Commercial vs Local Yoghurt: A Study on Quality and Safety

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Abstract: Yogurt is a nutrient-rich probiotic dairy product produced by fermenting milk with *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* [8]. This study compared the microbiological safety and physicochemical properties of commercial yogurt (Sample A) and locally produced yogurt (Sample B) over four weeks. Sample A maintained acceptable microbial quality, with no detectable coliforms or *Escherichia coli*, indicating proper hygiene and processing. In contrast, Sample B showed higher microbial loads, including coliforms and *E. coli*, suggesting inadequate sanitation. Proximate analysis revealed that Sample A had stable composition, with protein (7.5–7.6%), fat (~2.14%), and ash (0.90–0.98%). Sample B showed lower protein (6.6–6.7%), higher fat (~3.0%), and lower ash (0.71–0.78%). Carbohydrate content decreased in both samples due to fermentation, more significantly in Sample B. Moisture increased and solids-not-fat decreased during storage, especially in Sample B, indicating instability. Sample A showed controlled fermentation, with pH decreasing slightly (4.32–4.25) and acidity rising marginally (1.11–1.15%). Sample B exhibited greater changes (pH 4.10–3.60; acidity 1.70–3.17%), reflecting uncontrolled fermentation. Structural analysis showed better gel quality in Sample A, with lower syneresis (10.76%) and higher water-holding capacity (78.5%). Overall, commercial yogurt demonstrated superior safety and quality.

Keywords: *Yogurt; Commercial Yogurt; Probiotic; Microbial Quality; Escherichia Coli; Proximate Composition; Syneresis; Titratable Acidity; Water-Holding Capacity.*

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I. INTRODUCTION

The word "Yoghurt" comes from the Turkish word "Jugurt," which describes fermented dishes with an acidic flavor. It is created when certain lactic acid bacteria, primarily Streptococcus thermophilus and Lactobacillus delbrueckii subsp. bulgaricus, ferment milk [30]. Yoghurt obtains its characteristic flavour, texture, and acidity through the conversion of lactose into lactic acid by these bacteria. Additional probiotic bacteria, such as Lactobacillus acidophilus and Bifidobacterium species, are added to some contemporary or "new generation" yoghurts to improve the product's nutritional and health benefits [8],[25].

Yogurt is a dairy product that usually has a shelf life of three weeks or fewer [18]. The improper storage conditions can lead to a decline in the nutritional content and sensory aspects of yoghurt as well as a decrease in the quantity of beneficial bacteria responsible for lactic acid fermentation [4],[24],[25].

II. MATERIALS AND METHODS

- *Sample Collection:* Two samples were collected simultaneously: branded industrial yoghurt (Sample A) and unbranded locally prepared yoghurt (Sample B) from Nettoor market near Cochin, Ernakulam. Branded samples were retained in original packaging, while local samples were collected in sterile containers and analyzed immediately.
- *Microbiological Analysis:* Samples were serially diluted in Ringer's Solutions up to 10^7. After that, the usual procedure advised by APHA 2001 was used to count the microorganisms [19]. HiMedia Laboratories Pvt. Ltd. advocated the standard method for preparing plate count agar media [2],[5] presented the standard plate count method for determining the total viable count. According to Harrigan and McCance (1976), the selective media utilized for the viable count of E. Coli and Coliform were Violet Red Bile Agar and MacConkey agar, respectively. When preparing MacConkey agar media for coliforms,

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HiMedia Laboratories Pvt. Ltd.'s standard procedure was used [14]. Total viable count of *S. thermophilus, L. bulgaricus* was determined by standard plate count method [5].

- *Biochemical confirmatory test:* Bluish fluorescent colonies were streaked onto EMB agar plates and incubated 18-24 h at 35°C. Examine for Gram staining, Indole production, Voges-Proskauer (VP)-test, Methyl red-test. For the determine the number of coliforms per gram by multiplying the number of suspect colonies in BGLB by dilution factor.
- *Evaluation of Proximate Composition*: The [1] method was used to measure the sample's moisture content, ash content, crude protein content, crude fat content, titratable acidity, SNF, and pH. The other compositions were reduced to determine the carbohydrate content.
- *Evaluation of Quality Parameters-Sensory Evaluation:* Sensory evaluation of samples was carried out by a consumer panel using 9-point hedonic scale developed by [23] with required modification. The samples (about 25 ml) were served in transparent glasses. Consumer acceptability test was conducted with a 9-point hedonic scale to evaluate attributes such as color, flavor, appearance, texture, taste, and overall acceptance with individual scores from 9 (like extremely) to 1 (dislike extremely) [9].

- *Evaluation of Engineering Properties*

✓ *Syneresis (%)*-Syneresis of yoghurt samples was determined by the method described by [9] with slight modifications.

✓ *Syneresis Rate*-Syneresis rate was evaluated by monitoring moisture loss over time under controlled conditions, based on the approach reported in [9].

✓ *Water Holding Capacity (WHC)*-Water holding capacity was determined according to the standard method described in Fundamentals of Dairy Science.

✓ *Mass Transfer Analysis*- Moisture diffusion in yoghurt was determined by measuring weight loss over time at controlled temperature [6].

✓ *Microstructure analysis*- The microstructural properties of yoghurt samples were analysed by light microscopy by following the method proposed in [27]

III. RESULTS AND DISCUSSION

➢ *Microbiological Analysis:*

Making sure the product is not undergoing microbial deterioration during its anticipated shelf life is the main objective of the microbiological quality assessment of yogurt [3]. In fact, it helps identify potential health concerns (pathogens) and anticipate product shelf life by assessing the degree to which sanitary precautions have been applied during production. The 4-week tests' total viable count of unbranded yoghurt (B) demonstrates a steady rise in the number of plates recorded during the first week of treatment. The table (1) contains the results. Each set of samples was duplicated in accordance with AOAC official Method 966.23 in order to conduct the experiments.

The findings indicate that as time goes on, the unbranded yogurt's quality declines. Its range exceeded acceptable limits, ranging from 240.45×10^5 CFU/ml to 125×10^{10} CFU/ml. The use of undefined wild starting cultures in an incorrect ratio and quantity or poor fermentation conditions during the processing process are the causes of the notable difference in sample B's total viable count. The overall viable count of sample A, which is branded and packaged correctly, is in a standard expansion, as indicated in table (1). By analysing the sample investigations conducted over the next four weeks A indicates that it will begin to deteriorate after the package seal is opened and time passes, but it also stays within the AOAC's approved range of 10^6 to 10^9.

Due to pasteurization before incubation, the coliform bacteria are absent from the majority of yoghurt samples; however, some yogurt samples had lower coliform counts. Contamination in storage and display/sale outlets is most likely the cause. Lopez et al. (1997) reported similar findings, citing low coliform counts in a yogurt sample. Coliforms were detected in local yogurt samples starting in the second week, according to the microbiological examination. The analysis of variance revealed a highly significant variation in the coliform count means between the samples. The coliform count in Sample B continuously shows a slow rise starting in the second week. The range from 127×10^1 CFU/ml to 127×10^3 CFU/ml was reported, and this is also displayed in table (2). Unbranded yogurt samples had a greater number of coliforms, indicating severe mistreatment. The unclean conditions that existed during the production process may be the cause of the increased coliform count. Furthermore, this figure might possibly represent post-process contamination.

Escherichia coli counts were used to assess the microbiological quality of two yogurt samples. The microbiological safety of the two samples was clearly different, according to plate count analysis. Over the course of the four-week storage period, Sample A continuously registered less than 10 CFU/ml of E. coli. Such low counts are indicative of hygienic processing, appropriate pasteurization, and efficient packaging. For fermented dairy products, these values are within permissible microbiological bounds. Sample B, on the other hand, revealed the presence of E. coli starting in the third week, with a count of 19.09×10^2 CFU/ml, which grew to 189.09×10^2 CFU/ml in the fourth week. E. coli is frequently seen as a sign of fecal contamination or unsanitary handling during distribution, processing, or storage. Inadequate sanitation or unsuitable storage conditions are suggested by the significant rise in the bacterial count.

➢ *Biochemical Confirmatory Test:*

Biochemical tests were performed to confirm the presence of *Escherichia coli* isolated from both yoghurt samples. The isolate showed typical biochemical characteristics associated with *E. coli*. The results obtained are summarized below table no 4.

The isolate produced a red ring in the indole test, indicating tryptophan degradation to indole. A positive

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methyl red test showed mixed acid fermentation. The Voges–Proskauer and citrate tests were negative, which is characteristic of *E. coli*. The biochemical profile obtained in this study corresponds to the standard characteristics of *Escherichia coli*. The organism showed the typical IMViC pattern of ++-- (Indole positive, Methyl Red positive, Voges–Proskauer negative, Citrate negative) shown in fig 1(a to d), which is widely used for confirmation of *E. coli* in food microbiology.

The detection of *E. coli* in yoghurt sample B indicates possible fecal contamination or poor hygienic conditions during processing, handling, or storage. Although yoghurt is a fermented dairy product where lactic acid bacteria normally inhibit pathogenic microorganisms through acid production, the presence of *E. coli* suggests that contamination may have occurred after fermentation, possibly during packaging or improper storage. The presence of this organism in yoghurt is considered an indicator of sanitary quality and may pose a potential health risk to consumers.

The absence of *E. coli* in the yoghurt sample A suggests that the product was microbiologically safe with respect to fecal contamination. Yoghurt naturally contains beneficial lactic acid bacteria, which produce lactic acid during fermentation and lower the pH of the product. This acidic environment can inhibit the growth of many pathogenic microorganisms, including *E. coli* [25]. Therefore, the negative biochemical test result indicates good hygienic quality of the yoghurt sample and proper handling during processing and storage. However, continuous monitoring and adherence to good manufacturing practices are necessary to maintain the microbiological safety of dairy products [26].

The presence of coliform bacteria in the yoghurt sample was tested using Brilliant Green Lactose Bile Broth test. After incubation at 37 °C for 24–48 hours, the inoculated BGLB broth tubes showed turbidity and gas production in the Durham tubes [29], indicating a positive reaction for coliform bacteria in the case of B which is shown in fig 1(g) but not in A.

The formation of gas along with the change in clarity of the broth confirmed the fermentation of lactose by coliform organisms present in the yoghurt sample. This biochemical reaction indicates the presence of lactose-fermenting bacteria belonging to the coliform group. In this study, the positive biochemical reaction in BGLB broth suggests the presence of coliform bacteria, which are commonly used as indicator organisms of sanitary quality in food products. The detection of coliforms in yoghurt may indicate contamination during milk handling, processing, equipment sanitation, packaging, or storage conditions. Although yoghurt normally contains beneficial lactic acid bacteria that produce acidic conditions unfavourable for many pathogens, the presence of coliform bacteria suggests post-processing contamination or inadequate hygienic practices during production.

Gram staining was performed on the bacterial isolate obtained from the yoghurt samples to determine its morphological and staining characteristics. Microscopic observation after staining showed pink-coloured rod-shaped cells, indicating the presence of Gram-negative bacilli following from the third week onwards in sample B. The morphology and staining pattern observed were consistent with the characteristics of Escherichia coli. The cells appeared as short rods occurring singly or in small groups shown in fig 1(f), which is typical of *E. coli*. Therefore, the Gram staining result indicated a positive identification of Gram-negative bacteria consistent with *E. coli* in the yoghurt sample B. The detection of *E. coli* in yoghurt suggests possible contamination during processing, handling, or storage of the dairy product. Although yoghurt normally contains beneficial lactic acid bacteria that produce an acidic environment capable of inhibiting many harmful microorganisms, the presence of *E. coli* indicates that contamination may have occurred after fermentation or due to inadequate hygienic practices.

Table 1 TPC Value of Yoghurt Sample.

Sample	1 WEEKS	2 WEEKS	3 WEEKS	4 WEEKS
B	240.45×10^5 CFU/ml	243.18×10^7 CFU/ml	161.81×10^8 CFU/ml	125×10^{10} CFU/ml
A	155.90×10^3 CFU/ml	164.09×10^4 CFU/ml	165.45×10^5 CFU/ml	169.54×10^5 CFU/ml

Table 2 Coliform Count of Yoghurt Sample.

Sample	1 WEEK	2 WEEKS	3 WEEKS	4 WEEKS
B	<10 CFU/ml	127×10^1 CFU/ml	112.27×10^2 CFU/ml	127×10^3 CFU/ml
A	<10 CFU/ml	<10 CFU/ml	<10 CFU/ml	<10 CFU/ml

Table 3 E. Coli Count of Yoghurt Sample.

Sample	1 WEEKS	2 WEEKS	3 WEEKS	4 WEEKS
B	<10 CFU/ml	<10 CFU/ml	19.09×10^1 CFU/ml	189.09×10^2 CFU/ml
A	<10 CFU/ml	<10 CFU/ml	<10 CFU/ml	<10 CFU/ml

Table 4 Biochemical Test Result

BIOCHEMICAL TEST	RESULT B	RESULT A
Indole Test	Positive	Negative
Methyl Red Test	Positive	Negative
Voges-Proskauer Test	Negative	Negative

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Citrate Utilization Test	Negative	Negative
Gram Staining	Gram-negative rod	No Gram-negative rods typical of *E. coli* observed

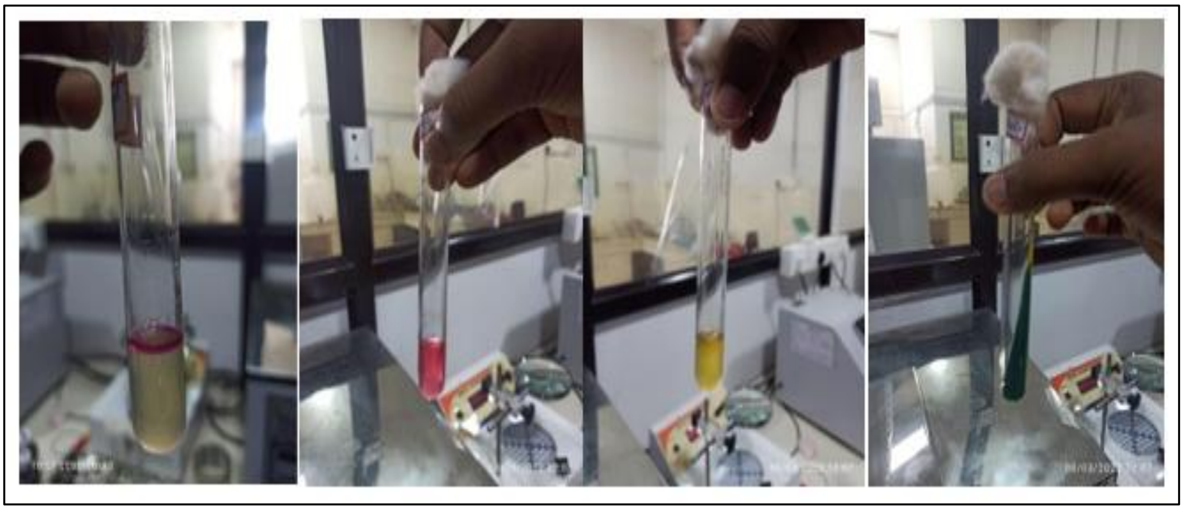

Fig 1 (a) Positive Indole Test, Fig 1 (b) Positive VP Test Showing Eosin Pink Colour Formation, Fig 1 (c) Negative Methyl Red Test, Fig 1(d) Negative Citrate Test.

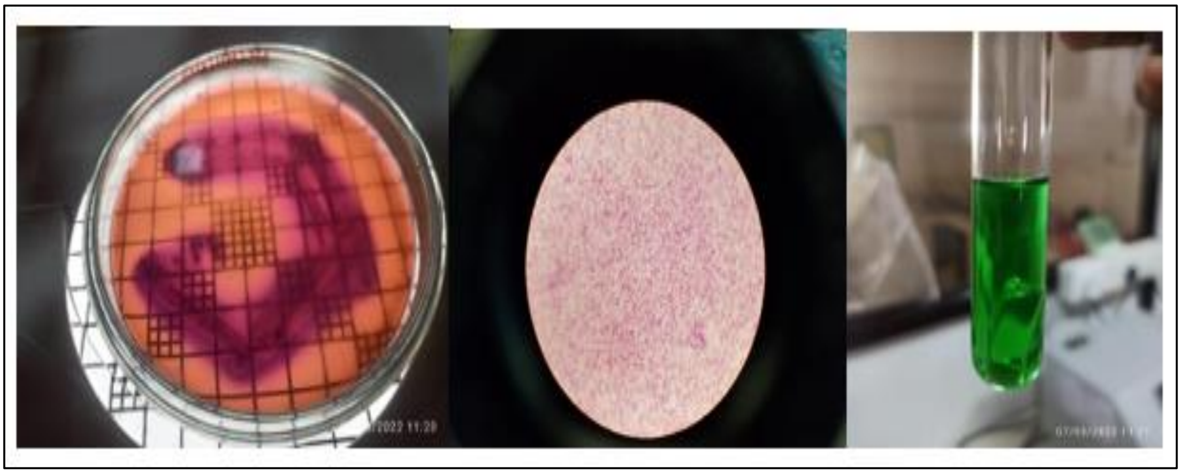

Fig 1 (e) Positive EMB Plate, Fig 1 (f) Gram-Negative Rod-Shaped Bacterial Cells, Fig 1(g) Positive BGLB Broth

Figure no 1; Showing the positive results of biochemical studies of E. coli and Coliforms.

Table 5 The Proximate Results of Yoghurt Samples.

SAMPLE	WEEKS	CHO%	PROTEIN %	MOISTURE %	ASH %	FAT %	SNF %	TA g/l	pH
A	1	17.43	7.52	72.09	0.90	2.141	25.77	1.11	4.32
	2	10.36	7.51	79.06	0.92	2.142	18.80	1.12	4.30
	3	3.80	7.50	85.64	0.91	2.142	12.22	1.14	4.27
	4	0.02	7.62	89.23	0.98	2.143	8.63	1.15	4.25
B	1	13.98	6.66	75.63	0.71	3.012	10.36	1.70	4.10
	2	7.77	6.69	81.74	0.78	3.014	6.25	1.81	4.02
	3	2.68	6.67	86.84	0.79	3.015	0.85	2.29	3.85
	4	0.66	6.68	88.86	0.78	3.016	0.97	3.17	3.60

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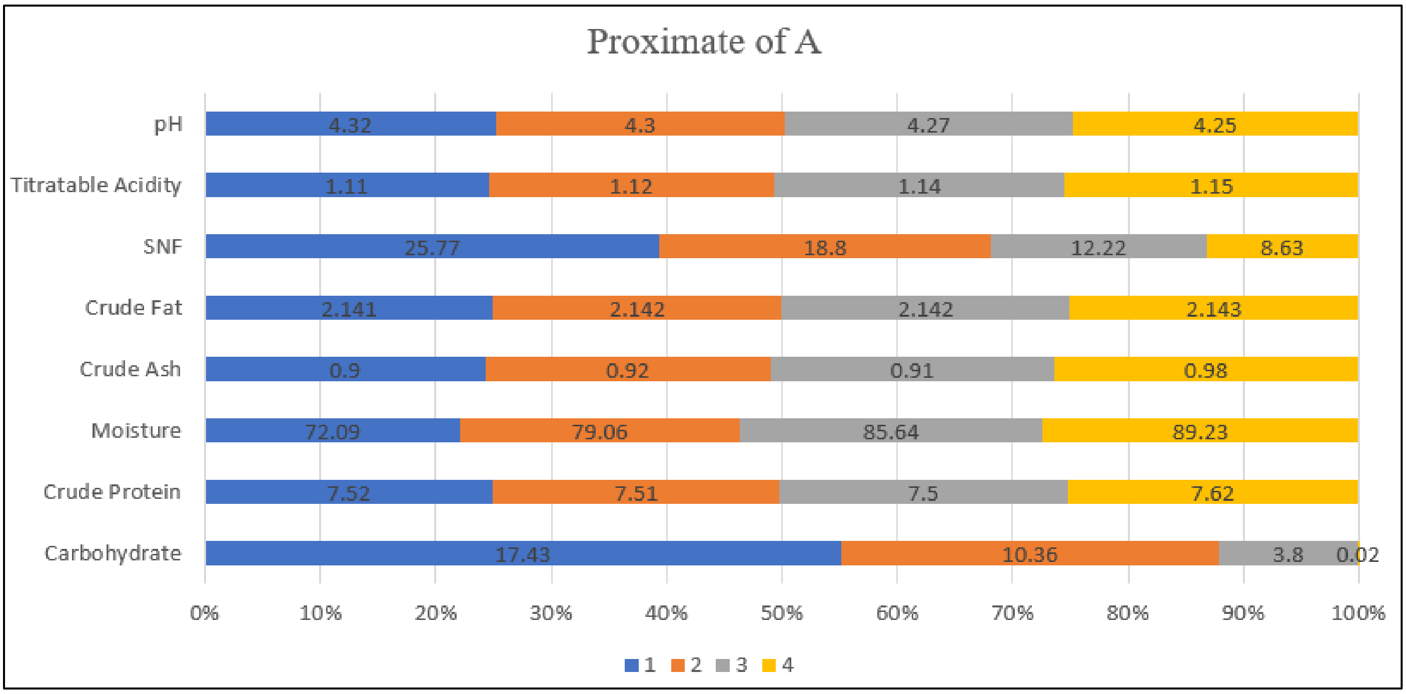

Fig 2 Showing the 4-Week Proximate Analysis Result of Sample A

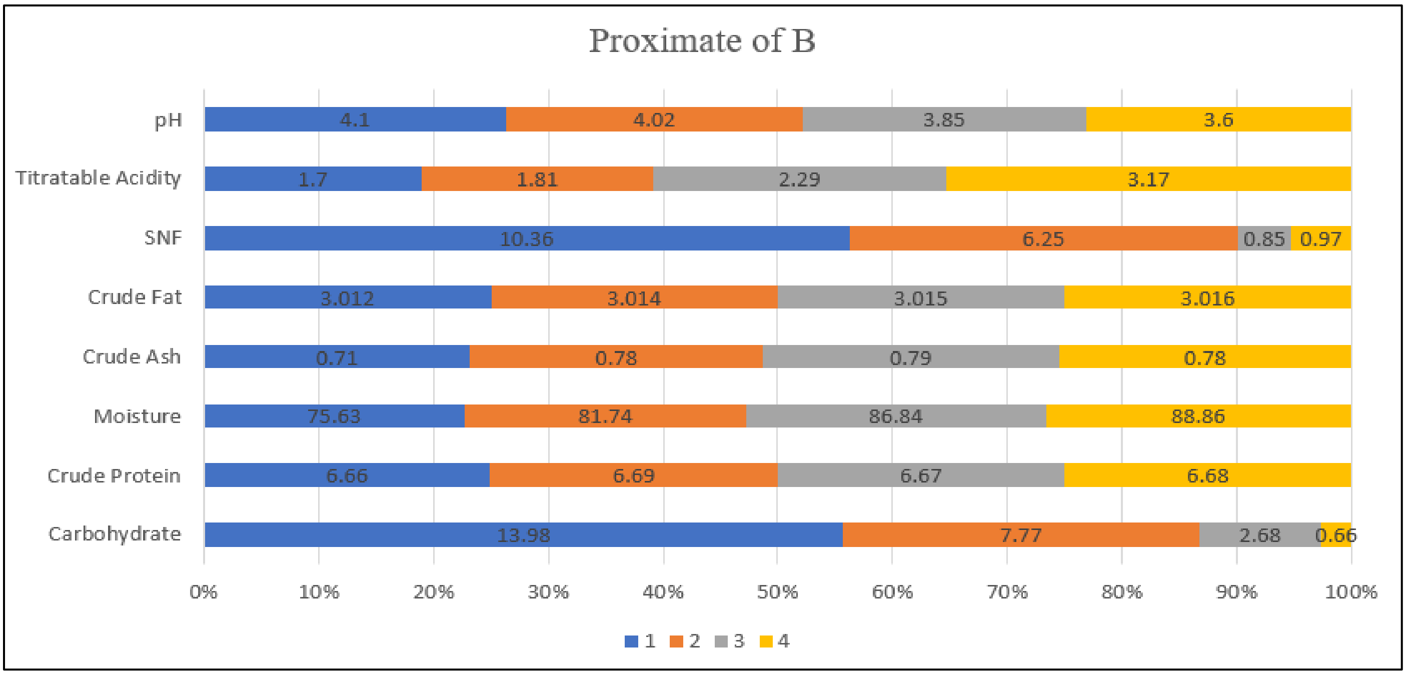

Fig 3 Showing the 4-Week Proximate Analysis Result of Sample B

➢ *Chemical Analysis:*

- *Carbohydrate analysis:* Over the course of the four weeks, Sample A's carbohydrate content gradually decreased. The percentage of carbohydrates was 17.43% at first, but by the fourth week, it had gradually dropped to 0.02%. This decrease is a sign of active microbial fermentation, in which lactic acid bacteria use lactose to produce lactic acid and other metabolites. According to [25], regulated fermentation and appropriate processing conditions are responsible for this slow drop in yoghurt production. Sample B, on the other hand, started out with a significantly lower carbohydrate content 13.98% in the first week, which continued to drop over the next few weeks to 0.66%. Reduced initial lactose content, lengthy fermentation before measurement, variations in dilution or formulation, or increased microbial activity that quickly used the available lactose could all contribute to the lower carbohydrate level. These discrepancies point to disparities in the two yoghurt samples' processing and quality.
- *Protein analysis:* During storage, Sample A's protein level varied slightly, rising from 7.522% in the first week to 7.622% in the fourth. Sample B, on the other hand, had a

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lower protein content—6.66% in the first week, which marginally climbed to 6.68% in the subsequent weeks. Moisture loss and concentration changes during storage could be the cause of the little rise in protein content in both samples [21]. Yogurt may experience minor syneresis, or whey separation, which lowers the water content and marginally raises the protein concentration. Furthermore, modest structural alterations in milk proteins, especially casein, may result from the continuous metabolic activity of lactic acid bacteria. Sample A showed appropriate milk standardization and controlled fermentation typical of industrial production, as evidenced by its comparatively steady and higher protein level. Sample B, on the other hand, had a reduced protein level; this could be due to variations in milk quality, fewer milk solids, dilution, or non-standard processing.

- *Moisture analysis:* Sample A's moisture content rose over the course of storage, from 72.09% in the first week to 89.23% in the fourth. Sample B, on the other hand, had a greater moisture content from the start, starting at 75.63% in the first week and rising to 88.86% in the subsequent weeks. Whey separation, structural alterations in the yoghurt matrix, and absorption of ambient moisture during handling or storage could all be contributing factors to the rise in moisture content in both samples. Moisture measurements may be impacted by whey release during storage due to modifications in the protein gel network [13]. The slight breakdown of the protein gel structure in Samples may have contributed to the modest rise in moisture, which made it possible to identify more free water during analysis [25].
- *Ash analysis:* Sample A displayed ash values between 0.90% and 0.98% over the course of the four-week analysis period. The little moisture loss that concentrates the solid components of yoghurt, including minerals, could be the cause of the tiny increase in ash content after storage. Standardized milk and regulated processing conditions are typically used in the production of branded yogurt, which aids in maintaining a comparatively constant mineral content during storage. In contrast, Sample B had a lower ash level, measuring 0.71% in the first week of examination and rising to 0.78% in the subsequent weeks. A modest decrease in moisture or whey separation during storage, which leads to a relative increase in mineral concentration, could potentially be the cause of this increase in ash % [22].
- *Fat analysis:* Sample A displayed fat readings between 2.141% and 2.143% over the course of the four-week analysis period. The modest shift during storage could be the result of small moisture changes that have a slight impact on fat concentration or small variances in the experiments. The small change in fat percentage over time in commercially made yogurt can be explained by the standardization of milk fat during processing [25,26]. Sample B, on the other hand, had a greater fat content—3.012% in the first week of examination, which marginally increased to 3.016% in the subsequent weeks. This slight rise could be the result of whey separation during storage, which concentrates the leftover solids, including fat, or moisture loss. Furthermore, yogurt made locally frequently uses whole milk without standardization, which raises the amount of natural fat in the product. Sample B's overall fat content was higher than Sample A's, which could explain its thicker texture and fuller flavour. On the other hand, Sample A's fat level was more stable and consistent, suggesting improved processing control and consistent production quality.
- *SNF analysis:* Sample A displayed SNF values between 25.77% and 8.63% over the analysis period. Yogurt's physical and biochemical alterations, such as whey separation and lactose fermentation by lactic acid bacteria, may be responsible for the drop in SNF level after storage. Over time, these procedures may lower the quantifiable concentration of non-fat solids. On the other hand, Sample B's SNF value dropped to 0.97% during the storage period after starting at 10.36% in the first week. These factors may contribute to observed changes. According to [22], microbial activity during storage may also have a role in the breakdown of lactose and proteins, which results in SNF alterations.
- *Titratable Acidity analysis:* Sample A displayed TA values between 1.11% and 1.15% over the course of the four-week analysis period. Even after fermentation, remaining lactose is gradually converted into lactic acid by lactic acid bacteria, which could be the cause of the minor increase in acidity during storage. The branded yoghurt had stable storage conditions and good fermentation control, as evidenced by the small change. Sample B, on the other hand, had a TA value of 1.70% in the first week, which dramatically rose to 3.17% in subsequent weeks. Higher microbial activity, unchecked fermentation, or potential contamination during storage could be the cause of this sudden increase. Bacteria that ferment lactose continuously may produce too much lactic acid, which raises the titratable acidity.
- *pH:* The findings show that during the storage period, the pH of both yoghurt samples gradually decreased, indicating an increase in acidity. Over the course of four weeks, Sample A's pH marginally dropped from 4.32 to 4.25, demonstrating good stability. Standardized processing, the use of particular starting cultures, and improved quality control procedures could be the cause of this regulated pH decrease. Such small adjustments point to a longer shelf life and steady product quality. On the other hand, the pH of Sample B significantly decreased from 4.10 to 3.60. This dramatic decline suggests increased acid generation, most likely as a result of unchecked fermentation and elevated microbial activity. Rapid acidification can cause textural flaws such enhanced syneresis and negatively impact sensory qualities, making the yogurt excessively sour.
- *Sensory evaluation:* Sensory Hedonic Scale result for two yoghurt samples evaluated by 10 consumers using a 9-point hedonic scale [9] during the first week of analysis the values are ploted in a radar chart which is given below in fig no 4. The branded yoghurt sample (A) received higher mean scores for all sensory attributes, indicating greater consumer preference. The locally available sample (B) showed comparatively lower scores in flavour, consistency, and overall acceptability, suggesting inferior quality compared to the branded product.

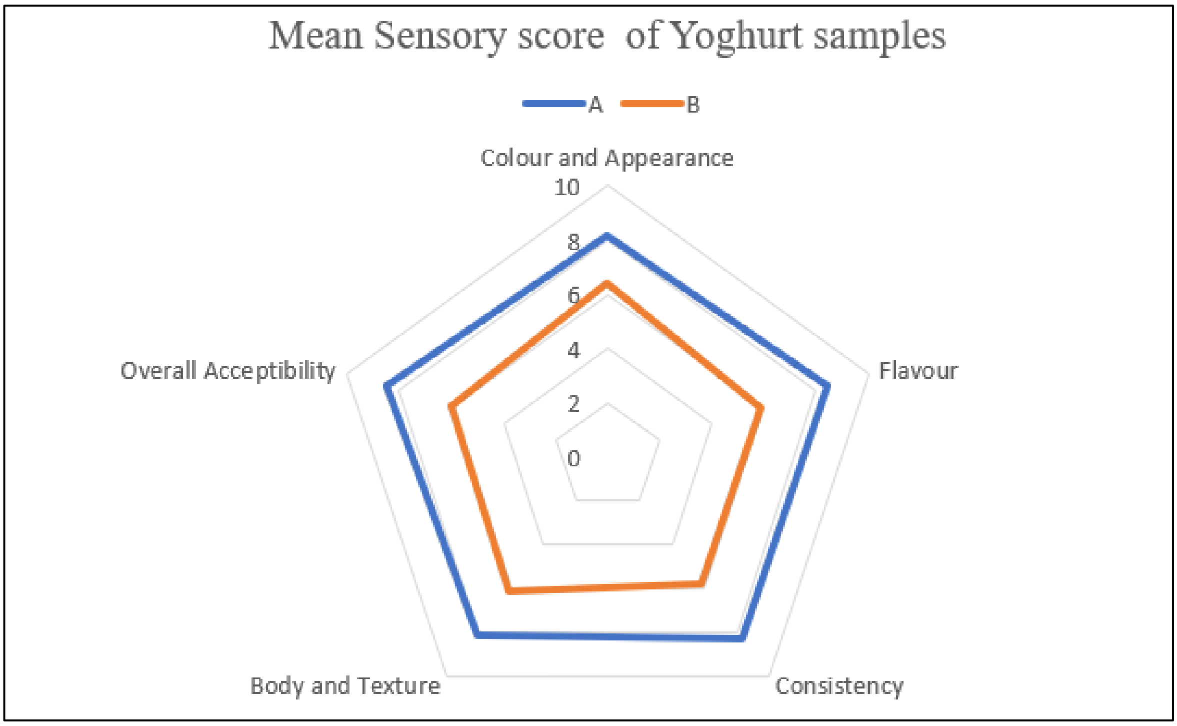

Fig 4 The Radar Chart Corresponding to the Sensory Analysis of Yoghurt Samples [23]. This Chart Indicates the Mean Rank of Appearance, Colour, Body, Texture, Consistency and Overall Acceptability of the Two Samples.

- *Engineering Parameters-* The engineering properties of the yoghurt samples (Table 6) revealed clear differences between the branded sample (A) and the locally available sample (B). Sample A showed a lower syneresis value (10.76%) compared to sample B (16.70%), indicating better gel stability and water retention. Since syneresis represents whey separation, lower values are desirable as excessive whey release negatively affects texture and consumer acceptability. The reduced syneresis in sample A suggests a stronger and more stable protein network, likely due to improved formulation and processing conditions.

Interestingly, sample A exhibited a higher syneresis rate (0.011) than sample B (0.006). This indicates that although whey release may occur faster initially in sample A, the overall extent of separation remains lower. This behaviour may be attributed to differences in gel firmness or the initial structural arrangement of the protein matrix.

Water holding capacity (WHC) further supports these findings. Sample A had a higher WHC (78.5%) compared to sample B (66.8%), reflecting a greater ability to retain moisture within the gel. Higher WHC is associated with improved texture, creaminess, and reduced whey separation, while lower WHC indicates a weaker gel network. These differences may be due to variations in total solids, homogenization, stabilizer use, and starter culture activity. Overall, sample A demonstrates superior quality characteristics [10].

The diffusion rate graph (fig 5) shows the change in weight of yoghurt samples A and B over time, indicating moisture movement within their gel structures. Both samples exhibit a steady decrease in weight, reflecting continuous moisture loss due to diffusion. Initially, both samples have similar values (around 5 units), suggesting comparable starting moisture content and structure.

As time progresses, differences become evident. Sample A maintains a slightly higher weight than sample B, especially at later time intervals (6–7 units), indicating slower moisture diffusion. In contrast, the sharper decline in sample B suggests a higher diffusion rate, meaning water moves more freely through its weaker and less organized protein network.

The gradual decline in sample A indicates a denser and more stable gel matrix with better resistance to moisture movement. This improved performance may be due to better processing, higher total solids, and stabilizer use. Overall, sample A demonstrates superior structural integrity and water retention compared to sample B.

Table 6 The Engineering Properties of Yoghurt Samples.

SAMPLE	SYNERESIS %	SYNERSIS RATE	WHC %
A	10.76	0.011	78.5
B	16.70	0.006	66.8

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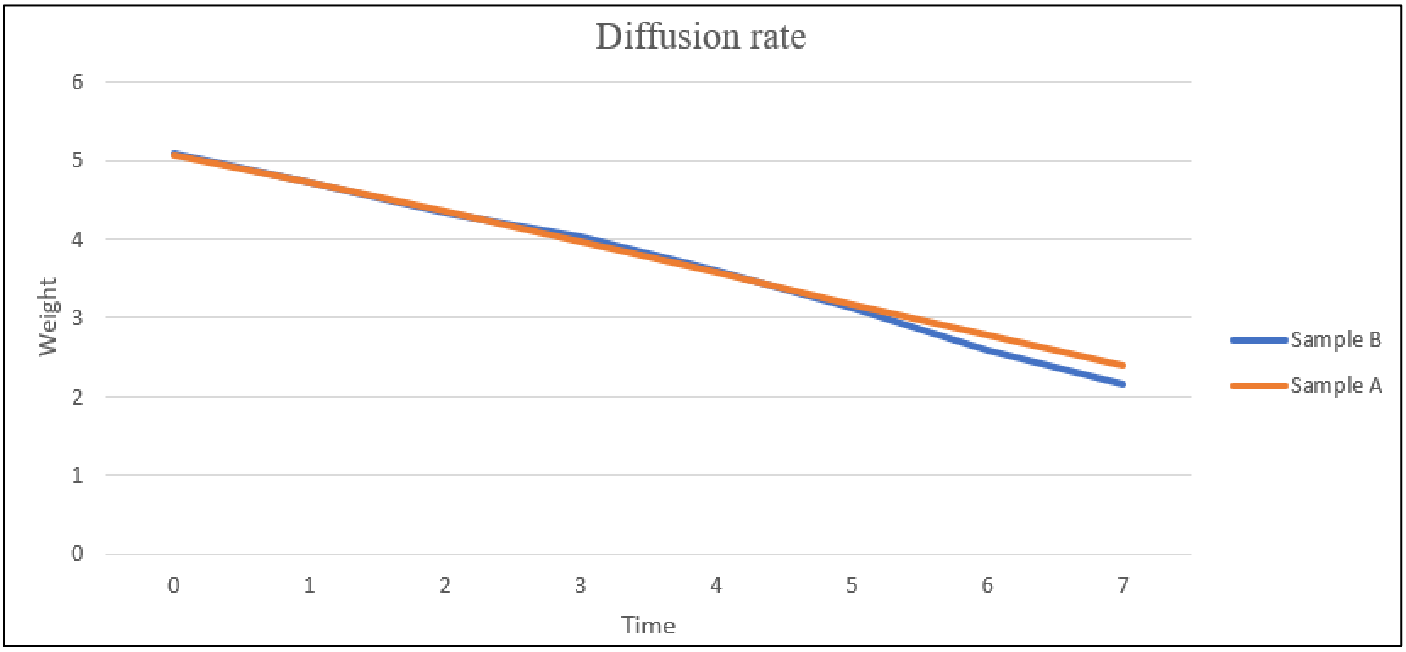

Fig 5 The Moisture Difussion Chart of Sample A & B; Resulting that the Rate of Difussion Decreases with Increasing Time.[X Axis Represent the Time (hr) of the Sample and Y Axis Represent the Weight (g)]

The observed microstructure reflects the compositional characteristics of the yoghurt, particularly its high moisture content, low carbohydrate content, and moderate levels of fat and protein. High moisture contributes to the formation of a weak gel network by diluting casein interactions, leading to reduced cross-linking and increased porosity. This explains the presence of large voids and whey pockets within the structure. The low carbohydrate content, particularly lactose, may have influenced the extent of fermentation and acid production, thereby affecting proper gel formation. Moderate fat content contributes to some structural reinforcement; however, the uneven distribution of fat globules suggests inadequate homogenization, limiting their role in strengthening the gel matrix. Similarly, the moderate protein level is insufficient to form a dense and continuous network, resulting in a fragile structure. Overall, the microstructure indicates poor gel stability and low water holding capacity, which are typically associated with higher syneresis and inferior textural quality. These characteristics are commonly observed in locally produced yoghurts due to less controlled processing conditions compared to standardized commercial products.

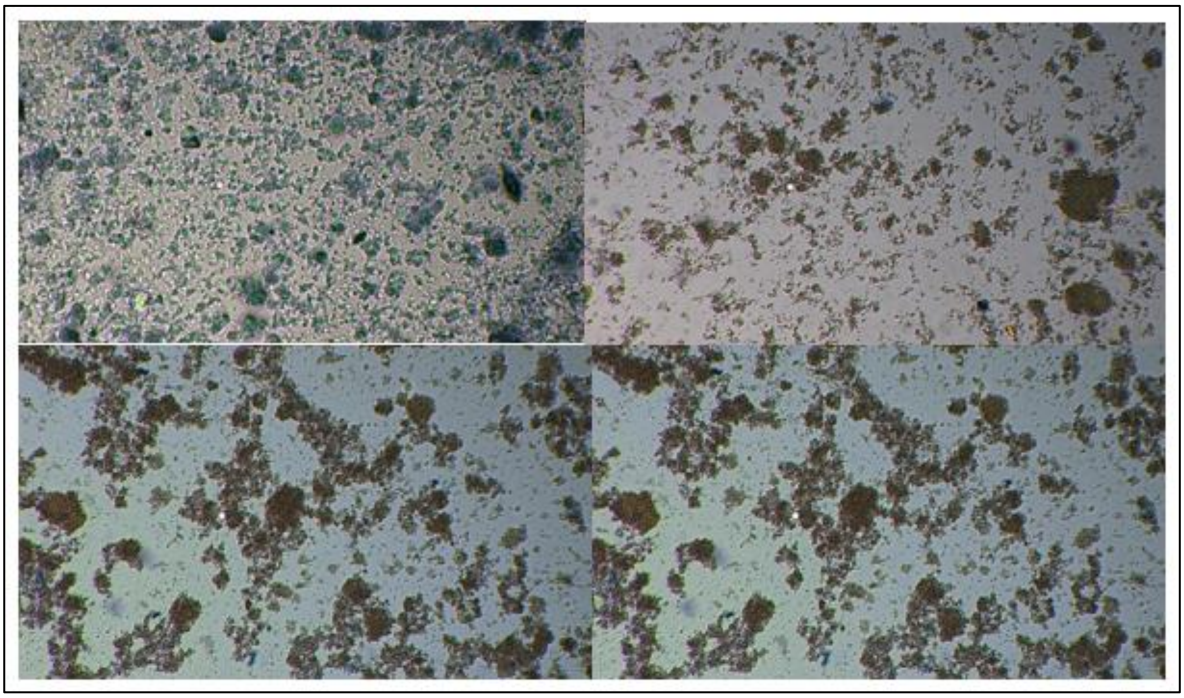

Fig 6 Microstructural Images of Local Yoghurt Sample by Light Microscopy.

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IV. CONCLUSION

Over the course of a four-week storage period, the study revealed significant differences in the quality, safety, and general acceptability of yogurt produced locally and commercially. Significant differences in microbiological stability, content, and structural integrity were found when commercial yogurt (Sample A) and locally made yoghurt (Sample B) were compared. Sample A demonstrated no coliforms or Escherichia coli and maintained total viable counts within acceptable ranges (10^3–10^1 CFU/ml), demonstrating efficient pasteurization, sanitary handling, and appropriate packing. Sample B, on the other hand, demonstrated a significant rise in microbial load, up to 10^1 CFU/ml, as well as identifiable coliforms (up to 10^3 CFU/ml) and E. coli (up to 10^1 CFU/ml), indicating inadequate sanitation and post-processing contamination. According to proximate analysis, Sample B had slightly lower protein (~6.6–6.7%) but greater fat (~3.0%), while Sample A maintained steady protein (~7.5–7.6%) and fat (~2.14%) levels. Lactose fermentation reduced the amount of carbohydrates in both samples, although Sample B's decrease was more rapid. Over time, the moisture level rose but the solids-not-fat content decreased, particularly in Sample B. Sample A's controlled fermentation and Sample B's excessive acidification were further supported by the drop in pH (4.32 to 4.25 in A; 4.10 to 3.60 in B) and rise in titratable acidity (1.11 to 1.15% in A; 1.70 to 3.17% in B).These results were corroborated by engineering properties, which showed that Sample A had a stronger gel network than Sample B, with lower syneresis (10.76%), higher water holding capacity (78.5%), and less moisture diffusion. Overall, strict hygiene practices and standardized processing are essential to guarantee the safety and quality of yogurt.

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