Physico-chemicial Quality of a Yoghurt-Like Product from African Yam Bean

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Abstract: The production of yoghurt from whole and dehulled African yam bean seeds was studied. African yam bean milk was extracted from whole and dehulled seed, pasteurized and fermented with yoghurmet (a commercial yoghurt culture of *Streptococcus thermophilus* and *Lactobacillus bulgaricus*). Physicochemical qualities of the yam bean yoghurt samples were evaluated to determine the physical and chemical quality of the products. There was a gradual decrease in the pH and an increase in the total titratable acidity of the samples.
[Amakoromo ER, Innocent-Adiele HC, Njoku HO. **Physico-chemicial Quality of a Yoghurt-Like Product from African Yam Bean.** Rep Opinion. 2012;4(4):58-61]. (ISSN: 1553-9873). http://www.sciencepub.net/report 11

Keywords: African yam bean milk, *Streptococcus thermophilus*, *Lactobacillus bulgaricus*, Yoghurt, Physicochemical quality

1. INTRODUCTION

Yogurt a nutrient-dense food is one the most popular fermented milk products worldwide (Willey *et al*., 2008). Over the years the beneficial health effects of yogurt has been attributed to yogurt nutrients (*S. thermophilus and L. delbrueckii ssp. bulgaricus).* However to confer health benefits, the yogurt starter and probiotic bacteria should be present at the recommended concentration of log 6 to 8cfu/g at the time of consumption (Vasiljevic and Shah, 2008).In most yogurt products, culture viability generally declines during refrigerated temperature storage due to a variety and possibly a combination of changes in the environmental conditions, such as a decreased pH. According to Adams and Moss, (1995), the advisory guideline for microbiological quality recommended that satisfactory yogurt should contain less than 1 coliform/g, less than 1 mould/g and less than 10 yeast/g and remain of satisfactory quality.

The African yam bean (AYB) is one of the underutilized legumes found in Nigeria, Central African Republic, Gabon, Zaire and Ethiopia (Ojewola *et al*., 2006). Kine *et al.* (1991) observed that the AYB contain percent crude protein that ranged from 21-29 with 3270 kcal/kg metabolizable energy. The amino acid composition indicates that its methionine and lysine levels are equal to or better than those of soybean. However, the undesirable properties of AYB are similar to those of soybean which are mainly the beany flavour, possession of antinutritional components (Liener*, 1989;* Buono *et al.,* 1990) and hard-to-cook defect. Kinsella (1985) determined that there are four critical criteria determining the acceptability of new foods or food ingredients– nutritional value, safety, acceptability and cost. Through proper processing techniques and handling procedures AYB products can be a safe food source. The acceptability of AYB has been improved through fermentation by bacteria and fungi. The few fermented products developed from extracts of AYB include a cheese-like product (Ofuya *et al.,* 1991), vegetable milk fermented with indigenous micro-organisms (Nnam*,* 1997), and a yoghurt-like product (Aminigo *et al.,* 2007).

The aim of this study is to determine the physiochemical quality of a yogurt-like product from African Yam Bean.

2. MATERIALS AND METHODS

2.1. SOURCE OF AFRICAN YAM BEAN (AYB)

The African yam bean (cream coloured variety) was purchased from Umuahia main market, Abia State. The bean was packaged in polyethylene bags, transported to the laboratory and kept at 4^0C until required. Yogourmet Freeze-dried yogurt starter (Lyo San Inc.,Canada) was gotten from Ariara market in Aba.

2.2. PRODUCTION OF AFRICAN YAM BEAN MILK AND YOGURT

African yam bean seed was divided into two portions and one portion was milled in a sample mill and passed through a 0.5mm screen to obtain flours. The African yam bean milk was prepared from the flour as described by (Aminigo et al, 2007). Each bean flour was blended with 85^0C hot water (1:4 seed : water) in a blender for 3min.The resulting slurry was filtered through two layers of double folded cheese cloth and coarse particles were removed by allowing the filtrate to settle for 10min. The second portion was soaked in 4% NaCl for 12hr, heated for 5min at 100^oC, dehulled and blended with water (1:4) for 3min.The slurry was filtered through two layers of double cheese cloth. Soybean seed was milled and passed through a 0.5mm screen to obtain the flours and the milk was also prepared from the flour as described by (Aminigo *et al*., 2007). African yam bean milk and soybean milk were supplemented with 4% skim milk powder, 1.25% sucrose and 0.5%

gelatine. The mixture was heated with stirring to 95°C for 20 min and cooled to 43°C. The milk was then inoculated with starter culture (5g in litre milk) and incubated at ambient temperature for 12hr. The yogurt was stored at 4°C and at room temperature for 21 days.

2.3. PHYSICAL CHARACTERISTICS

The method used by Amadi *et al.* (1999) was adopted to subjectively describe the colour, texture, and flavor.

2.4. TEMPERATURE AND pH

pH and temperature were determined as described by Aderibigbe and Osegboun (2006) and Njoku *et al.* (1990) respectively.

2.5. STATISTICAL ANALYSIS

The data obtained were subjected to analysis of variance (ANOVA) using Graph Pad Prism Software, version 5.01. Significant difference between means were determined at $p<0.05$.

3. RESULTS ANALYSIS

3.1. Physicochemical Characteristics of African Yam Bean Yoghurt

The changes in the pH and titratable acidity of African Yam Bean yoghurt samples stored at room temperature are shown in figures 1 and 2. The pH value of AYB yoghurt from whole seeds decreased from 5.30 to 3.80 during 21days of storage. Similarly, the pH value for the sample from dehulled seed decreased from 5.0 to 3.80 under the same storage conditions. The titratable acidity of AYB yoghurt from whole seeds increased slightly from 0.84 to 0.98% for 0 to 21day storage, while the value for the sample from dehulled seed increased from 0.86 to 0.97 during the 21day storage period.

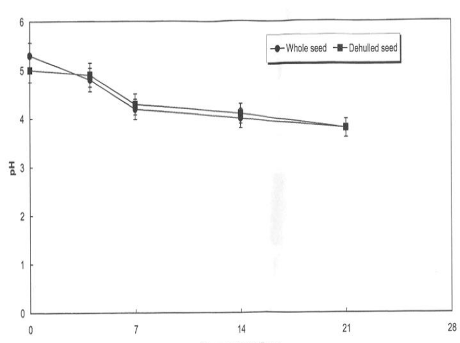

Fig. 1: Changes in pH of yam bean yogurt stored at 29±2°C

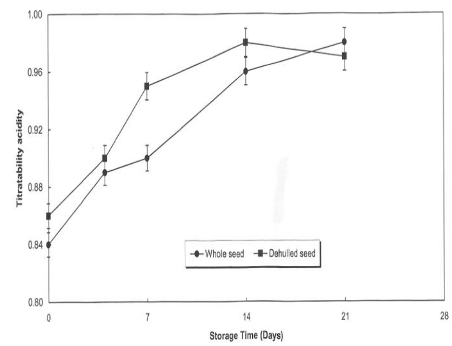

Fig. 2: Changes in titratable acidity of yam bean yoghurt stored at 29±2°C

The changes in pH and titratable acidity of African yam bean yoghurt samples stored at refrigeration temperature are presented in figs 3 and 4. Both the pH and titratable acidity values had similar trends of decrease and increase, respectively, as observed during the room temperature storage.

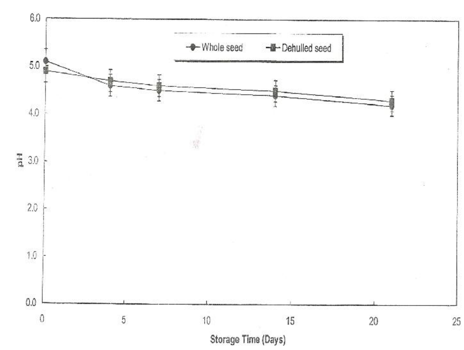

Fig. 3: Changes in pH of yam bean yogurt stored at 4°C

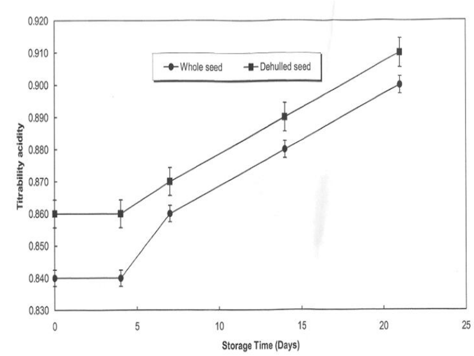

Fig. 4: changes in titratable acidity of yam bean yoghurt stored at 4°C

4. DISCUSSION

The physicochemical quality of AYB yogurt during storage at 29±2°C and at 4°C was evaluated. There was a significant difference ($p<0.05$) in pH of yam bean yoghurt from whole seed and yam bean yoghurt from dehulled seed only on the zero day of storage at room temperature. The difference in pH and titratable acidity levels during storage at refrigeration temperature were not significant for yam bean yoghurt from whole seed and yam bean yoghurt from dehulled seed. The titratable acidity values obtained for AYB yoghurt stored at room are comparable to values reported by Muhammad *et. al*. (2009); 0.88 to 1.20 for stored whole cow milk yoghurt, 0.76 to 1.17 for powdered milk yoghurt and 0.76 to 1.08 for Soymilk yoghurt.

The gradual increase in titratable acidity during storage was also observed in Sudanese yoghurt (Manhal and Kamal, 2010). The pH obtained for AYB yoghurt is similar to values reported for soy yoghurt (Sugimoto and Van Buren, 1970; Buono, 1988, and Moriguchi *et. al*., 1960) which range between 5 and 6. The difference in the rate of decrease in pH during yoghurt production is due to production of lactic acid using *Lactobacillus* (Adams and Moss, 1995) and other lactic acid bacteria.

The titratable acidity values obtained during storage at refrigeration temperature is comparable to the values obtained by Davis and Mclachian (1974) and Younua *et. al*. (2002), who reported mean values of titratable acidity in the range of 0.87 to 1.13. This was different from the values of 2.5 to 2.07 reported by Muhammed *et. al*. (2009) for soy milk stored at refrigeration temperature. The decrease in pH from 5.1 to 4.2 for AYB yoghurt from whole seeds is a reflection of the souring activity of lactic acid produced during fermentation.

The production of lactic acid after fermentation has the effect of lowering pH and thereby arresting any further development of pathogens and other toxic microorganisms, apart from having lethal and destructive effect on bacteria and arresting bacterial multiplication (Jayeola *et al.,* 2010). There was however no direct relationship observed between pH values and titratable acidity as has been reported by other workers (Robinson and Tamime, 1975) and this has been attributed to the presence of milk powder which increases the buffering capacity of the product.

Temperature increased from 29^0C and peaked at 45^0C and later reduced to 39^0C. Related research carried out by Njoku et al. (1990) Amadi et al., (1999) and Nout and Rombouts (1990) reported similar result. This could be attributed to metabolic activity of the fungi. The reduction in p^H during fermentation of breadfruit tempeh from 6.55 to 5.71 might be as a result of acidification by acetic acid fermentation of breadfruit which reduces the chance of microbial spoilage.

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4/12/2012