Nutritional Properties of Yoghurt Prepared Using Exopolysaccharide Producing *Lactobacillus* spp. Isolated from *Nono*

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Abstract: Yoghurt is a widely accepted and consumed fermented dairy product, rich in protein, vitamins and essential minerals. There could be variation in nutritional properties of yoghurt, which could be due to variation in milk properties, or type of starter culture used. Three (3) high yielding EPS *Lactobacillus* spp. from a previous study were used for yoghurt production. The produced yoghurt samples were subjected to physicochemical, proximate, and elemental analysis using standard methods. The produced yoghurt had pH values in the range, 4.05- 4.92, Titratable acidity (0.90 – 1.45%), viscosity (1441 - 8121 cps) and syneresis (8.36 -17.40%) which significantly differed at 95% confidence level. Proximate content analysis indicated all the yoghurt to be of low fat (1-3%), with good protein content in the range 3.34 and 4.20%, mean ash contents and total solids content of yoghurt were, 0.49% and 20.63% respectively. The yoghurt samples had varying values of trace elements, Phosphorus, Zinc, Calcium and Potassium in the range of; 44.38 - 45.05ppm, 0.21 -0.38ppm, 65.53 - 79.87ppm, 107.6 -183.85ppm for each respectively. These isolates were able to produce yoghurt with desirable properties (Physicochemical, proximate, and trace elements), comparable to the control yoghurt produced with standard starter culture; and were within acceptable limits of FDA. These strains could be considered as adjunct or potential starter culture candidates for yoghurt production.

Keywords: Yoghurt, Kano, *Lactobacillus* spp. Nutritional properties.

INTRODUCTION

Milk is a highly nutritious substance with a very short shelf life; therefore it is fermented in order to preserve and extend its shelf life. The act of fermentation is brought about by the growth and activity of microorganisms. Lactic acid bacteria are the primary group of micro-organisms responsible for most food fermentations (Neysens *et al*., 2003). Fermentation is an ancient method used for the preservation of foods such as meat, vegetables, cereals and milk. Milk is a white liquid produced by the mammary glands of female mammals to nourish their young ones (Adams and Moss, 2005). Lactic acid bacteria have been described as the main organisms responsible for fermentation of cereal and milk (dairy). The Lactic Acid Bacteria (LAB) associated with fermentation of dairy and dairy products are *Leuconostoc, Streptococcus, Lactobacillus, Enterococcus, Aerococcus* and *Pediococcus spp*. Fermented milk and milk products are vast and consumed worldwide in a variety of forms. Yoghurt, *nono, laban, koumiss, kefir,* sour milk, buttermilk and cheese, to mention a few are milk products consumed in some regions (Khalil and Anwar, 2016). *Nono* is a locally fermented milk that is produced by introducing a quantity from the previous batch of fermented milk into the fresh milk. It is left to ferment overnight in calabashes. It has a distinct sharp acidic sour taste. *Nono* is widely consumed in northern part of Nigeria and other West African countries, either plain or in combination with *fura* (a millet processed gruel). The process of fermentation of milk by lactic acid bacteria results in, creation of variety in flavour, improvement of its nutritive value and product preservation (Opere *et al*., 2012). Any combination of organisms could be utilized to make a fermented milk product. In Nigeria most yoghurt are produced using imported strains of Lactic Acid Bacteria (LAB). There is need to explore the potentials of indigenous LAB strains, with a view to harnessing their potentials.

MATERIALS AND METHODS

Sample collection

Samples of locally produced *nono* by the Fulani were collected from Kofar Wambai market Kano which is located at 12°00'64" and longitude 8°52'62".

Ten different samples were randomly collected in sterile glass sample bottles. The bottles were labelled properly and instantly transported to the Department of Microbiology Laboratory, Bayero University, Kano in an ice pack box.

Yoghurt Production

This was prepared by dissolving 200g of powdered milk (Lactorich) in 600ml of sterile distilled water in large glass jars with lids. This was pasteurized by heating to 72°C for 17 secs, after which it was homogenized and cooled to 40°C. The milk was then inoculated with 3% (v/v) inocula of previously isolated *Lactobacillus* spp. The *Lactobacillus* spp which have been isolated, identified and screened for exopolysaccharide production from our previous study (Kabir *et al.*, 2022) were selected and used as inoculants because of their better exopolysaccharide producing ability. The selected strains were *Lb. acidophilus* 1 (A), *Lactobacillus brevis* 1 (J), *Lactobacillus fermentum* 1 (S). The inocula were prepared from fresh overnight culture of organism, single and consortia, using normal saline. The suspension was adjusted to contain approximately 1.5×10^8 CFU mL^1 using 0.5 M Mac-Farland turbidometry standards. Commercial yoghurt starter (Yogourmet) which contained pure cultures of mixed strains of *Lactobacillus bulgaricus, Streptococcus thermophillus* and *Lactobacillus acidophilus* (labelled as X), was inoculated in one of the milk jars which served as positive control. One of the milk jars was left uninoculated, and it served as negative control. The jars were labelled appropriately and incubated at 45°C until curd formation was observed (Benson, 1998; Obi *et al*., 2016).

Physicochemical Analysis of the Yoghurt Samples

Determination of pH

The pH was obtained by immersing the probe of the digital pH meter (Jenway 3505) into the samples. Readings were taken in triplicate. Prior to use the pH meter was calibrated with buffer standard of pH 4.0 and pH 10.0 (Benson, 1998).

Determination of Titratable acidity

Ten millilitres of *nono* was transferred into a clean beaker, two drops of freshly prepared phenolophthalein was added. The resulting mixture was titrated against 0.1N NaOH until a pink colour was formed. The volume of lactic acid was calculated by dividing the titration value by 10 (Sulieman *et al*., 2006).

Determination of Viscosity

Viscosity measurement was obtained at room temperature (25ºC) using a Brookfield DV-E viscometer, spindle speed was set at 20rpm. Measurements were expressed in centipoises (cps) and performed in triplicates, then averaged (Han *et al*., 2016).

Proximate Analysis of the Produced Yoghurt Samples

Determination of Fat content

This was achieved according to the Gerber method. Gerber acid was prepared by mixing 90ml of sulphuric acid with 10ml of distilled water to obtain 90% sulphuric acid. Ten millilitres of Gerber acid, was dispensed into the butyrometer tube, this was followed by the addition of 11ml of the test sample into the tube. One millilitre of amyl alcohol was carefully added such that it didn't mix with the already dispensed solvents. The tube was tightly closed and contents thoroughly mixed, by carefully shaking and inverting the tubes. The butryometer was then placed in a water bath and heated to 65°C for 3 minutes. The fat present in the sample accumulates together. The fat content is determined by reading directly from the graduated scale of the butyrometer (AOAC, 2005).

Determination of Protein Content

The Kjeldah method was employed as described by AOAC, (2005). Five millilitres of yoghurt sample was dispensed into the digestion flask, after which 15ml of concentrated sulphuric acid and 5g of copper sulphate (Kjeldah catalyst) were added. The contents of the flask were gently mixed together. The flask was placed into the digestion block in the fume cupboard and heated for two hours until frothing ceased. This yielded a light blue solution.

The mixture was allowed to cool after which it was transferred into a 100ml volumetric flask, and then diluted with water to attain a 100ml volume. This aforementioned solution was labelled digest. Ten millilitres of this digest was fed into the distillation apparatus, and then 15ml of 40% Sodium hydroxide was added. This resulted in the release of ammonia. The released ammonia is collected from the condenser using 10ml of trapping solution consisting of 2% boric acid mixed with 2 drops of methyl red indicator. The resulting solution (distillate) was titrated against 0.025N sulphuric acid to a purple end point. The volume of sulphuric acid consumed was recorded.

Determination of Ash Content

The ash content was determined by the direct heating method as contained in AOAC, (2005). Two grams each, of the samples was measured into a crucible of known weight, the sample was burnt to ash in a muffle furnace for 3h at 550°C. It was then cooled in a desiccator; the weight of the ash was determined by calculating the % Ash content as;

$$\%\,Ash = \frac{W_1 - W_2}{W_1}\ x\ 100$$

Where;

W_1 = Initial weight of the sample

W_2 = Weight of the dried sample

Determination of Total Solids and Moisture content

Total solids and moisture content was determined according to Association of Official Analytical Chemists method (AOAC, 1995). Five grams (5g) of *nono* was placed in an oven and heated at 105°C for 3 hours. Readings were taken at constant weight. The moisture content is expressed as % of the dry weight sample. The weight of the residue obtained from moisture content analysis is expressed as percentage of total solids using the formula below:

$$Total\ solids\ (\%) = \frac{(Weight\ of\ dish + dry\ yoghurt) - (Weight\ of\ dish)}{Weight\ of\ samples}\ x\ 100$$

Determination of Solid Non-fat (SNF)

This was determined using the difference method adapted from Matela *et al*., 2019b.

% SNF = % Total solids - % Fat

Determination of Trace Elements

Sample preparation (Digestion)

The samples were prepared using Advanced Microwave Digestion System, Model: EHOS EASY, as programmed by the equipment at the Centre for Dry Land Agriculture (CDA) Bayero University Kano. Two hundred milligram (200mg) of samples were weighed and transferred into 90ml microwave digestion vessels. Ten millilitres mixture of 15.9N trace metal grade Nitric acid, hydrogen peroxide and per chloric acid (7:2:1) was added to each vessel. After standing for one hour (1h), the samples were processed by microwave digestion system as follows: ramp temperature from ambient to 200°C over 20min, then hold at 200°C for 20min, after digesting, they were allowed cool to approximately 50°C before handling. The digest was transferred to 50ml volumetric flask, and then solution volume was adjusted to 50ml with deionised water and filtered for instrumental analysis (Li *et al* ., 2013).

Determination of Phosphorus, Zinc, Calcium, and Potassium

These were performed using microwave plasma atomic emission spectrometers, model; Agilent 4210 MP-AES. The sample introduction system consisted of PVC peristaltic pump tubing (white/white and blue/blue), a single pass cyclonic spray chamber and the oneNeb nebulizer. The Agilent MP Expert software was used to automatically subtract the background signal from the analytical signal. A background spectrum from a blank solution was recorded and automatically subtracted from each standard and sample solution that was analysed. The software was also used to optimize the nebulization pressure and the viewing position for each wavelength selected to maximize sensitivity. Because of this optimization, and considering that all determinations were carried out sequentially, each analyte was determined under optimized conditions. A standard reference solution was used to quickly and easily optimize the parameters (Li *et al.*, 2013).

STATISTICAL ANALYSIS

Data collected on yoghurt physico-chemical properties, proximate content and trace element were subjected to analysis of variance. The significant difference within the means were separated using Fisher's least significant difference test at $p \leq 0.05$ using Microsoft Excel 2010. Results were presented in means ± standard deviation

RESULTS

Table 1, gives the physicochemical properties of the yoghurt. All the produced yoghurt samples had pH within the acidic range; and had mean Titratable acidity of 1.25% and mean density of 0.21g/cm^3. The coagulation time for the milk ranged from 9.19h – 11.19h. Significant difference was observed in coagulation time between yoghurt samples. Viscosity values of the yoghurt ranged from 1,740 – 6,638cp, there was significant difference statistically (P> 0.05), between viscosity values of yoghurt. The ratio of syneresis of all the produced yoghurt sample was within the range of 08.36 – 17.40%. Table 2 presents the values for fat, protein, ash, were in the range 0.93 – 1.95%, 3.34 – 4.20%, 0.42 – 0.52% respectively. The total solid and solids non-fat had mean values of 20.63% and 19.27% respectively. All the aforementioned parameters were statistically different (P>0.05). The results for trace element contents of yoghurt are presented in Table 3. The trace elements evaluated were Phosphorus, Zinc, Calcium and Potassium. Yoghurt samples had mean values of; (42.11, 0.24, 73.61, 118.74) ppm for Phosphorus, Zinc, Calcium and Potassium respectively.

Table 1: Physico-chemical Properties of the Produced Yoghurt

Yoghurt Sample code	pH	Titratable Acidity%	Density g/cm^3	Coagulation Time (hours)	Viscosity (cps)	Ratio of Syneresis (%)
A	4.05±0.03^{f}	1.45±0.02^{c}	1.01±0.01^{bc}	09.33±0.12^{e}	5179±1.15^{e}	13.15±0.02^{d}
J	4.92±0.03^{a}	0.70±0.21^{d}	1.03±0.01^{abc}	16.00±0.02^{a}	1240±3.00^{h}	17.40±0.01^{a}
S	4.32±0.07^{c,d}	1.50±0.02^{c}	1.04±0.02^{ab}	09.19±0.10^{f}	1441±1.15^{g}	11.69±0.01^{f}
JA	4.07±0.04^{f}	1.73±0.49^{a}	1.05±0.01^{a}	10.30±0.02^{c}	8121±1.53^{a}	16.44±0.01^{b}
SA	4.37±0.04^{c}	1.27±0.13^{b}	0.96±0.03^{e}	10.30±0.05^{c}	6704±1.54^{b}	15.26±0.01^{c}
SJ	4.30±0.01^{d}	1.22±0.02^{d}	0.97±0.02^{de}	11.19±0.32^{b}	2241±1.15^{f}	12.77±0.01^{e}
SJA	4.23±0.01^{e}	1.23±0.06^{a}	1.00±0.02^{cd}	10.00±0.46^{d}	6638±2.08^{c}	10.46±0.01^{g}
X	4.53±0.02^{b}	0.90±0.15^{c}	1.02±0.02^{abc}	08.20±0.17^{f}	5865±2.00^{d}	08.36±0.01^{h}
LSD	**0.06**	**0.35**	**0.03**	**0.31**	**3.05**	**0.02**

Key: A = *Lb. acidophilus 1, J = Lb. brevis 1, S = Lb. fermentum 1* are local EPS producing strains; X: control yoghurt produced using standard starter culture

*Means along columns with different superscript are statistically different at 95% confidence level.

Table 2: Proximate Composition of the produced Yoghurt

	Percentage (%)					
Yoghurt Sample code	**Fat**	**Protein**	**Ash**	**T.S.**	**SNF**	**Moisture Content**
A	1.13±0.20 ^{c}	3.90±0.04^{c}	0.44±0.04^{b}	21.00±1.0^{ab}	19.87±0.7^{bc}	79.00±1.00^{bc}
J	1.21±0.20^{cd}	3.41±0.08^{e}	0.42±0.03^{b}	22.00±1.0 ^{a}	20.79±0.5 ^{a}	78.00±0.45 ^{c}
S	0.51±0.04^{e}	3.80±0.01^{c}	0.52±0.04^{a}	21.00±0.6^{ab}	20.49±0.8^{ab}	79.00±0.93^{bc}
JA	1.99±0.01^{a}	3.61±0.02^{d}	0.50±0.01^{a}	20.00±1.0 ^{b}	18.01±0.3 ^{e}	80.00±0.50^{ab}
SA	1.20±0.21^{cd}	3.34±0.08 ^{e}	0.49±0.02^{a}	19.00±1.0 ^{c}	17.80±0.2 ^{e}	81.00±0.76 ^{a}
SJ	1.53±0.15 ^{b}	3.93±0.06^{bc}	0.51±0.03^{a}	20.00±1.0 ^{b}	18.47.±0.5^{d}	80.00±0.40^{ab}
SJA	1.30±0.20^{bc}	4.01±0.08^{b}	0.49±0.01^{a}	21.00±0.6^{ab}	19.70±0.2^{bc}	79.00±1.08^{bc}
X	0.93±0.10 ^{d}	4.20±0.02 ^{a}	0.52±0.03^{a}	20.00±1.5^{ab}	19.07±0.2^{cd}	80.00±0.47^{ab}
LSD	0.25	0.15	0.04	1.72	0.81	1.29

Key: A = *Lb. acidophilus 1, J = Lb. brevis 1, S = Lb. fermentum 1,* are local EPS producing strains; X: control yoghurt produced using standard starter culture

*Means along columns with different superscript are statistically different at 95% confidence level.

Table 3: Trace Elements Obtained from the Produced Yoghurt

	Part Per Million (PPM)			
Sample	**Phosphorus (P)**	**Zinc (Zn)**	**Calcium (Ca)**	**Potassium (K)**
A	45.05±0.06 ^{a}	0.38±0.02 ^{a}	79.87±0.11 ^{a}	183.85±0.59 ^{a}
J	40.85±0.41^{d}	0.21±0.01 ^{c}	70.87±0.43 ^{d}	107.61±0.23^{e}
S	42.18±0.05^{c}	0.22±0.01 ^{bc}	73.13±0.86 ^{cd}	111.58±0.18^{d}
JA	36.77±0.35^{e}	0.22±0.01 ^{bc}	65.53±0.24 ^{e}	93.90±0.10^{g}
SA	40.26±0.08^{d}	0.22±0.01 ^{bc}	74.43±0.01^{bc}	105.69±0.05^{f}
SJ	42.22±0.47^{c}	0.21±0.01 ^{c}	72.52±2.40^{d}	112.13±0.11^{c}
SJA	42.61±0.53^{c}	0.23±0.01 ^{b}	76.09±1.97 ^{b}	111.92±0.06^{cd}
X	44.38±0.60^{b}	0.23±0.01 ^{b}	80.93±0.02 ^{a}	122.65±0.11 ^{b}
LSD	0.66	0.01	1.99	0.42

Key: A = *Lb. acidophilus 1, J = Lb. brevis 1, S = Lb. fermentum 1,* are local EPS producing strains; X: control yoghurt produced using standard starter culture

*Means along columns with different superscript are statistically different at 95% confidence level.

DISCUSSION

The physicochemical properties of the yoghurt produced with the three highest yielding EPS producing strains; *Lb. acidophilus* 1(A), *Lb. brevis* 1 (J), *Lb. fermentum* 1 (S), singly and in consortia, had mean pH values of 4.35. The highest pH value of 4.92 was obtained from yoghurt J, while yoghurt A had the least pH (4.05). Values of the yoghurt pH varied significantly (P>0.05). The acidic pH of yoghurt is significant in the preservation of yoghurt, because it inhibits the growth of spoilage microorganisms. The pH values reported in this study (except yoghurt J) comply with the recommendation of Food and Drug Agency (FDA) 2009, which states that all yoghurt samples should have a pH less than 4.50. The values obtained from this study agrees with the finding of Osatohanmwe and Olisaka (2020) who reported yoghurt pH of 4.00 – 5.60 from Edo State. Conversely, these findings do not agree with the work of Obi *et al.* (2016) and Fahmid *et al.* (2016), this difference could be attributed to difference in starter culture strains.

Titratable acidity values differed significantly (P>0.05), and ranged from 0.90% (control yoghurt X) to 1.73% (yoghurt JA). The Titratable acidity is essential to yoghurt because it is responsible for the acidic taste of yoghurt as reported by Corrieu and Béal, (2016). These values are in line with the work of Matela *et al.* (2019a), who obtained similar values (0.9 - 1.81%) from yoghurt samples of Lesotho, South Africa. However, results of the study by of Guler and Park (2011) from Turkish yoghurt, are not in conformity with the findings of this research.

The produced yoghurt had density values in the range between 0.96 and 1.05g/cm^3, which varied statistically (P>0.05) where, density values of yoghurt A, J, S and SJA were observed to be comparable to density values of control yoghurt X (1.02) produced with standard starter. According to Food and agricultural Organisation, FAO (2011), low fat unsweetened yoghurt should have a density of 1.03g/cm$^{3.}$ This finding is in line with the work of Kiani *et al.* (2008), which reported density values of 1.02 g/cm^3 from Iranian yoghurt samples. The result of coagulation time of the different yoghurt samples produced by isolated local *Lactobacillus* strains ranged from 8.20 – 16.00 hours which significantly differs, but coagulation time of yoghurt A, JA and SA are similar. It is worthy to note that yoghurt J had the highest coagulation time of 18.00 hours, this might be due to the poor acidification ability of isolate J as previously indicated by its high pH value of 4.92. Coagulation of milk to yoghurt, results when milk protein (casein) reaches its isoelectric point around pH 4.6 as reported by Adams and Moss, (2005; Corrieu and Béal, (2016). Similar findings were reported by Fagbemigun *et al.* (2021), who characterized potential starter cultures from *nono* obtained from; Jigawa, Bauchi, Katsina and Kano states of Nigeria.

Viscosity values of the produced yoghurt varied statistically (P> 0.05). This is not surprising because isolates produced different quantities of exopolysaccharide. Exopolysaccharide when produced in situ during milk fermentation improves the quality and viscosity of product. These findings are similar to the findings of Feldmane *et al.* (2013) which evaluated the potentials of exopolysaccharide from LAB in yoghurt production, but does not agree with the work of Omola *et al.*, (2014). The produced yoghurt batches had syneresis values in the range, 17.40 - 8.36%. The least syneresis value of 8.36%, was obtained from control yoghurt X, while yoghurt J had the highest syneresis value of 17.40%. Syneresis in yoghurt is considered as a product defect in yoghurt. The significant difference observed in the syneresis quality of the produced yoghurt, could be due to difference in quantity of exopolysaccharide produced by each strain, the degree of interactions of the produced exopolysaccharide with milk caseins, type of charge and molecular mass of the produced EPS as reported by Bachtarzai *et al.*, (2019). Similar values of syneresis of 21.50% were reported by Fahmid *et al.*, (2016), also Matela *et al.*, (2019a) reported syneresis values in the range (1.76-35.15%) from yoghurt sampled in South Africa. However, these values are not in agreement with the findings of Aydemir (2020) which reported syneresis values of; 18.36 – 27.78% from yoghurt samples from Turkey.

The proximate content composition of the produced yoghurt revealed variable compositions of; fat, protein, ash, total solid and solid non-fat contents in the range of; 0.93-1.99%, 3.34-4.20%, 0.42-0.52%, 29-31%, 27.77-30.93% respectively. All the mentioned parameters differed significantly statistically at 95% confidence limit (P>0.05). The yoghurt samples can be ranked as low fat yoghurt; as stated by USDA (2001), yoghurt having 0.5-2.0% fat content is a low fat yoghurt. Fat acts an aroma solvent, thus impacts on the aroma and flavour of the yoghurt. The highest protein content was observed in the control yoghurt X (4.20%) which is akin to yoghurt SJA (4.01%). The partial hydrolysis of milk proteins by LAB make yoghurt proteins

easier to digest. Proteins are vital for the proper growth, development and healing of the body. Hassan and Amjad (2010) have reported similar protein values. Obi *et al*., (2016) reported similar protein values from yoghurt. Ash content values of produced yoghurt samples where within the range 0.42-0.52%. The quantity of ash present gives a clue of its mineral content. Minerals are essential for proper development of bones and teeth, especially in children. The highest total solid content value was yoghurt J (22%) while yoghurt SA had the least value (19%).The total solids impact on the structure of the yoghurt. According to Matela *et al*. (2019b); yoghurt having less than 20% total solid are evaluated as thin and tasteless. Solids non-fat contents of the yoghurt was somewhat high, this could be attributed to the fact that the yoghurt was prepared using powdered milk. Moisture content of yoghurt samples was in the range of 78-81%. The tendency of microorganisms to grow in foods depends on its water content, high water content will support microbial growth, thus reducing the shelf life of the product. It is recommended that moisture content of yoghurt should be less than 84% (Bibiana *et al*., 2014).

Variable quantities of trace element; phosphorus, zinc, calcium, and potassium values were obtained from the produced yoghurt. Phosphorus values were within the range 36.77 – 45.05ppm. Phosphorus plays a vital role in cell and skeletal development, as well as in cellular functions as reported by Takeda *et al.*, (2004). The highest zinc content value of 0.38ppm was obtained in yoghurt A, this value was very much greater than the value (0.23ppm) obtained from control yoghurt X produced using standard starter culture. Zinc functions as a cofactor and is a constituent of many enzymes. It is essential for tissue repair. Zinc plays a role in cell replication, gene expression and in nucleic acid metabolism, it also increases iron utilization (Adelekan and Saleh, 2020). Calcium is essential for the proper development and maintenance of teeth and bones. The highest calcium content of 80.93ppm was obtained in control yoghurt X, while yoghurt JA had the least calcium value of 65.53ppm. The calcium contents of yoghurt varied statistically (P>0.05), although the calcium values obtained in yoghurt X are statistically equivalent to yoghurt A. The calcium present in yoghurt exists in ionic form; as such they are easily absorbed and utilized by the body (Matela *et al*., 2019b). Prepared yoghurts were found to contain potassium contents in the range 93.90-183.85ppm. Statistical analysis revealed significant difference (P>0.05) in potassium contents among the produced yoghurt samples. Yoghurt A had the highest potassium content 183.85ppm while the least value of 93.90ppm was obtained from yoghurt JA. Potassium is an electrolyte essential in intracellular fluid and in the regulation of nerve impulse, muscle contraction and osmotic pressure. Potassium deficiency could result in renal impairment and failure (Soetan *et al*., 2010). The mineral content values obtained in this research are not in line with the findings of Adubofuor (2014), which reported higher mineral values from yoghurt samples sold in Kumasi Ghana.

CONCLUSION AND RECOMMENDATIONS

The study revealed that the previously studied *Lactobacillus* spp.; *Lb. acidophilus 1, Lb. brevis, Lb. fermentum,* from *nono* were able to ferment milk to produce yoghurt with desirable properties (Proximate and trace elements), comparable to the control yoghurt produced with standard starter culture. The physicochemical properties and proximate composition of the produced yoghurt were within acceptable limits of Food and Agricultural Organisation and FDA, 2010; which recommended minimum milk protein of 2.7%;milk fat- Less than 15%;titratable acidity -min 0.6% ;pH<4.50 (FAO and WHO, 2010). These strains could be considered as adjunct or potential starter culture candidates for yoghurt production. Technological properties and probiotic

potentials of isolates should be evaluated. Molecular studies on other potentials and properties of isolates should be conducted.

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