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Full Length Research

Effect of different stabilizers on acceptability and shelf-stability of soy-yoghurt

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The effect of cassava starch and corn starch on the consumers` acceptability and shelf- stability of soy-yoghurt was investigated. Three batches of soy-yoghurt were prepared using corn starch, cassava starch and gelatin as stabilizers, while the fourth batch served as control. All the batches were organoleptically evaluated and stored at 6 ± 2°C for 16 days and were subjected to physical examination and chemical analyses such as pH, titratable acidity (TTA) and microbial counts. All the stabilizers prevent whey separation. A putrid/offensive odour developed in all yoghurt samples from the 8th day of storage; while gas production was observed in all stabilized soy-yoghurt samples. For both pH and TTA, there was significant difference (P<0.05) between all the treatments and the length of storage. Microbial counts increased within first four day of storage and this was followed by a decrease. Gelatin stabilized soy-yoghurt was rated best, followed by cassava starch stabilized soy-yoghurt. Result from the present study suggests cassava starch as a probable alternative stabilizer in soy-yoghurt production.

Key words: Soy-yoghurt, stabilizers, cassava starch, corn starch, shelf-stability.

INTRODUCTION

There is no denying that soybean products have many health benefits. These health benefits are mainly coming from the quality of the soy proteins and from the isoflavones and daidzein (Smoothie Recipes, 2006). Such health benefits include improvement of bone health, reduction of menopausal symptoms and risk for heart diseases and certain cancers; in addition to being highly nutritive. These immense benefits must have stimulated a lot of researches on incorporating soybean into indigenous diet such as soybean fortified gari and tapioca (Sanni and Sobamiwa, 1994; Kolapo and Sanni, 2005), soy daddawa (Popoola and Akueshi, 1985, Popoola et al., 2007) and soy-yoghurt (Nsofor et al., 1992; Olubamiwa et al., 2006).

Soymilk is a traditional oriental food beverage that is growing in popularity in the United States and the world (Haumann, 1984). It is commonly characterized as having a beany, grassy, or soy flavour, which reportedly can be improved by lactic acid fermentation, as in yoghurt-like products (Mital et al., 1974 and Pithong et al., 1980). In addition to this beneficial effect of lactic acid fermentation of soymilk Lee et al. (1990) reported that soy yoghurt would offer several distinct nutritional advantages over milk yoghurt to the consumers. Such advantages include reduced levels of cholesterol, saturated fat and lactose.

There have been various processing protocols aimed at reducing syneresis in yoghurt production. These include heating the premix to 80 – 85°C for 30 min (Morr, 1985, 1989) and addition of stabilizer gums (Lee et al., 1990) of which gelatin is the most commonly used. Collins et al. (1991) have suggested the use of starch, especially sweet potato starch as stabilizers in soy-yoghurt production. The use of locally sourced raw materials would help reduce the production cost of soy-yoghurt. The present paper investigates the effect of cassava starch and corn starch on the consumers` acceptability and shelf-stability of soy-yoghurt.

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Table 1. Physical observation of stored, refrigerated soy-yoghurt samples.

Storage time (days)	CX				COX				CAX				GX			
	C	O	WS	G	C	O	WS	G	C	O	WS	G	C	O	WS	G
0	CR	-	-	-	CR	-	-	-	CR	-	-	-	CR	-	-	-
2	CR	-	-	-	CR	-	-	-	CR	-	-	-	CR	-	-	-
4	CR	-	-	-	CR	-	-	-	CR	-	-	-	CR	-	-	-
6	CR	-	+	-	CR	-	-	+	CR	-		+	CR	-	-	-
8	CR	P	+	-	CR	P	-	+	CR	P	-	+	CR	P	-	-
10	CR	P	+	-	CR	P	-	+	CR	P	-	+	CR	F	-	-
12	CR	P	+	-	CR	P	-	+	CR	P	-	+	CR	F	-	+
14	CR	P	+	-	CR	P	-	+	CR	P	-	+	CR	F	DC	+
16	CR	P	+	-	CR	P	+	+	CR	P	-/+	+	CR	F	DC	+

CX = Control; COX = Corn stabilized; CAX = Cassava Stabilized; GX = Gelatin stabilized.
C = colour; O = odour; WS = whey separation; G = gas production.
P = Putrid; F = offensive; CR = cream; DC = dense curdling.
+ = present.
- = No change.

MATERIALS AND METHODS

Production of soymilk and yoghurt fermentation

Soybean seeds (Variety TGX-923-2E) were obtained from the Institute of Agricultural Research and Training, Moor Plantation, Ibadan, Nigeria. Commercially available yoghurt starters and other ingredients were purchased from the local stores. The method of Mital et al. (1974) as reported by Lee et al. (1990) was used to produce soymilk. Mixtures of soymilk, sucrose and gelatin were prepared, homogenized and pasteurized as previously described by Collins et al. (1991). Gelatin, cassava starch and corn starch were used as stabilizers at 0.5% concentration as recommended in literature (Collins et al., 1991). The fourth experimental set up was a control, wherein no stabilizer was used. The mixture was subsequently placed in water bath to cool down to 43°C prior to inoculation of starter cultures. The cool down mixtures were inoculated with 1% commercial yoghurt culture (50:50 mixture of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*) as described by Lee et al. (1990). They were then incubated at 43°C and allowed to ferment for about a period of 12 h. After incubation, they were cooled in an ice bath, placed in a cabinet at 6 ± 2°C and held for evaluation within 12 hours, after which they were stored at 6 ± 2°C for 16 days and analyses were carried out at two days interval.

Physical examination of yoghurt samples

The stored yoghurt samples were physically assessed using the following criteria: colour, odour, whey separation and gas production.

Chemical evaluation of yoghurt samples

Samples were analysed for pH and titratable acidity. The pH of the yoghurt samples was measured with pH meter. Acidity was measured as previously described by Olubamiwa et al. (2006). A half milliliter of a 1% solution of phenolphthalein in 95% alcohol was added to ten milliliters of yoghurt sample. Acidity was measured by titrating the mixture thus obtained with 0.1 N NaOH; and it was expressed as g equivalent lactic acid/100 g. All the determinations were carried out in triplicates and mean values were calculated.

Microbial counts

Total viable counts of the yoghurt samples were done by pour plate technique, whereby 0.1 ml of the appropriate dilution was plated out on nutrient agar plates. The plates were incubated at 35°C for 48 h and colony forming units per g sample (cfu/g) was estimated. For mold and yeast counts, the above procedure was repeated using potato dextrose agar and incubation was done at 28°C for 3 - 5 days.

Sensory evaluation

The yoghurt samples were held at 6 ± 2°C until presented for evaluation. A 20-member panel who were regular yoghurt consumers consisted of students and staff of the Polytechnic,
Ibadan. A nine point hedonic scale was used for flavour, colour, taste and acceptability.

Statistical Analysis

Data obtained were expressed as the mean ± standard deviation (SD). The statistical significance of differences was assessed using Analysis of variance. A two-tailed P value of less than 0.05 was considered to be statistically significant.

RESULTS

The result of physical examination of stored soy-yoghurt samples is shown in Table 1. The abilities of the three stabilizers to prevent whey separation are evident when compared to the control experiment. The cream colour of soy yoghurt samples obtained from different approaches was maintained throughout the storage period. Generally speaking, a putrid/offensive odour developed in all soy yoghurt samples from the 8th day of storage; while gas production was observed only in stabilized yoghurt samples. Corn and cassava stabilizes yoghurt produced gas on the 8th day while gelatin stabilizes yoghurt produced

Table 2. pH and titratable acidity of stored, refrigerated soy –yoghurt samples.

Day	CX		COX		CAX		GX	
	pH	TTA	pH	TTA	pH	TTA	pH	TTA
0	3.39±0.55^{d}	0.31±0.05^{e}	3.41±0.01^{d}	0.31±0.02^{e}	3.39±0.61^{c}	0.36±0.00^{e}	3.32±0.53^{d}	0.31±0.02^{c}
2	3.56±0.0^{d}	0.43±0.00^{de}	3.42±0.02^{d}	0.42±0.02^{de}	3.61±0.01^{c}	0.44±0.05^{de}	3.51±0.01^{d}	0.36±0.00^{bc}
4	3.58±0.01^{d}	0.47±0.00^{cde}	3.47±0.21^{d}	0.44±0.05^{d}	3.66±0.01^{c}	0.45±0.13^{de}	3.56±0.01^{d}	0.36±0.00^{bc}
6	5.63±0.01^{a}	0.55±0.08^{bcd}	5.66±0.06^{a}	0.47±0.05^{cd}	5.64±0.00^{a}	0.49±0.08^{cde}	5.82±0.04^{a}	0.49±0.02^{bc}
8	5.64±0.06^{a}	0.69±0.02^{bc}	5.71±0.02^{a}	0.56±0.03^{c}	5.71±0.01^{a}	0.56±0.03^{bcd}	5.83±0.05^{a}	0.50±0.06^{bc}
10	5.68±0.04^{a}	0.69±0.11^{b}	5.72±0.03^{a}	0.68±0.00^{b}	5.71±0.04^{a}	0.60±0.02^{bc}	5.90±0.14^{a}	0.54±0.06^{bc}
12	4.95±0.07^{b}	0.99±0.03^{a}	5.00±0.00^{b}	0.74±0.03^{ab}	4.95±0.21^{b}	0.60±0.02^{bc}	5.55±0.42^{b}	0.58±0.00^{bc}
14	4.80±0.00^{bc}	1.12±0.05^{a}	4.90±0.07^{b}	0.74±0.03^{ab}	4.88±0.05^{b}	0.63±0.03^{ab}	5.05±0.07^{bc}	0.67±0.02^{b}
16	4.43±0.04^{c}	1.16±0.21^{a}	4.56±0.01^{c}	0.81±0.13^{a}	4.65±0.07^{b}	0.74±0.03^{a}	4.90±0.00^{c}	0.99±0.38^{a}

Within the same column, values with the same superscript are not significantly different (P>0.05).
CX = Control; COX = Corn stabilized; CAX = Cassava Stabilized; GX = Gelatin stabilized.

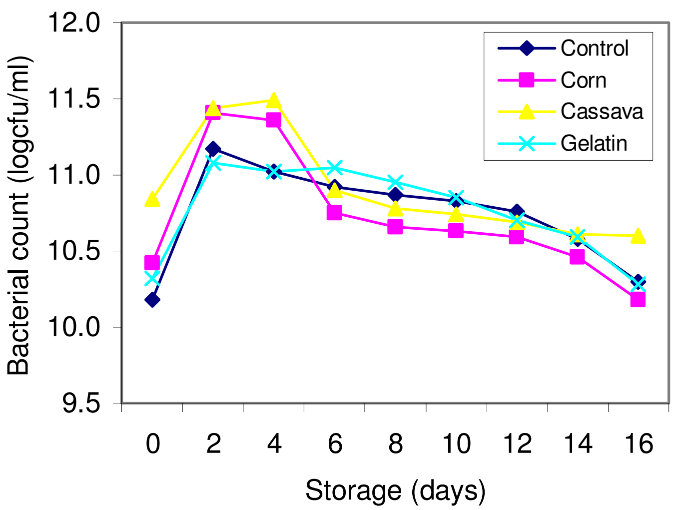

Figure 1. Total bacterial count (logcfu/ml) of stabilized and unstabilized yoghurt samples stored at refrigeration temperature.

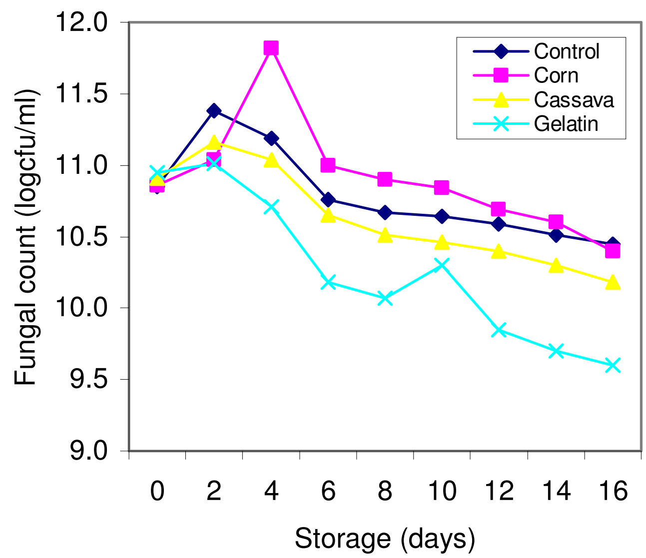

Figure 2. Fungal count (logcfu/ml) of stabilized and unstabilized soy yoghurt samples stored at refrigeration temperature.

gas on the 12th day.

Table 2 shows the changes in pH and titratable acidity (TTA) of the soy yoghurt samples. A two way ANOVA test of the data presented in Table 2 depicts that for both pH and TTA, there was significant difference (P<0.05) between the treatments and the length of storage. For all the soy yoghurt samples, there was a gradual increase in pH within the first four day of storage. However, this was followed by a significant leap on the sixth day, which was sustained till between 10th and 12th day of storage. However, there was a slight drop in pH in the later days of storage. On the contrary, however, the TTA development showed a consistently gradual increase from the beginning to the end of the storage period.

The results of bacterial and fungal counts are shown in Figures 1 and 2, respectively. For both counts, there was a significant increase in the total counts between 0 and 4th day of storage; after which a general decrease in microbial count was observed throughout the remaining storage period. The result of the sensory evaluation of the soy-yoghurt samples prepared in four ways is shown in Table 3. For all the organoleptic parameters, gelatin stabilized soy-yoghurt was rated best. This was followed by cassava starch stabilized soy-yoghurt sample. Corn starch stabilized soy-yoghurt samples was the least rated among the samples investigated.

DISCUSSION

There is an agreement between the result of the physical examination, pH and TTA changes of the stored soy yoghurt samples. The non significant changes in pH and TTA of the stored products within the first four day of

Table 3. Sensory evaluation of stabilized and unstabilized soy-yoghurt samples.

Batches	Colour	Flavour	Taste	Over all acceptability
GX	8.58^{a}	8.08^{a}	7.75^{a}	8.33^{a}
CAX	6.17^{b}	5.92^{b}	5.83^{b}	5.08^{b}
CX	5.42^{b}	4.92^{b}	4.58^{c}	4.25^{bc}
COX	5.17^{b}	4.83^{b}	4.33^{c}	3.67^{c}

Within the same column, values with the same superscript are not significantly different (P>0.05)

CX = Control; COX = Corn stabilized; CAX = Cassava Stabilized; GX = Gelatin stabilized.

storage might be responsible for the shelf stability of the stored soy yoghurt within four days of storage; thus lending credence to the widely held opinion that chemical changes in foods grossly affect their shelf stability and consumer acceptability (Tomassi, 1988). The overall changes in pH and TTA observed for all the stored soy yoghurt samples in the study may be suggesting that the fermentative activities of the yoghurt starters still continued in storage. The simultaneous increase in pH and TTA in the present study is similar to that reported for another soyfood- soybean daddawa (Popoola et al., 2007), wherein the production of acid and ammonia were found to be superimposed in the course of storage; the balance between the two being responsible for the over all pH. The production of ammonia (which could increase the pH) in the present study becomes more probable as some yoghurt starter could produce ammonia from arginine (Collado et al., 1994).

The significant increase in both bacterial and fungal counts of stored soy-yoghurt within the first four days of storage might be further affirming microbial activities in the early days of storage. However, the subsequent reduction in microbial count in the later days might be consequent upon a modified environment which may not be favourable for subsequent microbial proliferation.

Gelatin, being the commonly used stabilizer in yoghurt production had the highest sensorial rating. However, result from the present study suggests cassava starch as a probable alternative stabilizer in producing soy yoghurt while corn starch may not be as useful as cassava starch. In the present era of cassava revolution, particularly in Nigeria, the present study has demonstrated another application of cassava in soy yoghurt production and thus encouraging the utilization of local raw materials in the production process.

REFERENCES

Collado LS, Mabesa RC, Sumague MJV, Mok CK (1994). Yoghurt-like Products from Riceflour and Soymilk The Philippine Agriculturist 77(3): 307-319.

Collins JL, Ebah CB, Mount JR, Demott BJ, Draughon FA (1991). Production and evaluation of Milk-sweet Potato mixtures Fermented with Yoghurt Bacteria. J. Food Sci. 56(3): 685-688.

Haumann BF (1984). Soymilk: New processing, packaging. Expand markets. J. Am. Oil Chem. Soc. 61: 17884.

Kolapo AL, Sanni MO (2005). Processing and Charactristics of Soybean-Fortified Tapioca. J. Women in Tech. Educ. 4:59- 66

Lee SY, Morr CV, Seo A (1990). Comparison of Milk-Based and Soymilk- Based Yoghurt. J. Food Sci 55(2): 532-536.

Mital BK, Steinkraus KH, Naylor HB (1974). Growth of lactic acid bacteria in soymilks. J Food Sci. 39: 1018.

Morr CV (1985). Functionality of heated milk proteins in dairy and related foods. J. Dairy Sci. 68: 2773.

Morr CV (1989). Beneficial and adverse effects of water-protein interactions in selected dairy products. J. Dairy Sci. 72: 575.

Nsofor LM, Nsofor ON, Nwachukwu KE (1992). Soya- Yoghurt starter culture Development from Fermented Tropical Vegetables. J. Sci. Food Agricul. 60: 515-518.

Olubamiwa AO, Kolapo AL, Odetoyinbo BB (2006). Effect of different starter cultures on the chemical compositions and acceptability of soy-yoghurt. Being a paper delivered at the 37th Annual Conference of Nutrition Society of Nigeria. Abeokuta. Nigeria. pp. 8-11.

Pithong R, Macrae R, Rothwell J (1980) The develo-pment of Soya-based yoghurt II. Sensory evaluation and analysis of volatiles. J Food Technol. 15: 653.

Popoola TOS, Akuesh, CO (1985). Microorg-anisms associated with thefermentation of soybean for the production of Soybean Daddawa' (A condiment). Nig. Food J. 2: 194-196.

Popoola TOS, Kolapo AL, Afolabi OR (2007). Biochemical deterioration of soybean daddawa- A condiment. J. Food Agric. Environ. 5(1): 67-70.

Sanni MO, Sobamiwa AO (1994) Processing and characteristics of soybean-fortified gari. World J. Microbiol. Biotechnol. 10: 268- 270.

Smoothie Recipes. (2006). Soya- Information about soy and soya product. http://www.soya.be/soy-health.php

Tomassi G (1988) Nutritional and safety aspect of Natural antioxidants. In: Walker R, Quattruci E (Eds). Nutritional and Toxicological Aspects of Food processing. Taylor and Francis. Basingstoke pp. 1-13.