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Nutritional Evaluation and Microbiological Analysis of Full Fat Yoghurt processed with biological and chemical preservatives

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ABSTRACT

The production of full fat yoghurt from full cream milk enhanced with ginger extract and sodium benzoate with a view to improve its nutritional quality and shelf life was carried out. The pH of the yoghurt samples were determined, as incubation time increased the pH of the samples reduced. The yoghurt with 5000mg/L of sodium benzoate had the lowest pH of 4.2, while yoghurt with ginger extract had the highest pH of 4.8. The organoleptic evaluation was conducted by ten panel members to assess: appearance, sourness, consistency, aroma, taste and general acceptance; yoghurt with ginger was rated the best and the most acceptable. Proximate analysis was carried out to evaluate nutritional composition such as: crude protein, fiber, fat, moisture and ash contents; yoghurt with ginger extract had the highest protein content of 10.44% while the control sample had the lowest (3.59%). Also, the control sample had the highest fat content of 3.71% while yoghurt with ginger extract had the lowest (1.58%). The shelf life of the four yoghurt samples were monitored and the control had the lowest shelf life of three weeks, followed by yoghurt with 2500mg/L of sodium benzoate had shelf life of eight weeks, while the yoghurt with ginger extract and yoghurt with 5000mg/L of sodium benzoate had the highest shelf life of three months. Lactic acid bacteria and non-lactics isolates were isolated from the yoghurt. The isolates were characterized and identified as *Lactobacillus brevis, Lactobacillus casei, Lactobacillus plantarum, Lactobacillus lactis, Lactobacillus bulgaricus, Bacillus cereus, Pseudomonas fluorescens, Proteus mirabilis, Pseudomonas chlororaphis, Bacillus subtilis.* The total bacteria colony count of each of the samples was monitored for four weeks and the control sample had the microbial load of 2.0×10^4 in the first week after production and increased to $>6.0 \times 10^7$ in the fourth week. The ginger preserved cheese had the lowest microbial load of 2.0×10^2 in the first week and increased to 5.0×10^5 in the fourth week. Therefore, the high cost and side effect of chemical preservatives could be overcome by the application of biological preservatives particularly ginger extract which added to the nutritional value of the yoghurt, it also demonstrated a good preservative property.

Introduction

Yoghurt is one of the oldest fermented milk products known. Fermentation of milk involves the action of lactic acid bacteria. These microorganisms convert milk lactose into lactic acid and make milk sour (Kagan, 1985). It can also be said to be low fat milk coagulate to custard like consistency with a mixed lactic acid culture or starter culture. Yoghurt primarily is produced from milk of ruminants such as cow, goat, sheep, camel etc. which is defined as a secretion of the mammary gland of these animals. Milk is often described as naturally the most nearly perfect single food. It is the natural food of new born mammals for whom it provide the sole source of energy and nourishment. The principal constituents of milk are fat, protein (primarily casein), milk sugar or lactose and minerals. The popularity of yoghurt to milk is due to its characteristics; the pleasant aromatic flavor, thick creamy consistency and its reputation as food associated with good health (Kleyn *et al*., 1979; Domagla, 2005).

Generally, yoghurt is the best known of all fermented milk product and the most popular all over the world (Thapa, 2000). It has many forms, including drinkable or liquid, low fat or fat free, fruit or cereal flavored, and it is a healthy and nutritious food (Mckinley, 2005). All yoghurt must contain at least 8.25% solid, while the fat content varied based upon the type of milk used in the production of the yoghurt. Full cream milk will produce full fat yoghurt with fat content of about 3.25%, low cream milk for low fat yoghurt having not more than 2% milk fat and skimmed milk for the production of non-fat yoghurt, having less than 0.5% fat content (Cornell, 2006).

It is generally accepted that three main factors determine the physical properties of yoghurt; these factors are the preparation of the base milk, the fermentation process and the post fermentation treatment (Smit, 2003). It is the changes in the physical, chemical and microbiological structure of yoghurt that determine the storage and shelf life of the product and alteration of these properties causes color, aroma and texture deterioration of yoghurt, which are considered important quality criteria by consumers (Sofu and Ekinci, 2007). Therefore it is of economic importance to use substances i.e. preservatives, which can inhibit microbial activities and extend the shelf-life of the

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product. Yoghurt quality is also affected by environmental conditions and inoculation concentration of the starter culture. The most significant environmental condition affecting the quality of yoghurt is the temperature of incubation which must be the optimal temperature of the lactic acid bacteria (40^{o}C-45^{o}C) any temperature below or above this range will result in poor quality yoghurt.

The post-fermentation treatment is also an important factor affecting the quality of yoghurt during and after processing. After termination of the fermentation process, it is necessary to store the yoghurt at a temperature below the optimal temperature of the starter culture bacterial i.e. storage at temperature of about 4^{o}C to inhibit the microbial activities of the lactic acid bacterial. The use of food additives such as sweetener, flavor and preservation to increase the keeping quality of yoghurt and extend the shelf life is part of post-fermentation treatment. Flavored yoghurt is made by adding fruit concentrate or flavored syrup to culture milk before or after incubation (Keating and White, 1990) which enhance the quality of the yoghurt. Also, the use of preservative such as sodium benzoate (5mg/L and ginger extract also help to extend the keeping quality of yoghurt, however ginger solely function in flavoring. Preservatives are often added to improve yoghurt consistency. These are general additives which prolong the life span of foods and drinks by preventing microorganisms attack. Technically, preservatives are chemically used to poison microorganism and prevent the food onto which it is added from fermentation and spoilage without causing harmful effect to the person who consume it. The use of chemical preservation enhances food quality, reduce waste and enhance consumer acceptability (Friezer, 1989). Chemical preservative are classified into three main groups; Anti- microbial (such as Benzoic acid, propionate and Dimethyl pyrocarbonates), anti-oxidant such as ascorbic acid, butylated hydroxyl anisole, and antibiotic such as ox-tetracycline, nicin and lacto peroxidase (Friezer, 1989). Sodium benzoate as preservative has microbial (anti) effect and is sometimes used as antiseptic; to disguise taste, as of poor-quality food; orange soft drink contain a high amount of it, up to 25mg per 250mL; also in milk and meat product, relishes and condiments, baked goods and lolly; used in many oral medications. The FDA says it is safe because the amount used to preserve foods is very low. However, it must not be combine with vitamin c or t as this causes benzene to be formed. This is because benzene is a known carcinogen i.e. causes cancer. Heat also liberate benzene from sodium benzoate therefore food product having it as preservatives must be kept at low temperature. Biological preservative such as garlic and ginger have also been incorporated into different food product as preservative although they are mostly used as flavoring agent (spices). These are due to their medicinal properties, anti- inflammatory effect and therapeutic properties.

Materials and Methods

Sample Collection

Full- cream milk with 3.5% milk fat was purchased from a super market within Ogbomoso, Oyo State, Nigeria. Commercially prepared starter culture was obtained from Oja-tuntun in Ilorin, Kwara State.

Culture Media

The media used for microbiological isolation of microorganism were nutrient agar, MRS agar and nutrient broth. The media were prepared according to the manufacturer's specification. These media were sterilized in an autoclave at 121^{O}C for 15minutes.

Production of Yoghurt

The first step was preparation of starter culture, which was prepared by adding 200g of milk to 400ml of water at about 40-45^{o}C and homogenized 5g of the commercial starter culture was added to the milk solution and incubated at temperature between 40- 45^{o}C for 24 hours before it was used. Reconstitution of the milk was the second step, this involved preparation of the milk solution. Four liter of water heated to 82-90^{0}C was used to reconstitute 550g of full-cream milk. This high temperature allowed pasteurization of the milk. The milk solution was stirred very well in order to avoid lump formation which can affect consistence of the yoghurt.

Fermentation followed reconstitution, the milk solution above were dispensed into sterile jars such that each jar contained 1000mL. 100mL of starter culture was introduced into each jar aseptically at a temperature between 40-45^{O}C then incubated at 44^{o}C for approximately 8 hours. After two hours of incubation, different concentration of preservatives were introduced to three of the yoghurt, which were: 2500mg/L of sodium benzoate, 5000mg/L of sodium benzoate and 100ml/L of ginger extract and the fourth was used as control. The pH of the milk was determined at interval of two hours using automatic pH meter.

Organoleptic Test

A total numbers of 10 panels were selected to evaluate the quality of the yoghurt samples through sensory evaluation. The qualities assessed were, appearance, sourness, consistency, aroma, taste and general acceptance. The yoghurt samples were rated successively on a scale 0-4, 0 being regarded as poor, 1 as fair, 2 as good, 3 as very good and 4 been the highest point for each parameter as excellent.

Isolation procedures

One milliliter of each yoghurt sample was serially diluted, 1ml of an appropriate dilution was inoculated on nutrient and MRS agar plates and the plates were incubated for 24 hours at 30^{O}C. After 24 hours sterile wire loop was used to pick the isolate from the plate and was streaked on a freshly prepared sterile nutrient agar and MRS agar plates, then incubate for 24 hours at 30^{O}C in order to get pure cultures. Pure cultures were then stored in a refrigerator at 4^{O}C. The routine laboratory method of Cruickshank *et al*. (1975) was used to characterize different isolates. The isolates were identified using their macroscopic, cultural, physiological and biochemical characteristics.

Total Colony Count: One milliliter of each sample was dissolved in sterile de-ionized water and serially diluted. One milliliter of appropriate dilutions was seeded on plate count agar using spread plate method, and the medium was then incubated at 37°C for 24 hours. The plate count agar was examined and colonies present were counted and recorded after incubation at 37°C for 24 hours, to get the total colony count in CFU/mL. This was done to monitor the microbial load for 4 weeks at 7 days interval and the shelf-life of each sample was also monitored

Proximate Analysis

This refers to the determination of the major constitute of food and it is used to assess if a food is within its normal compositional parameters or somehow has been adulterated. This method partitioned nutrients in feed into 6 components;

moisture content, ash content, crude protein, fat content, crude fiber and total solid.

Determination of Moisture content

The method of Oladipo and Jadesimi (2013) was used for the determination of moisture content of the yoghurt samples. Briefly, about 2ml of the yoghurt sample was weighed into a silica dish previously dried and weighed. The sample was then dried in an oven for 65°C for 36 hours, cooled in a desiccator and weighed. The drying and weighing continued until a constant weight is achieved.

$$\% \text{ moisture} = \frac{\text{wt. of sample + dish before drying} - \text{weight of Sample + dish after drying} \times 100}{\text{Wt. of sample taken}}$$

Determination of Crude Fat Content

The ether extract of a cheese represents the fat and oil in the yoghurt samples. Soxhlet apparatus was the equipment used for the determination of ether extract. It consists of 3 major components. An extractor: comprising the thimble which holds the sample, Condenser: for cooling and condensing the ether vapour and 250ml flask. About 150ml of an anhydrous diethyl ether (petroleum ether) of boiling point of 40^{O}-60^{O}C was placed in the flask. 2-5g of the sample was weighed into a thimble and the thimble was plugged with cotton wool. The thimble with content was placed into the extractor; the ether in the flask was then heated. As the ether vapour reached the condenser through the side arm of the extractor, it condensed to liquid form and drop back into the sample in the thimble, the ether soluble substances were dissolved and were carried into solution through the siphon tube back into the flask. The extraction continued for at least 4 hours. The thimble was removed and most of the solvent was distilled from the flask into the extractor. The flask was then disconnected and placed in an oven at 65^{O}C for 4 hours, cooled in a desiccator and weighed (Oladipo and Jadesimi, 2013).

$$\%\text{fat content} = \frac{\text{wt. of flask + extract-tare wt. of flask} \times 100}{\text{Wt. of sample}}$$

Determination of Crude Protein Content

Samples: Crude protein is determined by measuring the nitrogen content of the feed and multiplying it by a factor of 6.25. This factor is based on the fact that most protein contains 16% nitrogen. Crude protein is determined by kjeldahl method. The method involves: Digestion, Distillation and Titration.

Digestion: About 2g of the sample was weighed into kjeldahl flask and 25ml of concentrated sulphuric acid, 0.5g of copper sulphate, 5g of sodium sulphate and a speck of selenium tablet were added. Heat in a fume cupboard was applied slowly at first to prevent undue frothing, digestion continued for 45 minutes until the digester became clear pale green. It was left until completely cooled and 100ml of distilled water was rapidly added. The digestion flask was rinsed 2-3 times and the rinsing was added to the bulk.

Distillation: Markham distillation apparatus was used for distillation. The distillation apparatus was steamed up and about 10ml of the digest was added into the apparatus via a funnel and allowed to boil. 10mls of sodium hydroxide was added from the measuring cylinder so that ammonia was not lost. It was distilled into 50ml of 2% boric acid containing screened methyl red indicator.

Titration: the alkaline ammonium borate formed was titrated directly with 0.1N HCl. The titre value which was the volume of acid used was recorded. The volume of acid used was fitted into the formula which became

$$\%N = \frac{[14 \times V.A \times 0.1]\, w \times 100}{1000 \times 100}$$

V.A = Volume of acid used, wt. = weight of sample

% crude protein = %N x 6.25

Determination of Crude Ash Content

Ash is the inorganic residue obtained by burning off the organic matter of feed stuff at 400-600°C in muffle furnace for 4 hours. 2g of the sample was weighed into a preheated crucible. The crucible was placed into muffle furnace at 400-600°C for 4 hours or until whitish-grey ash was obtained. The crucible was then placed in the desiccator and weighed (Oladipo and Jadesimi, 2013).

$$\%\ \text{Ash} = \frac{\text{wt. of crucible + ash} - \text{wt. of crucible}}{\text{Wt. of sample}}$$

Determination of Crude Fibre

The organic residue left after sequential extraction of feed with ether can be used to determine the crude fibre, however if a fresh sample was used, the fat in it could be extracted by adding petroleum ether, stirred and allowed to settle and decanted. This was done three times. The fat-free material was then transferred into a flask/beaker and 200ml of pre-heated 1.25% H_2SO_4 was added and the solution was gently boiled for about 30mins, maintaining constant volume of acid by the addition of hot water. The Buckner flask funnel fitted with Whatman filter was pre-heated by pouring hot water into the funnel. The boiled acid sample mixture was then filtered hot through the funnel under sufficient suction. The residue was then washed several times with boiling water (until the residue was neutral to litmus paper) and transferred back into the beaker. Then 200ml of pre-heated 1.25% Na_2SO_4 was added and boiled for another 30 minutes. Filtered under suction and washed thoroughly with hot water and twice with ethanol. The residue was dried at 65^{O}C for about 24 hours and weighed. The residue was transferred into a crucible and placed in muffle furnace (400-600^{O}C) and ashed for 4 hours, then cooled in desiccator and weighed (Oladipo and Jadesimi, 2013).

$$\%\text{Crude fibre} = \frac{\text{Dry wt. of residue before ashing - weight of residue after ashing} \times 100}{\text{weight of sample}}$$

Results

The pH of the milk solution was monitored during production and it was found to decrease as the hour of incubation increased. The initial pH of the milk solution was 6.7, after 8 hours; the pH of the control decreased to 4.6, yoghurt with high concentration of sodium benzoate showed pH of 4.2, while the yoghurt with ginger extract decreased to 4.8 (Figure 1).

Organoleptic test was carried out on the freshly prepared yoghurt samples. This was to determine the general acceptance, taste, sourness, consistency, aroma and appearance of the yoghurt samples. Ten people tasted the cheese samples and graded the samples from poor to excellent with regards to the parameters above. The result of organoleptic test conducted by a panel of ten members as shown in Table 1 indicated the yoghurt with ginger extract as the most generally accepted followed by the yoghurt with high concentration of sodium benzoate then yoghurt with low concentration of sodium benzoate, the control was the least acceptable. Also, the aroma, appearance, taste and general acceptance of yoghurt with ginger extract were excellent.

The microbial count result indicated that with increase in the number of days, the microbial count of all samples increased. The control sample had the microbial load of 2.0 x 10^4 in the first week after production and increased to >6.0 x 10^7 in the fourth week. The ginger preserved cheese had the lowest microbial load of 2.0 x 10^2 in the first week and increased to 5.0 x10^5 in the fourth week (Table 2).

The yoghurt preserved with high concentration of sodium benzoate and ginger extract extended the shelf life of the samples for three months while control sample got spoilt after three weeks under refrigeration condition. The yoghurt preserved with low concentration of sodium benzoate extended the shelf life of the samples for eight weeks (Table 3).

A total number of sixteen micro-organisms were isolated from the yoghurt samples, out of which 9 were non-lactic acid bacteria and 7 were lactic acid bacteria. The isolates were subjected to microscopic, macroscopic, macroscopic, physiological and biochemical test. The bacteria were identified using Bergey's manual of Systemic Classification and were identified as *Bacillus cereus* (1), *Pseudomonas fluorescens* (3), *Proteus mirabilis* (2), *Pseudomonas chlororaphis* (1), *Lactobacillus brevis* (2), *Lactobacillus casei* (2), *Lactobacillus plantarum* (1), *Lactobacillus lactis* (1), *Lactobacillus bulgaricus* (2), *Bacillus subtilis* (1).

Bacillus cereus, Pseudomonas fluorescens , Lactobacillus brevis, Lactobacillus casei, Lactobacillus plantarum, Lactobacillus lactis, Bacillus subtilis were isolated from control yoghurt sample, while *Lactobacillus brevis, Lactobacillus bulgaricus, Pseudomonas fluorescens* and *Proteus mirabilis* were isolated from yoghurt preserved with ginger extract. *Lactobacillus bulgaricus, Pseudomonas fluorescens* and *Pseudomonas chlororaphis* were isolated from yoghurt preserved with low concentration of sodium benzoate while *Lactobacillus casei* and *Proteus mirabilis* were isolated from yoghurt preserved with high concentration of sodium benzoate (Table 4).

Proximate analysis result showed that fiber was absent in all yoghurt samples. Yoghurt preserved with ginger extract had the highest percentage crude protein (10.44%) while the control sample had the lowest (3.59%) . Also, the control sample had the highest percentage crude fat (3.71%) while the yoghurt preserved with ginger extract had the lowest. The detailed proximate analysis result is shown in Table 5.

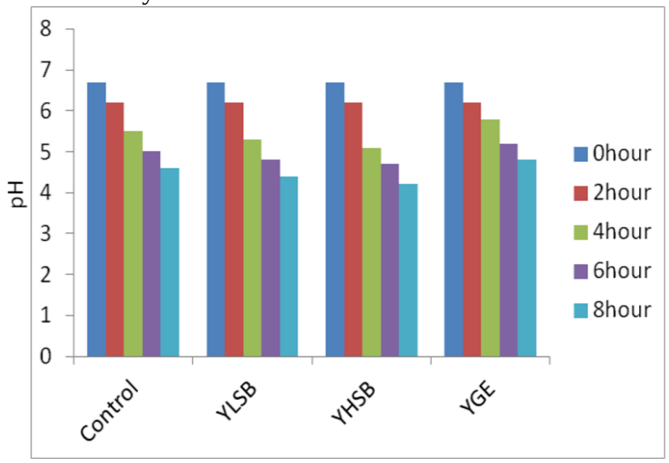

Figure 1: pH values of the yoghurt samples

Keys: YGE – Yoghurt with ginger extract, YLSB – Yoghurt with 2500mg/L sodium benzoate, YHSB – Yoghurt with 5000mg/L sodium benzoate, Control – No preservative added.

Table 1: Organoleptic properties of yoghurt samples

	CONTROL	YGE	YLSB	YHSB
Appearance	2.80 ± 0.40	3.80 ± 0.40	2.40 ± 0.80	1.80 ± 1.17
Sourness	2.60 ± 1.36	2.20 ± 1.47	2.00 ± 0.60	2.80 ± 1.47
Consistency	2.40 ± 0.80	0.40 ± 0.48	2.00 ± 0.98	3.40 ± 0.80
Aroma	2.60 ± 0.80	3.60 ± 0.80	1.80 ± 0.75	2.80 ± 2.56
Taste	2.60 ± 1.20	3.20 ± 0.40	1.60 ± 1.02	2.40 ± 1.62
General acceptance	1.20 ± 1.17	3.00 ± 0.89	2.20 ± 0.75	2.60 ± 1.74

Keys: YGE – Yoghurt with ginger extract, YLSB – Yoghurt with 2500mg/L sodium benzoate, YHSB – Yoghurt with 5000mg/L sodium benzoate, Control – No preservative added.

Table 2: Microbial load of the yoghurt samples

SAMPLE	WEEK 1	WEEK 2	WEEK 3	WEEK 4
YGE	2.0 X 10^2	3. 0 X 10^3	4.0 X 10^4	5.0 X 10^5
YLSB	3. 0 X 10^4	4.0 X 10^5	6.0 X 10^6	8.0 X 10^7
YHSB	4.0 X 10^3	5.0 X 10^4	7.0 X10^5	9.0 X 10^6
CONTROL	2.0 X 10^4	3.0 X 10^6	5.0 X 10^7	>6.0 X 10^7

Keys: YGE – Yoghurt with ginger extract, YLSB – Yoghurt with 2500mg/L sodium benzoate, YHSB – Yoghurt with 5000mg/L sodium benzoate, Control – No preservative added.

Table 3: Shelf life of the yoghurt samples

Samples	Shelf life
Control	Three weeks
YGE	Three months
YLSB	Eight weeks
YHSB	Three months

Keys: YGE – Yoghurt with ginger extract, YLSB – Yoghurt with 2500mg/L sodium benzoate, YHSB – Yoghurt with 5000mg/L sodium benzoate, Control – No preservative added.

Table 4: Distribution of bacteria isolate in different samples

ISOLATE	CONTROL	YGE	YLSB	YHSB
L. brevis	+	+	_	_
L. casei	+	_	_	+
L. plantarum	+	_	_	_
L. lactis	+	_	_	_
L. bulgaricus	_	+	+	_
B. substilis	+	_	_	_
B cereus	+	_	_	_
P. fluorescens	+	+	+	_
Proteus mirabilis	_	+	_	+
P. chlororaphis	_	_	+	_

Keys: YGE – Yoghurt with ginger extract, YLSB – Yoghurt with 2500mg/L sodium benzoate, YHSB – Yoghurt with 5000mg/L sodium benzoate, Control – No preservative added.

Table 5: Proximate composition of yoghurt samples

Sample Description	Crude protein %	Ash %	Moisture %	Fiber %	Fat %
CONTROL	3.59	0.97	75.72	-	3.71
YGE	10.44	0.86	76.89	-	3.58
YLSB	5.69	1.08	73.45	-	2.87
YHSB	4.29	1.12	71.96	-	2.49

Keys: YGE – Yoghurt with ginger extract, YLSB – Yoghurt with 2500mg/L sodium benzoate, YHSB – Yoghurt with 5000mg/L sodium benzoate, Control – No preservative added.

Discussion and Conclusion

The pH of the milk solution as at production was 6.7 and this gradually reduced as the hour of incubation increased. The yoghurt with high concentration of sodium benzoate had the lowest pH of 4.3, while yoghurt with ginger extract has the

highest pH of 4.8 after 8 hours. This result confirms the ability of lactic acid bacteria to convert milk sugar (lactose) into lactic acid if incubated at their optimum temperature (40-45^{o}C).

The organoleptic test indicated that yoghurt produced had firm texture and this was supported the findings of Domaga, (2009) who reported that powder milk yoghurt has firm texture. The yoghurt with ginger extract had the highest acceptability and it was rated excellent, this may be attributed to the flavoring ability of ginger. Yoghurt with 500mg/L of sodium benzoate was rated very good, the yoghurt with 250mg/L of sodium benzoate was rated good, while control was rated fair, but all the samples were acceptable by all panel.

The result obtained showed that the control had the highest microbial count while the yoghurt preserved with ginger extract had the lowest count this may be associated with the inhibitory nature of ginger extract on bacteria. With increase in the number of weeks, the total bacteria count also increased for all the yoghurt samples. This result correlates with the findings of El-Gazzar and Hafez (1992), who reported that microbial hydrolysis of yoghurt component during storage, was found to be the key deteriorating factor to taste, color, flavor and texture which hence affect overall preference of the product.

The post production -treatment given to the yoghurt produced had an antimicrobial effect on the isolates, this explained why yoghurt with preservatives (sodium benzoate and ginger extract) has low microbial count compared to control. This is supported by findings of Ihekoronye and Ngoddy (1995) who reported that preservatives have been used to stored food substance and they act by inhibiting, retarding or arresting the growth of microorganism.

The control sample had the highest microbial load while the sample preserved with ginger extract had the lowest. The high microbial load of the control sample may be the reason for the deterioration after three weeks of storage. Ginger extract and 5000mg/L of sodium benzoate extended the shelf life of the samples to three months while 2500mg/L of sodium benzoate extended the shelf life of the yoghurt sample to eight weeks. The extended shelf life of samples treated with ginger extract could be due to the antioxidant property of ginger extract. Similar observations have been reported by Lee *et al*. (1986) when ginger extract was added to meat products. The poor growth of both Gram-negative and Gram-positive bacteria strains was attributed to the gingerol and shogaol components of ginger (Wilkinson, 2003). The extracts of ginger could have an anti-fungal, anti-histamine and antibacterial effect (Schulick, 1993) on the samples used, and this accounts for the reduction in the microbial load of yoghurt samples preserved with ginger.

The crude protein content of the samples preserved with ginger extract increased while there was reduction of the protein content in chemical treated sample, the reduction in the protein content could probably be due to the breakdown of protein by proteolytic organism in the samples (Aworh and Egounlety, 1985). While the non-reduction in the protein content of the ginger extracts treated samples may be due, probably to the antioxidant properties of the extracts. This is supported by Kikuzaki *et al.* (1994) who reported that most of the isolated compounds from ginger exhibited stronger antioxidant effect than alpha-tocopherol (vitamin E). This finding is similar to the report of Krishnakantha and Lokesh (1999) that ginger inhibits lipid oxidation and scavenges super-oxide anions.

Conclusion

From this study, microbial hydrolysis of yoghurt component during storage was found to be the key deteriorating factor to taste, color, flavor and texture which hence affect overall preference of the product. Hence, the preservation of yoghurt with ginger extract is quite a promising preservation technique.

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