional benefit. The addition of soy solids is advantageous and its uses as vitalized food supplement. The high cost of imported milk and milk production in Nigeria and Africa seen to have made consumers more ready to accept milk produced from plant protein.

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