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(RESEARCH ARTICLE)

Assessment of the quality of different brands of commercial yoghurt sold in Wukari Metropolis, Taraba State-Nigeria

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Abstract

The study evaluated physico-chemical and sensory properties of commercial yoghurts sold in Wukari metropolis. Six brands of yoghurt samples from different batches (two taken from each brand) were purchased from supermarkets and market. A total of twelve samples were analyzed for their nutritive value and sensory quality. The consumer's acceptability of the commercial yoghurts was assessed organoleptically. The nutritive value of yoghurt was determined by pH, titratable acidity, moisture, total solids, solids-non-fats, total fats and ash. The results showed a decrease in the level of acidity. The yoghurt sold within the locality showed a lower lactic acid content below the minimum range of 0.7% required for a standard fermented yoghurt product. The moisture content of the samples of batch 1and 2 yoghurt ranged from 72.38 to 89.55% respectively. The high moisture content of yoghurt higher than 84% in some of the samples analyzed is likely to affect the texture and mouth feel of the yoghurt. The total solid-nonfat (SNF) content of the yoghurt samples ranged from 11.26% to 24.62%. It was observed that there is no consistency in the total solid-nonfat content of the yoghurt samples even in the same product and amongst the different commercial yoghurt products. The result of this research revealed that some commercial yoghurts products sold in Wukari metropolis do not conform to regulatory standard for yoghurt products in their lactic acid content (>84%), higher total solid (>24%), and the lack of consistencies in color, appearance, taste, and flavor affected their consumer acceptability.

Keywords: Brands of yoghurt; Commercial yoghurts; Physico-chemical; Sensory properties

1. Introduction

Yoghurt is one of the oldest fermented milk products known and consumed by large segments of our population either as a part of diet or as a refreshing drink. Fermentation of milk involves the action of microorganisms, principally the lactic acid bacteria. These microorganisms ferment milk converting the milk sugar lactose to lactic acid through the action of starter culture containing *streptococcus thermophiles* and *lactobacillus bulgaricus* [1]. Yoghurt is a nutritiously balanced food containing almost all the nutrients present in milk but in a more assimilable form.

Human consumption of yoghurt has been associated with tremendous health benefits due to improvement of gastrointestinal functions and disease risk reduction [2].

Different forms of yoghurt are available in the market like sweetened or flavored, stirred, strained, set, frozen and liquid yoghurt. The consumption of yoghurt in Nigeria has increased during the last decade and is taken as dessert or refreshing beverage drink. The quality of yoghurt in local market varies from one producer to another [3]. Poor quality

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milk, unhygienic practices associated with the process involved and the used of "wild type" of starter culture gives rise to poor grade [4].

The Food and Drug Administration [5] standard of identity for yoghurt drinks specifies > 8.25% milk solids - non-fat (MSNF) and fat levels to satisfy non-fat-yoghurt (< 0.5%), low fat yoghurt (2%), or yoghurt (> 3.25%) before the addition of other ingredients [6].

Yoghurt can boost immunity. The regular consumption of live cultured yoghurt produces a higher level of immunity boosting interferon as this bacterial culture stimulate infection-fighting white blood cells in the blood stream with anti-tumor effects [7]. Daily consumption of ounces (100 g) of yoghurt significantly improved the cholesterol while raising high density lipoprotein (HDL) (good cholesterol). This may be because of the ability of the live culture in yoghurt to assimilate cholesterol or because yoghurt binds the bile acids which lowers cholesterol [7].

Yoghurt is nutritionally rich in protein, carbohydrates, vitamins and minerals (for example calcium) which contributes to a healthy living including decreasing the risk of colon cancer, improved digestion and many other benefits [8].

Sensory appeal is one of the essential strategies associated with the market success of fermented products like yoghurt. The popularity of yoghurt as a food component has been linked to its sensory characteristics [9]**.**

Consequently, there is a great need to assess the quality of some types of yoghurt sold in Wukari metropolis in order to ascertain the nutritional and organoleptic properties of these products.

2. Material and methods

2.1. Determination of pH

The pH of the yoghurt products was determined in duplicates using pH meter (OHAUS U.K) after standardization with pH4 and pH 7 buffers (BDH, England). The yoghurt drinks in its packaging container was shaken to mixing before opening. 50 ml of each of the samples was placed in 100 ml beaker and the pH probe inserted. The pH value was read and recorded. The pH of the sample was determined in duplicate and the average value calculated and recorded as the pH of the product under investigation. The pH probe was rinsed thoroughly with distilled water before use on other yoghurt product samples.

2.2. Determination of Total Titratable Acidity (TTA)

The Method described by the Association of Official Analytical Chemists [10] was adopted for the determination of the titratable acidity of the yoghurt drinks samples in triplicates by titrating 10 ml of the sample with 0.1N sodium hydroxide to phenolphthalein end point (pink). The titratable acidity (expressed as% lactic acid) was calculated for each sample in triplicates.

$$\text{Calculation: } TTA\ (\%) = \frac{ml\ of\ base\ used\ X\ mole\ of\ base\ X\ Meq.wt\ of\ acid}{ml\ of\ sample\ used}\ X\ 100$$

2.3. Determination of Moisture Content

The methods described by the Association of Official Analytical Chemists [10] was adopted.10 g of yoghurt drink product was measure into a clean moisture dish in duplicates and placed in an oven at a temperature of 105 ℃ for 3 hours. It was cooled in a desiccator and dried to a constant weight. The reading was taken and expressed as the percentage of the moist weight of the sample.

$$\text{Calculation: } Percentage\ Moisture\ Content\ (\%\ Mc) = \frac{Initial\ weight\ of\ sample - final\ weight}{initial\ weight\ of\ sample}\ X\ 100$$

2.4. Determination of Total Solid (TS)

The method described by [11] was adopted. The weight of the residue obtained from moisture content analysis of yoghurt drinks products sample was expressed as a percentage (%)

Total solid using the formula below:

$$\text{Calculation: } Total\ Solid\ (\%) = \frac{weight\ of\ sample\ after\ oven\ drying}{initial\ weight\ of\ sample} \text{ X } 100$$

2.5. Determination of Total Fat (TF)

The fat content of the yoghurt drink samples was determined by using a modified Majonnier ether method described by the Association of Official Analytical Chemists [10]. 10 gram of yoghurt drink sample was weighed into a 250 ml conical flask and 2 ml of 98% ethanol and 8 ml distilled water was added and dispersed in the sample. 4 ml concentrated hydrochloric acid was added and held for 70^{o}C for 30 minutes and cooled. 25 ml of analytical grade petroleum ether and 25ml analytical grade diethyl ether was added and the solution was swirled and gently shaken, stand to permit the layer to separate. The mixed ether was decanted into a dried weighed conical flask and the mixed ether layer treatment was repeated into the weighed flask in two further occasions. The mixed ether layer was distilled off. The extracted fat in the flask was dried in and oven at 105^{o}C to a constant weight, ensuring that all the ether has been removed. The weight was recorded and expressed as a percentage (%) fat per weight of sample as follow:

$$\text{Calculation: } Total\ Fat\ (\%) = \frac{Weight\ of\ extracted\ fat\ (g)}{Weight\ of\ sample\ used}\ X\ 100$$

2.6. Determination of Total Solids- Non- Fat (TSNF)

The total solids-non-fat (TSNF) was determined using the method described by [12] by conducting total solid and total fat analysis and the percentage total fat (TF) was subtracted from the percentage total solid (TS) in order to obtain the percentage total solids-non-fat in the yoghurt drink sample.

$$\text{Calculation: } \%\ Total\ Solids - non - fat = \%\ Total\ Solids - \%\ Total\ Fat$$

2.7. Determination of Ash

The ash content of each product sample was determined by the method described by [10]. Product sample was charred and incinerated in a muffle furnace at 550^{o}C. The ash content was expressed as a percentage (%) of the inorganic residue present in the yoghurt product sample.

$$\text{Calculation: } Total\ Ash\ (\%) = \frac{Weight\ of\ Ash}{initial\ weight\ of\ sample}\ X\ 100$$

2.8. Sensory Evaluation

All the samples were evaluated for organoleptic characteristics and overall acceptability by 15 panelists that comprised undergraduate, teaching and non-teaching staff members from the Department of Food Science and Technology, Federal University Wukari; using nine-point hedonic scale ranging from excellent (score = 9) to very poor (score = 0) as extremes [13].

2.9. Statistical analysis

The data were analyzed by analysis of variance using Statistical Package for Social Sciences (SPSS) version 20, 2007 software. Means where significantly different were separated by the least significant difference (LSD) test. Significance was accepted at $p<0.05$.

3. Results and discussion

3.1. Physico-chemical analysis of different brands of commercial yoghurt drinks sold in Wukari metropolis

The results of the physico-chemical analysis of commercial yoghurt drinks sold in Wukari metropolis are shown on tables 1A and B. Samples ZX1, ZB1, ZA1, DZ1, ZY1, and EZ1 were found to have a pH of 3.70b, 3.97a, 3.85b, 3.88b, 3.65b and 3.96a, respectively. While, ZX2, ZB2, ZA2, DZ2, ZY2, and EZ2 was found to have a pH of 3.69b, 3.96a, 3.84b, 3.57b, 3.54b and 3.96a respectively. The result showed there is a decrease in the level of acidity for all the samples in both batches from supermarket and markets. This may be due to prolonged and uncontrolled fermentation, by the producers of these yoghurts which may have contributed to lowering the pH and also since yoghurt has a pH between 4.3 and 4.4; thus, the commercial yoghurt drink with pH ranges from 3.54 to 3.97, is considered an acidic food drink. This result is also in agreement with the report of other workers who investigated on different types of yoghurts sold in other parts of the country and had a similar result [14]. Additional ingredients like citrus fruits and other acidulants and increased

fermentation time may make yoghurt to be more acidic. Therefore, pH level can vary and is not on the fermentation alone.

The titratable acidity of a normal fermented milk is within the range of 0.7 – 1.2% [15], [16] and the, measured titratable acidity in this study as shown in Tables1A and B was within the range of 0.12% to 0.26% in the commercial yoghurt samples sold in Wukari metropolis. Thus, the entire commercial yoghurt sample sold within Wukari has lower lactic acid content below the minimum range of 0.7%. Thus, the fermentation process may not have proceeded in a normal way. The titratable acidity is an important measurement of evaluation because it is easier to measure all acids and is generally considered a better way to measure perceivable acidity in drinks. While, total acidity is a more accurate measurement of the total acid content of a solution, titratable acidity is an approximation of the total acidity in a solution. The titratable acidity of a good finished yoghurt drink is around 0.85 to 0.90% and the result obtained showed a low titratable acidity when compared with the standard for yoghurt production.

The moisture content of samples ZX1, ZB1, ZAI, DZ1, ZY1, and EZ1 was found to be 83.45%, 88.46%, 86.67%, 79.64%, 80.46% and 72.38% respectively. While samples ZX2, ZB2, ZA2, DZ2, ZY2, and EZ2 was found to be 82.13%, 86.74%, 89.55%, 80.72%, 82.81% and 84.85% respectively. It was observed that DZ2 exhibited highest moisture content of 89.55%, while EZ1 showed the yoghurt drink with the lowest moisture content of 73.38%. Some of the commercial yoghurt drinks sold within Wukari metropolis from supermarkets and markets do not conformed to the moisture content as reported by [12] affirming that "the moisture content of yoghurt should be less than 84%. This is because the high moisture content of yoghurt affects the texture and mouth feel" of the product.

The total solid content of yoghurt drinks samples is within the range of 10.45% to 27.62%. Samples ZX1, ZX2, ZA1, DZ1, ZY1, and EZ1 was found to be 16.55%, 11.54%, 13.33%, 20.36%, 19.54%, and 27.62% respectively. While, ZX2, ZB2, ZA2, DZ2, ZY2, and EZ2 was found to be 17.87%, 13.26%, 10.45%, 19.28%, 17.19%, and 15.15% respectively. Sample ZA2 (10.45%) was having the lowest total solid, while, EZ1 (27.62%) was having the highest total solid content. The yoghurt drinks for total solid contents are the measures of non-water components of the yoghurt samples which includes protein, lactose, mineral and fat. These variations in total solid content may be influenced by the composition of milk used, inadequate quality control and adherence to standards of manufacturing practices. Yoghurt derived from milk of different species of animal tends to vary in sensory and physicochemical characteristics due to difference per milk composition. For instance, yoghurt derived from milk high in fat content (e.g., sheep, goat and buffalo) has a more creamy texture compared to that derived from milk with lower fat content (e.g., bovine, mare, and ass). Therefore, the species of the milk producing mammal significantly influence the characteristics and total solid content of produced yoghurt [17]. It is also a common practice to add 3 – 5% skim milk, 0.1 to 1% gelatin or starch, and 15 – 22% in fruit puree to milk prior to inoculation to raise the nutritive value and give it a better body and consistency [18], [18] also reported that "the total solids concentration level of 24% and above would severely inhibit the growth of lactobacillus bulgaricus". On the other hand, the low percentage of total solids in yoghurt could lead to malfunction of starter culture [12].

The results on Table 1A and B also showed that the total milk fat content of the yoghurt drinks samples sold in Wukari metropolis was within the range of 1 to 3. Samples ZX1, ZB1, DZ1, ZY1, ZX2, ZA2, DZ2, and ZY2 were found to have 1% total milk fat respectively. While, ZA1, and ZB2 has 2% milk fat, EZ1, and EZ2 has 3% total milk fat content. The code of practice for the composition and labeling of yoghurt recommends that yoghurt described as 'very low' fat yoghurt should contain less than 0.5% total fat, 'low fat' should contain not less 0.5% and not more than 2% total fat, while, 'full fat' yoghurt should contain not less than3.2% total fat [6].The type of milk used determined the type of yoghurt – whole milk for full fat yoghurt, and skimmed milk for low fat yoghurt. Thus the samples results on total fat as presented shows that the commercial yoghurt drinks sold in Wukari metropolis can be best described as of the high fat type. The results of this study shows that high fat is sufficient for making yoghurt and are in accordance with the previous studies of [14].

The total solid-nonfat (SNF) content of the yoghurt samples ZX1, ZX2, ZA1, DZ1, ZY1, and EZ1 were 15.55%, 10.54%, 11.33%, 19.36%, 17.54%, and 24.62%; while, their respective product samples on different batch ZX2, ZB2, ZA2, DZ2, ZY2, and EZ2 was found to be 16.87%, 11.26%, 9.45%, 18.28%, 16.19%, and 12.15% respectively. EZ1 has the highest total solids-non-fat content of 24.62% while, ZA2 has the lowest total solids-non-fat content of 9.45% It was observed that there is no consistency in the total solid-nonfat content of the yoghurt samples even in the same product and amongst the different commercial yoghurt products sold in the metropolis. The higher the dry matter (solids-non-fat) content of yoghurt, the firmer the yoghurt will be. The dry matter content must be controlled in yoghurt production by the manufacturers in order to ensure consistency of their product.

3.2. Sensory evaluation of the different commercial yoghurt sold in Wukari metropolis

The results on sensory evaluation of all the commercial yoghurt sold in Wukari metropolis as shown in Tables 2A and 2B represents samples of coded commercial yoghurt products obtained at different batches from supermarkets and market on the basis of color, appearance, taste, flavor, and general acceptability. Mean with the same superscripts within the column are not significantly different at P>0.05. In Table 2A samples ZX1, ZB1 and EZ1 are significantly the same but different in their color from samples ZA1, DZ1 and ZY1.while, sample ZX1, ZB1, EZ1 are significantly the same in appearance but different from ZA1 at P>.0.05; and neither sample DZ1 and ZY1 was different from ZX1, ZB1 and EZ1 in appearance at P>0.05. Samples are the same in taste and flavor at P>0.05 with exception of sample DZ1 being significantly different in taste from ZX1, ZB1, ZA1, ZY1 and EZ1 P>0.05.

Table 1A Physico-chemical Properties of different brands of commercial yoghurt sold in Wukari Metropolis (batch1)

Parameters							
Sample code	**Ave. pH**	**TTA (%M Eq. Lactic acids)**	**Moisture (%)**	**Total Solid (%TS)**	**Total Fat (%)**	**TSNF (%)**	**Ash (%)**
ZX1	3.70^{c}	0.26^{a}	83.45^{c}	16.55^{d}	1.00^{c}	15.55^{d}	0.39^{c}
ZB1	3.97^{a}	0.25^{a}	88.46^{a}	11.54^{f}	1.00^{c}	10.54^{f}	0.37^{c}
ZA1	3.85^{b}	0.12^{c}	86.67^{b}	13.33^{e}	2.00^{b}	11.33^{e}	0.23^{d}
DZ1	3.58^{e}	0.17^{b}	79.64^{e}	20.36^{b}	1.00^{c}	19.36^{b}	0.23^{d}
ZY1	3.65^{d}	0.26^{a}	80.46^{d}	19.54^{c}	1.00^{c}	17.54^{c}	0.48^{b}
EZ1	3.96^{a}	0.16^{b}	72.38^{f}	27.62^{a}	3.00^{a}	24.62^{a}	0.54^{a}

Values are means of 2 replications. Means with the same superscripts within a column are not significantly different (P>0.05) batch 1.

Table 1B Physico-chemical properties of different brands commercial yoghurt sold in Wukari Metropolis (batch 2)

Parameters							
Sample code	**Ave. pH**	**TTA (%M Eq. Lactic acids)**	**Moisture (%)**	**Total Solid (%TS)**	**Total Fat (%)**	**TSNF (%)**	**Ash (%)**
ZX2	3.69^{c}	0.25^{a}	83.13^{e}	17.87^{b}	1.00^{c}	16.87^{b}	0.69^{a}
ZB2	3.96^{a}	0.25^{a}	86.74^{b}	13.26^{e}	2.00^{b}	11.26^{e}	0.36^{c}
ZA2	3.84^{b}	0.13^{c}	89.55^{a}	10.45^{f}	1.00^{c}	9.45^{f}	0.11^{e}
DZ2	3.57^{d}	0.17^{b}	80.72^{f}	19.28^{a}	1.00^{c}	18.28^{a}	0.30^{d}
ZY2	3.54^{e}	0.25^{a}	82.81^{d}	17.19^{c}	1.00^{c}	16.19^{c}	0.51^{b}
EZ2	3.96^{a}	0.16^{b}	84.85^{c}	15.15^{d}	3.00^{a}	12.15^{d}	0.50^{b}

Values are means of 2 replications. Means with the same superscripts within a column are not significantly different (P>0.05) batch 2

Table 2A Sensory evaluation of different brands of commercial yoghurt drinks sold in wukari Metropolis (batch1)

Sample Code	Color	Appearance	Taste	Flavor	General acceptability
ZX1	$7.09^{a} \pm 0.88$	$7.33^{a} \pm 0.62$	$6.00^{ab} \pm 2.17$	$5.80^{ab} \pm 2.63$	$7.00^{a} \pm 1.56$
ZB1	$7.33^{a} \pm 1.45$	$7.33^{a} \pm 1.11$	$6.87^{a} \pm 1.41$	$6.60^{ab} \pm 1.45$	$6.80^{a} \pm 1.42$
ZA1	$5.73^{b} \pm 2.05$	$5.33^{b} \pm 1.51$	$5.80^{ab} \pm 1.82$	$6.87^{a} \pm 1.55$	$6.20^{a} \pm 1.15$
DZ1	$6.27^{b} \pm 2.22$	$6.40^{ab} \pm 2.03$	$4.73^{b} \pm 2.40$	$5.25^{ab} \pm 1.87$	$5.60^{a} \pm 2.13$
ZY1	$5.60^{b} \pm 2.53$	$6.27^{ab} \pm 2.05$	$5.20^{ab} \pm 2.39$	$5.07^{b} \pm 2.19$	$5.87^{a} \pm 2.07$
EZ1	$7.07^{a} \pm 1.79$	$7.00^{a} \pm 1.25$	$6.00^{ab} \pm 2.33$	$6.27^{ab} \pm 2.09$	$6.33^{a} \pm 1.91$

Values are means ± Standard Deviation of 15 panelists. Mean with the same superscripts within a column are not significantly different (P>0.05).

In Table 2B, samples ZX2, ZB2 and ZY2 are significantly the same (P>0.05) and different from samples ZA2, DZ2 and EZ2 in terms of color. While, samples ZB2 and ZY2 are neither different statically at P>0.05 from samples ZX2, ZY2, ZA2 DZ2 and EZ2 respectively in color. Samples ZY2, ZB2, ZY2 and EZ2 are significantly the same (P>0.05) but varies significantly from samples ZA2, and DZ2 in appearance. Samples ZB2, ZY2, AND EZ2 are neither different significantly from samples ZX2, ZA2, and DZ2 P>0.05 respectively. Samples ZB2, ZA2, and ZX2 are significantly the same in taste but varies from samples DZ2, ZY2, and EZ2. DZ2, ZY2, and EZ2 are also the same in taste at P>0.05. Samples ZA2, ZX2, ZB2, DZ2, and EZ2 are significantly the same in flavor but varies from samples ZY2 at P>0.05. However, similarities exist in flavor between samples ZB2, DZ2 and EZ2 and sample ZA2 was rated higher in flavor at P>.0.05. Sample ZA2 was more acceptable product than samples ZX2, ZB2 and EZ2. Sample DZ2 and ZY2 were the least acceptable commercial yoghurt product.

The overall evaluation of the products based on sensory parameters comparing same products taken from different batches from supermarkets and market in Tables 2A and 2B showed that there was no significant different between samples ZX1 and ZX2; ZB1 and ZB2; ZA1 and ZA2; and DZ1 and DZ2 at P>0.05 but the samples showed consistency in terms of color, appearance, taste, flavor and general acceptability. However, in relation to the attributes assessed above samples ZY1 and ZY2; EZ1 and EZ2 are significantly different at P>.0.05. The general acceptability results showed that there was no significant difference in all yoghurt samples from batch 1 both from supermarkets and market but yoghurt ZX1 had highest mean than the other yoghurts, thus yoghurt ZX1 was the most preferred out of all the yoghurts. Also in batch 2 samples the general acceptability results showed that there was no significant difference in yoghurts ZX2, ZB2 and ZA2, but significantly difference exist between samples DZ2, ZY2 and EZ2. Yohurt ZA2 had highest mean than the other yoghurts in this batch, thus yoghurt ZA2 was the most preferred out of all the yoghurts. The high mean values obtained from all the yoghurt samples analyzed for batch 1 and 2 in terms of the sensory attributes in this study are similar with previous studies as reported by [19] who also obtained a high mean values from yoghurt samples in some metropolis in Nigeria.

Table 2B Sensory evaluation of different brands of commercial yoghurt drinks sold in wukari Metropolis (batch2)

Sample Code	Color	Appearance	Taste	Flavor	General acceptability
ZX2	$7.67^{a} \pm 1.05$	$7.60^{a} \pm 1.06$	$6.33^{ab} \pm 1.97$	$6.67^{a} \pm 2.35$	$7.00^{a} \pm 1.56$
ZB2	$6.93^{ab} \pm 1.28$	$6.60^{ab} \pm 1.40$	$7.87^{a} \pm 1.11$	$6.27^{ab} \pm 2.28$	$6.73^{ab} \pm 2.50$
ZA2	$6.33^{b} \pm 1.68$	$5.93^{b} \pm 1.33$	$7.13^{a} \pm 1.96$	$6.80^{a} \pm 1.42$	$7.13^{a} \pm 1.13$
DZ2	$6.20^{b} \pm 2.21$	$6.13^{b} \pm 2.10$	$5.40^{bc} \pm 2.32$	$5.37^{ab} \pm 2.43$	$4.73^{c} \pm 2.52$
ZY2	$8.80^{ab} \pm 1.93$	$6.53^{ab} \pm 1.92$	$4.60^{c} \pm 1.99$	$4.67^{b} \pm 2.29$	$5.07^{c} \pm 2.31$
EZ2	$6.27^{b} \pm 1.58$	$6.33^{ab} \pm 1.63$	$5.47^{bc} \pm 2.36$	$5.93^{ab} \pm 2.55$	$5.27^{bc} \pm 2.37$

Values are means ± standard Deviation of 1.5 panelists. Mean with the same superscripts within a column are not significantly different (P>0.05).

4. Conclusion

Yoghurt is an ancient nutritious milk product known and consumed by a large segment of population. Different forms of commercial yoghurts are available in the market with varied quality from one producer to another. The quality of milk, starter culture, and additives, and good quality and manufacturing practices adhered to in the production determined the quality of the final product. This research found that some commercial yoghurt products sold in Wukari metropolis do not conformed to regulatory standard for yoghurt products in their lactic acid content (>84%), higher total solid (>24%), and the lack of consistencies in color, appearance, taste, flavor which also affect their consumer acceptability. These variations can be corrected and the quality and consumer safety ensured when producers adhere to good quality control and manufacturing practices in yoghurt production. This research study is also an eye opener to say that most commercial yoghurts in the market are not properly monitored by the Nigerian regulatory bodies.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest, all authors agree to the subject.

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