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EVALUATION OF PHYSICO-CHEMICAL AND MICROBIOLOGICAL PROPERTIES OF STIRRED YOGHURT STABILIZED WITH SWEET POTATO *(IPOMOEA BATATAS)* STARCH.

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ABSTRACT
The physicochemical and microbiological qualities of stirred yoghurts stabilized with sweet potato starch were investigated. The yoghurt was prepared from whole milk powder and other essential ingredients. The product obtained after fermentation was divided into five equal portions and subsequently stabilized by the addition of sweet potato starch at the levels of 10%, 15%, 20%, 25% and 30% to produce different samples of yoghurt. The various samples of yoghurt produced were analysed for their physicochemical and microbiological qualities using standard methods. The physicochemical characteristics of the samples showed the pH of 4.30, 4.28, 4.36, 4.42 and 4.48, dry matter content of 17.74%, 21.26%, 22.76%, 23.10% and 24.38%, titrable acidity of 0.60%, 0.66%, 0.72%, 0.78% and 0.86%, lactose content of 3.86%, 3.92%, 3.98%, 4.18%, and 4.26%, total soluble solids content of 0.08%, 0.09%, 0.16%, 0.18% and 0.26% and viscosity of 334Cp, 356Cp, 368Cp, 374Cp and 386Cp respectively. The microbial count of the yoghurt samples revealed that the total viable count ranged between 0.9 x 10^2cfu/ml and 1.7 x 10^2cfu/ml. The coliform and fungal count were nil which is an indication of the microbial safety of all the samples.

KEYWORDS: Yoghurt, physicochemical, microbiological, quality, stabilization, sweet potato starch.

INTRODUCTION

Yoghurt is a cultured dairy product used extensively as a health food. Yoghurt is a fermented milk product in which the milk sugar (lactose) is converted into lactic acid by the addition of a characteristic culture of lactic acid-producing bacteria, *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. It is the fermentation of lactose (milk sugar) into lactic acid that gives yoghurt its gel-like texture and characteristic tang (Fiszman *et al;* 2001). Like milk and other fermented milk products, yoghurt is a complete food product, which possesses some biochemical and bacteriological characteristics that make it extremely useful in human diets (Everett and McLeod, 2005).

The use of food starches extracted from a wide variety of available and affordable dietary staples such as cereals, roots and tubers in the stabilization of yoghurt has greatly elicited the interest of nutritionists and food scientists in most sub-saharan African countries in recent times. This is because the starches produced form these staple food crops give body of bulk and improve the texture and nutritional value of yoghurt (Ikenebomeh and Omogbai, 2000). Sweet potato starch is one of the cheapest sources of carbohydrate and beta carotene yet to be exploited for yoghurt production in Nigeria. The successful utilization of sweet potato starch in the stabilization of yoghurt can lead to economic sustainability and alleviate the problem of protein-energy malnutrition prevalent among children in most developing nations of the tropics as a result of poverty. The objective of this study was to examine the physicochemical and microbiological qualities of stirred yoghurts stabilized with different proportions of sweet potato starch.

MATERIALS AND METHODS

The whole milk powder, sucrose (sugar), starter culture and sweet potato starch used for this study were procured from local markets in Onitsha and Umuahia, respectively. This research work was carried out in National Root Crops Research Institute Laboratory Umudike, Nigeria, in September, 2008.

Preparation of Yoghurt Samples

The stirred yoghurts were prepared according to the method of Kumar and Mishra (2004). The basic ingredients used for the preparation of yoghurt were 100% whole milk, 60% water, 4% starter culture and 6% sucrose. During preparation, the whole milk powder was initially prepared into milk solution by dissolving 500 grams of the milk powder with two litres of tap water in a plastic bowl. The milk solution obtained was immediately pasteurized (65^0C, 20min). During pasteurization, transparent precipitates of scum-curd formed as a result of the heat treatment were gradually skimmed off. After that, the pasteurized milk solution was thoroughly stirred manually with a stainless steel stirrer and allowed to cool to 43^0C. On cooling, sucrose (sugar) was added and the milk solution was then inoculated with the mixed culture of *Lactobacilus bulgaricus* and *Streptococcus thermophilus* (yoghurt starters). Thereafter, the mixture was allowed to ferment in a well-covered plastic bowl for 12h. After incubation, the yoghurt produced was cooled in an ice bath placed in a cabinet at 4^0C and stirred. The cooled and stirred yoghurt obtained was further divided into five equal portions and then stabilized by the addition of sweet potato starch at the levels of 10%, 15%, 20%, 25% and 30% respectively. Thereafter, the stirred yoghurts produced finally after stabilization were thoroughly stirred manually and packaged individually in sterilized plastic containers with airtight lids and kept in refrigerated conditions until further analysis.

Physicochemical Analysis

The pH and titrable acidity of each sample of yoghurt were determined according to the methods of Onwuka (2005). The dry matter, lactose and total soluble solids contents of each sample were determined according to the methods of AOAC (1995). The viscosity of each sample was determined according to the method of Odo and Ishiwu (1999). All determinations were carried out in triplicates.

Microbiological Analysis

The total viable count of the yoghurt samples was determined using pour plate procedure. One gram of each sample of yoghurt was serially diluted to 10^{-3}. 0.1 millilitre of each dilution was plated on nutrient agar plates and incubated at 35^0C for 48h. The colony forming unit per millilitre sample (cfu/ml) was counted in each case with the aid of Gallenkamp electronic colony counter. The above procedure was repeated for coliform count except that MacConkey agar was used at 37^0C in place of nutrient agar. Potato dextrose agar was used for fungal count at 28^0C for 4 days.

Statistical Analysis

Analysis of variance (ANOVA) was used where applicable for the detection of significant differences ($p<0.05$) among the sample values. The turkey test was used in separating the significant means.

RESULTS AND DISCUSSION

The results of the physicochemical properties of the yoghurt samples are shown in Table 1. The pH of the yoghurt samples was significantly different from each other ($p<0.05$). They were also similar with those reported by Collins *et al;* (1991). The dry matter content of the samples ranged from 17.74% to 24.38%. The differences were observed because the dry matter content of the yoghurt samples increased as the level of sweet potato starch inclusion increased. However, the result is in close agreement with the report of Langendorff *et al;* (2000). The titrable acidity of the samples was significantly different from each other ($p<0.05$). The differences could be due to variation in the growth of lactic acid bacteria during fermentation (James, 2003). The lactose content of the yoghurt samples ranged from 3.86% to 4.26%. There was significant difference in the lactose content of the samples. The lactose content of the yoghurt samples was higher than those reported by (Cimander *et al;* (2002). The total soluble solids content of the samples differed significantly from each other ($p<0.05$). They were also similar with those reported by Schkoda *et al;* (2001). The viscosity of the yoghurt samples ranged from 334Cp to 386Cp. The variation in viscosity of the samples could be attributed to differences in the amount of sweet potato starch added during stabilization. In effect, the result is in agreement with the report of Nelson and Trout (1992). Generally, the incorporation of sweet potato starch in the preparation of stirred yoghurts should be encouraged to improve their viscosity, dry matter and total soluble solids contents.

The microbial counts of the yoghurt samples are shown in Table 2. The total viable count of the yoghurt samples ranged from 0.9 x 10^2 cfu/ml to 1.7 x 10^2 cfu/ml. The presence of the organisms could be due to poor handling and inadequate heat treatment during preparation. However, the result is in agreement with the report of Ehirim *et al;* (2004). In addition, the result also indicated that the coliform and fungal count of the samples were nil. Generally, the absence of coliform and fungi followed by reduction in total viable count recorded by the yoghurt samples indicate that the products are fit for human consumption and will also have good keeping quality.

CONCLUSION

The sweet potato starch stabilized yoghurts of acceptable quality were prepared from whole milk powder and other essential ingredients. From the results, it was observed that the stirred yoghurts stabilized with different proportions of sweet potato starch were generally safe microbiologically but the sample stabilized with 30% sweet potato starch had better viscosity, dry matter and total soluble solids contents than the other samples. Further studies should be performed on stirred yoghurts to determine their respective shelf life and consumer acceptability.

Table 1: Means [1,2] of Physicochemical Properties of yoghurt samples.

Samples	pH	Dry matter (%)	Titrable acidity (%)	Lactose (%)	Total soluble solids (%)	Viscosity (Cp)
A	4.30^a	17.74^a	0.60^a	3.86^a	0.08^a	334^a
B	4.28^a	21.26^b	0.66^b	3.92^b	0.09^a	356^b
C	4.36^b	22.76^c	0.72^c	3.98^c	0.16^b	368^c
D	4.42^c	23.10^d	0.78^d	4.18^d	0.18^b	374^d
E	4.48^d	24.38^e	0.86^e	4.26^e	0.26^c	386^e

[1.]Values are means of triplicate samples. [2.]Means with different superscripts within the same column are significantly different from each other ($p<0.05$).

Legend:

A – Yoghurt stabilized with 10% sweet potato starch. B – Yoghurt stabilized with 15% sweet potato starch.
C – Yoghurt stabilized with 20% sweet potato starch. D – Yoghurt stabilized with 25% sweet potato starch.
E – Yoghurt stabilized with 30% sweet potato starch.

Table 2: Microbial counts of yoghurt samples

Samples	Total viable count (cfu/ml)	Coliform count (cfu/ml)	Fungal count (cfu/ml)
A	0.9 x 10^2	Nil	Nil
B	1.1 x 10^2	Nil	Nil
C	1.3 x 10^2	Nil	Nil
D	1.5 x 10^2	Nil	Nil
E	1.7 x 10^2	Nil	Nil

Legend:
A – Yoghurt stabilized with 10% sweet potato starch. B – Yoghurt stabilized with 15% sweet potato starch.
C – Yoghurt stabilized with 20% sweet potato starch. D – Yoghurt stabilized with 25% sweet potato starch.
E – Yoghurt stabilized with 30% sweet potato starch.

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