

Original Research Article

Yoghurt Production from Powdered Milk using Mixed Lactic Acid Bacteria Starter Cultures

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Abstract: *Lactobacillus bulgaricus*, *Streptococcus thermophilus* and *Lactobacillus fermentum* isolated from fermented foods: yoghurt, “ugba” and “kunu-zaki” using MRS agar and a commercially acquired lactic acid bacteria (LAB) were used to produce yoghurts samples A-H from Milksi Powered milk in a 5 hour fermentation process. The three LAB isolates were used singly and in combinations as starter cultures. There was a maximum drop in pH (4-4.8) between the second and third hour of fermentation while the yoghurt produced using *S. thermophilus* had the lowest pH (5.2) at the temperature of 40°C. The optimum pH for the yoghurt production was 5.5 while the optimum temperature was 40°C. Yoghurt samples B and F had the highest moisture level ($P<0.05$) while Samples C, E and G had the highest dry matter content. The highest ash content ($0.85^a \pm 0.01$; $P<0.05$) was from sample F while Samples D and E had the highest crude fibre content. Sample A had the highest crude fat value ($3.95^a \pm 0.01$; $P<0.05$), Sample F the highest crude protein content ($3.95^a \pm 0.01$; $P<0.05$) while the highest carbohydrate content was from Samples C, E, G and H (control). The control Sample (H) had the highest and Hedonic test for sensory properties of the eight yoghurt samples showed that the eight yoghurt samples were acceptable to the panelist indicating that the samples would compete favourably in the market with commercially sold yoghurts.

Keywords: LAB, milk, optimum conditions, proximate analyses, yoghurts.

INTRODUCTION

Yoghurt is a fermented milk product and is one of the famous fermented milk preparations. The word yoghurt is derived from the Turkish word “jugurt” which means dense thick [1]. However, yoghurt is known by other name in many other countries such as Turkey, India and the Balkan States. It is the most widely available fermented milk in western world where its popularity derives more from its flavour and versatility. Yoghurt is a dairy product produced by bacteria fermentation of milk sugar (lactose) into lactic acid. This gives yoghurt its gel-like texture and characteristics taste. It is often sold with a fruit vanilla or chocolate flavour but can be unflavoured. Its nutritional and therapeutic functions have been known in the middle east, far east and Eastern Europe for hundreds years, but it has only been appreciated in the west in the last decades.

Yoghurt is made by introducing two bacteria: *Lactobacillus bulgaricus* and *Streptococcus thermophilus* into either whole or skimmed milk. The milk is first heated to a temperature between 85°C to

95 °C for 30 minutes for pasteurization and proper viscosity and cooled to incubating temperature before inoculating the starter culture. These bacteria feed on milk, sugar, producing an acid in return, which coagulates the milk protein, resulting to a semi-solid consistency and a flavour. The *Lactobacillus bulgaricus* and *Streptococcus thermophilus* used as yoghurt starters has been found in such foods and fermented products as meat, milk products, vegetables, beverages and bakery products [2-4]. The optimum conditions for the growth of these organisms includes anaerobic conditions, temperature of about 35 °C to 45°C and a pH of 3.5 to 5.5 when cultured in DeMan Rogosa and Sharpe Media (MRS).

Yoghurt is rich in protein and several vitamins and essential minerals. It contains much fat than the milk form. It is made from starter culture that contains enzymes that help break down lactose inside the intestine; therefore, it is enjoyed by people with lactose intolerance. Yoghurt therefore helps to fight war against death because of hunger, malnutrition and famine in all aspect of life of an individual and of a community.

Although milk of various animals has been used for yoghurt production in various parts of the world, most of the industrialized yoghurt production uses cow milk. Whole milk, partially skimmed milk, skim milk or cream milk may be used. The milk used for yoghurt manufacture should be of the highest bacterial quality available and should be free from any material that will impede or prevent the growth of the starter organism (antibiotics, preservative, disinfectant and bacteriophages).

Fermentation of milk brings about many changes in its chemical constituents, which have bearing on its nutritive value. Yoghurt has been found to contain proteins, carbohydrate, fats, and high percentage of lactic acid than other fermented milk produce and it is rich in vitamin B complex. Yoghurt proteins are more digestible than that of fresh milk and that the partial hydrolysis of milk constituents in yoghurt contributes to their increase digestibility. Cow's milk is preferred for preparing yoghurt as having low fat. This provides immunity; protects the consumer from cold, cough and strengthens body's defense mechanism as well as strengthens the collagen in the skin. It lowers the blood pressure, bad cholesterol and risk of heart attack. Yoghurt is one of the major sources of vitamins and minerals and contains higher vitamins (vitamins B₁₂) than fresh milk.

Recently, there is a growing interest to develop a variety of fermented milk products for other beneficial purposes, particularly for health purposes and preventing of toxins produced by food-borne pathogens and spoilage bacteria that enter human body [5-8]. The beneficial effects of fermented milk products are produced by a variety of bioactive compound of lactic acid bacteria [9]. To this end, this work aimed at production of several yoghurt samples from powdered milk using LAB isolates recovered from fermented foods as well as determining the optimum conditions for the production of and the proximate analyses the yoghurts.

MATERIALS AND METHODS

Sample collection

Samples of traditional fermented food: Yoghurt, ugba and Kunu-zaki were purchased from Ubani Market so also Milksi powdered milk samples for the production of yoghurt and were taken to Microbiology Laboratory, Michael Okpara University of Agriculture, Umudike for further analyses.

Isolation of lactic acid bacteria (LAB).

The various samples were serially diluted in peptone water and 0.1ml of suitable aliquots was streaked in duplicates onto De Man Rogosa Sharpe (MRS) Agar plates containing 50mg of Nystatin and incubated at 37 °C for 48 hours under anaerobic conditions using Anaerobic Gas Jar (Excello) for the

isolation of LAB. The isolates were sub-cultured on MRS Agar, subjected to microscopic, biochemical and sugar fermentation tests and later stored in MRS Agar slant bottles and stored in the Refrigerator [10]. The identification procedure given in Bergey's manual of determinative Bacteriology [11] Cowan [12] were used to characterized and identify the LAB isolates.

Production of yoghurt

To each of eight glass beakers containing 500ml of distilled water was added 200g of Milksi powered milk and stirred continuously using a sterile spatula till a homogenous solution was formed. The eight glass beakers were covered with aluminium foil and then pasteurized and then cooled to 35°C and labeled A-H. Each of the LAB starter isolates was inoculated in beakers A-C while a double combination of the starter isolates were then inoculated in beakers D-F while beaker G had the three LAB isolates inoculated into it. A commercially procured LAB starter culture (control) was inoculated in beaker H and all the beakers were incubated at 35°C for 6 hrs as adapted from Adam and Moss [1].

Determination of pH

The pH of the fermented milk samples (yoghurt) was measured with a pH meter with a glass electrode every one hour.

Determination Of Titratable Acidity (T. A)

This was determined using the alkaline titrimetric method of Sadler and Murphy [13]. 20ml of the sample was dispensed into conical flask and 3 drops of phenolphthalein indicator was added. This was titrated against diluent standard alkaline solution (0.01N NAOH solution). Titration was done until a persistent faint pink colouration was obtained. The total titratable acidity was calculated using the formula below.

$$\% \text{ Titratable acidity (T. A)} = \frac{T \times N}{W} = \frac{100}{1}$$

Where,

T = Titre value

N = Normality of titrant

W= Weight of sample used.

Proximate Analysis

Proximate analysis of food is the determination of the major components of food. This includes moisture, fats (lipids), ash (mineral), protein carbohydrate and fibre.

1. Determination of Moisture Content

This was determined by the AOAC [14] gravimetric method. A measured weight of the sample (5g) was weighed into a previously weighed moisture can. The sample in the can was evaporated to dryness over a steam bath and then dried in the oven 105°C for 3 hours in the first instance. It was cooled in a desiccator and weighed. It was then returned to the oven for further drying. Drying, cooling and weighing were

repeated until a constant weight was obtained. By difference, the weight of the moisture lost was obtained and expressed as a percentage of the weight of sample analyzed.

$$\% \text{ moisture (\% MC)} = \frac{W2 - W3}{W2 - W1} \times \frac{100}{1}$$

Where,

W1 = weight of empty moisture can

W2 = weight of can + sample before drying

W3 = weight of can + sample after drying

2. Determination of Ash Content

Ash content was determined by the furnace incineration gravimetric method [15]. 5g of the sample was weighed into previously weighed crucible. It was evaporated to dryness over a steam bath and then burnt in a muffle furnace at 550°C until it become grey ash. The ash in the crucible was carefully removed and cooled in a desiccator and reweighed. By weighed increased, the weight of ash was obtained and expressed as percentage of the sample analyzed and calculated as shown below.

$$\% \text{ Ash} = \frac{W2 - W1}{W2 - W1} \times \frac{1000}{1}$$

Weight of sample

Where,

W1 = weight of empty crucible

W2 = weight of crucible + ash.

3. Determination Of Protein Content

Protein content was determined by the kjeldahl method in which the total nitrogen was obtained and multiplied with the factor 6.38 (having a milk- based product to obtain the protein) [15, 16]. 0.5g of the yoghurt sample was boiled in 10mls of concentration H₂SO₄ with selenium as catalyst. Boiling (digestion) was done under a fume cupboard until a clear solution was obtained. This digest was transformed quantitatively to a standard flask and diluted to 100ml with distilled water 10ml portion of the digest was mixed with equal volume 45% NaOH solution and distilled in a semi-micro-kjeldahl apparatus. The distillate was collected into 10% boric acid solution containing 3 drops of mixed indicator (methyl red and bromocresol green). A total of 50ml distillate was collected and titrated against 0.02N H₂SO₄ solution. Titration was done from green to a deep red end- point. A reagent blank was also treated as described above. The N2 content and hence protein was calculated as shown below.

$$\% \text{ N}_2 = \frac{100}{W} \times \frac{14 \times N}{1000} \times \frac{VF}{Va} \times T - \text{BLK}$$

W = weight of sample

N = Normality of titrant

Vf = Total digest volume

Va = Volume of digest analyzed

T = Sample titre

BLK = Reagent Blank titre.

4. Determination of Carbohydrate Content

Carbohydrate was calculated as nitrogen free extractives using the formula described by James (1995). % CHO = 100-% (Protein + ash + fat + moisture content).

5. Determination Of Fat Content

Yoghurt sample (5.0g) was mixed with 0.88 ammonia solution and 10mls of 95% ethanol was added to it and mixed well. 25mls of diethyl ether was added to it and shaken vigorously for 1 minute. 25mls of petroleum ether was added and mixed well. The mixture was allowed to separate into phases and after standing for 1 hour. The fat extract (ether phase) was collected and the sample was re-extracted with the same solvent and the extracts pooled together. The extract was then transferred to a weighed flask and the solvent recovered while the fat in the flask was dried in the oven 100°C for 30minutes cooled in a desiccator and weighed. The weight of fat was determined and the amount of fat determined and expressed as a percentage of the sample analysed. It was calculated as shown below.

$$\% \text{ fat} = \frac{W2 - W3}{W2 - W1} \times \frac{100}{1}$$

Weight of sample

Where,

W1 = weight of flask alone

W2 = weight of flask and extract

Evaluation Of Sensory Properties Of Yoghurt Samples

Five panelists from Michael Okpara University of Agriculture, Umudike assessed the yoghurt (both the commercial control sample and the produced samples) as regards to their tastes, colours, flavours, textures and general acceptability. The yoghurts were rated 1 for "Like Extremely", 2 for "Like very much", 3 for "Like moderately", 4 for "Like slightly", 5 for "Neither like nor dislike", 6 for "Dislike slightly", 7 for "Dislike moderately", 8 for "Dislike very much" for each parameter.

RESULTS AND DISCUSSION

The results show that three lactic acid bacteria: *Lactobacillus bulgaricus*, *L. fermentum* and *Streptococcus thermophilus* were recovered from the fermented food samples analyzed. The occurrence of these isolates in the yoghurt, ugba and kunu samples was in agreement with result of Tzaneta Kis *et al.*, [17] who isolated similar organisms from yoghurt of Senegal. The result of pH values for sample analyzed, showed that the acidity increased for all samples as the incubation period progressed. The pH on the exposure of time between 0-5 hours during fermentation of yoghurt varied between 6.8 and 4.8 for sample A, 6.9 – 5.0 for Sample B, 6.9 – 5.0 for Sample C, and 6.8 – 5.0 for Sample D. The pH of yoghurt Sample E was in the range 6.8- 5.0, Sample F was between 6.8 and 5.8 while Sample G (control) yoghurt produced using

commercially produced starter culture (Yogourmet Culture De Yoghourt) varied between 6.8 and 5.1 with an optimum pH of 5.5 (Fig. 1). The result showed that the lactic acid content increased the pH values of all the samples and the values fell within the range of good quality yoghurt [18]. There was a general fall in the pH among all the yoghurt samples between the zero and 5th hour of incubation.

The result of the effect of temperature on pH of the yoghurt samples (Fig. 2) showed that there was a general decrease in pH for Samples A-G between 38-40°C while Sample H (control) had an increase in pH value between the said time. The optimum temperature was found to be 40°C due to the fact it gave the most favourable and most acidic result and thus, the best effect on the quality of the yoghurts. It's noteworthy that the final pH of Sample B (produced by *Streptococcus thermophilus*) was lower (5.2) than that of the Sample H (control LAB) and also lower than Sample G containing the three test LAB isolates. However, the least acidic yoghurt was produced by a combination of *S. thermophilus* and *L. fermentum* (Sample F).

The result of proximate analysis of the produced yoghurt samples as shown in Table 2 revealed a favourable comparative stand vis vis, the samples of yoghurt produced using the various species of lactic acid bacteria used and the control. The results show that there was a significant difference ($P<0.05$) in the moisture content of the samples with values ranging from 85.55% to 87.5% respectively. The moisture content of Sample B (produced by *Streptococcus thermophilus*) is the highest ($87.50^a \pm 0.14$), followed by samples F, D, A, H, E, G, and C. The differences in the moisture content can be attributed to the water utilization capacity of the various starter cultures in the medium. Thus, since the moisture content is high, the yoghurt samples will require cold storage because high water activity which supports high microbial growth consequently will lead to a reduction in the shelf life of the milk samples. The moisture content of yoghurt samples studied was in conformity with the results of Heaney and Weaver [20] and Ajai *et al.*, [19].

There was a significant difference ($P<0.05$) between the carbohydrate content of the yoghurts. The carbohydrate ranges from $6.68^a \pm 0.22$ - $4.4^c \pm 0.2$. Sample E yoghurt produced using mixed starter cultures (*L. bulgaricus* and *L. fermentum*) had the highest carbohydrate content followed by sample G, C, H, D, A, B and F. The differences in the percentage of carbohydrate as compared with the various produced yoghurt samples may be due to differences in the utilization of the sugars present in the Milksi Milk used in producing the yoghurts. The carbohydrate value obtained here is within the same range in the result of Osundahunsi *et al.*, [21]. It was noted that the carbohydrate content of Sample G produced by the

three LAB isolates: *L. bulgaricus*, *S. thermophilus* and *L. fermentum*. However, the carbohydrate content of Sample G produced by the three LAB isolates ($6.44^a \pm 0.19$) was not significantly different from that produced by the Control LAB ($6.35^a \pm 0.13$).

The ash content of the samples ranges from 0.85% to 0.73%. The highest ash content was in sample F (produced by *S. thermophilus* and *L. fermentum*) and the lowest in sample H (Control). This shows that yoghurts were fortified with minerals for body maintenance which came from the powered milk used in the work. The slight changes in ash could be attributed to the fact that fermented food constitutes a product of microbial metabolism resulting in mineralization of the higher compounds [18].

The mean values of crude proteins of the eight samples are significantly different ($P<0.05$) with Sample F having the highest value of crude protein ($3.95^a \pm 0.01\%$) which value is significantly greater than $2.97^f \pm 0.01\%$ found in the Control sample which incidentally is the lowest crude protein value among the eight samples. The changes in the percentage of protein is compared among the various yoghurts could be as a result of hours of fermentation during processing.

There was also a significant differences ($P<0.05$) in the fat contents of the samples which ranged from $3.95^a \pm 0.01$ (for Sample A) to $3.17^g \pm 0.01$ (for the Control Sample). The differences in fat can be attributed to the fats and oil level of the milk, whether skimmed or full cream milk.

The highest fiber content ($0.53^a \pm 0.01\%$) was seen in Sample E (produced by *L. bulgaricus* and *L. fermentum*). The fiber content ranges from 0.5% and 0.43%. The differences in the fiber content can be attributed to effect of processing and microbial metabolism.

Yoghurt Samples C, E and G had statistically the highest dry matter value among all the samples produced. Table 3 showed that Sample H (Control) had the highest T. A value compared with other samples ($P<0.05$) while Samples C and F had the lowest T. A. values.

Five panelists were chosen from the staff and students of Michael Okpara University of Agriculture, Umudike to evaluate the colour, texture, taste, flavour and general acceptability of the yoghurts produced. From the results of the hedonic test result was shown in Table 4, Samples A-G were more acceptable than the control sample H. The sensory evaluation was useful in considering some of the factors that influence the acceptance of yoghurt produced from lactic acid bacteria. It was clear that the isolated yoghurt starter culture produced better result than the commercially sourced starter culture.

Table 1: Identification of Lactic Acid Bacteria isolated from fermented foods.

Colony morphology	Gram reaction	Cell arrangement	Catalase	Coagulase	Oxidase	Methyl Rred	Urease	Nitrate	Motility	Glucose	Lactose	Maltose	Sucrose	Fructose	Isolate
Raised, creamy with whitish colony	+	Rod in singles	-	-	-	+	-	-	-	+	+	-	-	+	<i>Lactobacillus bulgaricus</i>
Raised, circular, golden yellow colony	+	Rod in clusters	-	-	-	+	+	+	-	+	+	+	+	+	<i>Lactobacillus fermentum</i>
Raised, umbonate colony	+	Cocci in clusters	-	-	-	+	-	-	-	+	-	+	+	+	<i>Streptococcus thermophilus</i>

Key
 += Positive
 -= Negative

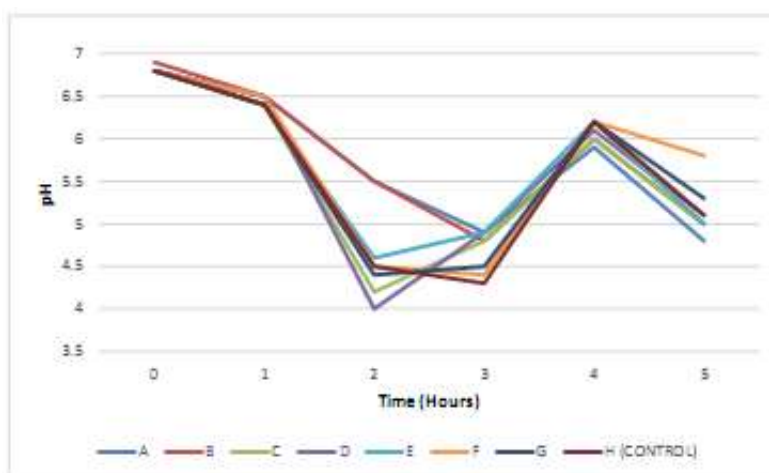


Fig-1: Changes in pH of yoghurts (A-H) with fermentation time

Key: A=Yoghurt produced using *Lactobacillus bulgaricus*
 B=Yoghurt produced using *Streptococcus thermophilus*
 C= Yoghurt produced using *Lactobacillus fermentum*
 D=Yoghurt produced using *L. bulgaricus* + *S. thermophilus*
 E=Yoghurt produced using *L. bulgaricus* + *L. fermentum*
 F= Yoghurt produced using *S. thermophilus* + *L. fermentum*
 G=Yoghurt produced using *L. bulgaricus* + *S. thermophilus* + *L. fermentum*
 H= Yoghurt produced using commercially produced starter culture (control)

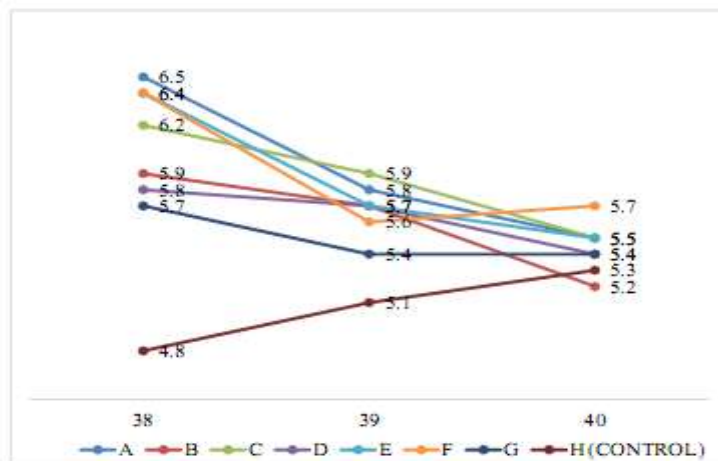


Fig-2: Changes in pH of yoghurts (A-H) with temperature

Key

- A=Yoghurt produced using *Lactobacillus bulgaricus*.
- B=Yoghurt produced using *Streptococcus thermophilus*.
- C= Yoghurt produced using *Lactobacillus fermentum*.
- D=Yoghurt produced using *L. bulgaricus* + *S. thermophilus*.
- E=Yoghurt produced using *L. bulgaricus* + *L. fermentum*.
- F= Yoghurt produced using *S. thermophilus* + *L. fermentum*.
- G=Yoghurt produced using *L. bulgaricus* + *S. thermophilus*+ *L. fermentum*.
- H= Yoghurt produced using commercially produced starter culture (control).

Table 2: Proximate analyses of yoghurt samples (A-H, %)

Parameter	A	B	C	D	E	F	G	H (control)
Moisture content	86.56 ^b ±0.19	87.50 ^a ±0.14	85.55 ^c ±0.08	86.58 ^b ±0.18	85.59 ^c ±0.15	87.42 ^a ±0.25	85.58 ^c ±0.18	86.39 ^b ±0.13
Dry matter	13.44 ^b ±0.19	12.4 ^c ±0.01	14.46 ^a ±0.08	13.43 ^b ±0.18	14.41 ^a ±0.14	12.58 ^c ±0.25	14.43 ^a ±0.18	13.6 ^b ±0.13
Ash	0.83 ^b ±0.01	0.79 ^c ±0.01	0.76 ^d ±0.01	0.75 ^d ±0.01	0.81 ^b ±0.01	0.85 ^a ±0.01	0.76 ^d ±0.01	0.73 ^e ±0.01
Crude fibre	0.4 ^{cd} ±0.01	0.49 ^b ±0.01	0.46 ^c ±0.01	0.51 ^{ab} ±0.02	0.53 ^a ±0.01	0.46 ^c ±0.01	0.49 ^b ±0.01	0.43 ^d ±0.01
Crude fat	3.95 ^a ±0.01	3.5 ^d ±0.01	3.27 ^e ±0.02	3.64 ^c ±0.02	3.2 ^f ±0.03	3.69 ^b ±0.01	3.49 ^d ±0.01	3.17 ^g ±0.01
Crude protein	3.79 ^b ±0.01	3.35 ^d ±0.1	3.61 ^c ±0.01	3.2 ^{cd} ±0.03	3.17 ^e ±0.01	3.95 ^a ±0.01	3.27 ^{cd} ±0.02	2.97 ^f ±0.01
Carbohydrate	4.4 ^c ±0.2	4.38 ^c ±0.01	6.38 ^a ±0.1	5.32 ^b ±0.23	6.68 ^a ±0.22	3.64 ^d ±0.27	6.44 ^a ±0.19	6.35 ^a ±0.13

Means with different superscript (P<0.05) in the row indicate significant difference while means with the same superscript (P<0.05) in the row indicate no significant difference.

KEY

- A=Yoghurt produced using *Lactobacillus bulgaricus*
- B=Yoghurt produced using *Streptococcus thermophilus*
- C= Yoghurt produced using *Lactobacillus fermentum*
- D=Yoghurt produced using *L. bulgaricus* + *S. thermophilus*
- E=Yoghurt produced using *L. bulgaricus* + *L. fermentum*
- F= Yoghurt produced using *S. thermophilus* + *L. fermentum*
- G=Yoghurt produced using *L. bulgaricus* + *S. thermophilus* + *L. fermentum*
- H= Yoghurt produced using commercially produced starter culture (control)

Table 3: Titratable acidity (T.A) of yoghurt samples (A-H)

SAMPLES	A	B	C	D	E	F	G	H (CONTROL)
T. A	0.023 ^d ±0.0	0.03 ^{cb} ±0.00	0.027 ^E ±0.0	0.025 ^{dc} ±0.0	0.03 ^C ±0.0	0.02 ^E ±0.0	0.03 ^B ±0.0	0.03 ^a ±0.00

Means with different superscript (P<0.05) in the row indicate significant difference

Key

- A=Yoghurt produced using *Lactobacillus bulgaricus*
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- G=Yoghurt produced using *L. bulgaricus* + *S. thermophilus*+ *L. fermentum*
- H= Yoghurt produced using commercially produced starter culture (control)

Table 4: Hedonic Test for Sensory properties of yoghurt samples

Sensory attributes	Yoghurt sample	Like extremely	Like very much	Like moderately	Like slightly	Neither like nor like	Dislike slightly	Dislike moderately	Dislike very much	Total
COLOUR	A	0	2	2	1	0	0	0	0	5
	B	0	3	2	0	0	0	0	0	5
	C	3	1	1	0	0	0	0	0	5
	D	1	2	2	0	0	0	0	0	5
	E	4	1	0	0	0	0	0	0	5
	F	2	1	2	0	0	0	0	0	5
	G	0	2	3	0	0	0	0	0	5
	H(control)	2	2	1	0	0	0	0	0	5
TEXTURE	A	0	1	3	1	0	0	0	0	5
	B	0	1	1	3	0	0	0	0	5
	C	0	1	1	3	0	0	0	0	5
	D	0	1	2	2	0	0	0	0	5
	E	1	1	3	0	0	0	0	0	5
	F	0	2	3	0	0	0	0	0	5
	G	0	0	1	4	0	0	0	0	5
	H(control)	3	2	0	0	0	0	0	0	5
FLAVOUR	A	1	4	0	0	0	0	0	0	5
	B	0	2	3	0	0	0	0	0	5
	C	0	0	0	1	3	1	0	0	5
	D	0	0	1	4	0	0	0	0	5
	E	0	0	1	4	0	0	0	0	5
	F	0	0	1	4	0	0	0	0	5
	G	0	0	2	3	0	0	0	0	5
	H(control)	0	2	2	1	0	0	0	0	5
TASTE	A	0	0	1	2	2	0	0	0	5
	B	0	0	0	2	1	2	0	0	5
	C	0	0	0	1	1	3	0	0	5
	D	0	0	0	2	1	2	0	0	5
	E	0	0	2	3	0	0	0	0	5
	F	0	0	2	2	1	0	0	0	5
	G	0	1	3	1	0	0	0	0	5
	H(control)	0	2	2	1	0	0	0	0	5
GENERAL ACCEPTABILITY	A	0	0	2	3	0	0	0	0	5
	B	0	0	3	2	0	0	0	0	5
	C	0	3	2	0	0	0	0	0	5
	D	0	2	3	0	0	0	0	0	5
	E	4	1	0	0	0	0	0	0	5
	F	1	4	0	0	0	0	0	0	5
	G	0	0	2	1	1	0	0	0	5
	H(control)	2	2	1	0	0	0	0	0	5

CONCLUSION

The result showed that the optimum conditions for the production of the yoghurt samples in this work gave products that were acceptable compared with other similar works. Also the use of lactic acid bacteria (*Lactobacillus bulgaricus*, *Streptococcus thermophilus* and *Lactobacillus fermentum*) as starter culture for yoghurt production compared very favourably with the already existing commercially made starter culture produced yoghurt (control). There were slight differences in moisture, ash and proteins of the products. However, the proximate analyses results of the samples rated well with other results. The results

from Hedonic test for the sensory properties (colour, taste, texture, flavour and general acceptance) showed that the yoghurt produced can also be sold since it gave a better sour taste as compared with control (yoghurt produced with commercially made starter culture).

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