

# Evaluation of Chemical, Microbiological and Sensorial Properties of Yoghurt Fortified with Aloe Vera Gel

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## ABSTRACT

Yoghurt is one of the most popular fermented dairy products in the world; it has a considerable market share due to its nutritional value as well as its health benefits. The buffalo milk yoghurts used in this study was fortified with varying amounts of either fresh (FAVG) or lyophilized Aloe Vera gel (LAVG). Five treatments used to prepare yoghurt ((T1: Control , T2: 1% (FAVG) , T3: 10% (FAVG) , T4:0.1% (LAVG) , T5:0.2% (LAVG)). The physicochemical, microbiological and sensorial properties of yoghurt treatments were studied during storage periods at 4 °C to determine the best concentration of aloe vera. The results obtained showed that T5 has the best physicochemical characteristics. T3 and T5 gave the best results for TBC. Concentration of 0.1% (LAVG) has the overall sample for the growth of lactic acid bacteria. Yoghurts with excellent sensory characteristics were obtained with 1% (FAVG) and 0.1 % (LAVG). The addition of Aloe Vera to yoghurt can improve the product's quality, particularly in terms of nutritional and functional qualities during the storage period.

**Key words:** *Aloe Vera gel, physicochemical, Sensorial Evaluation, microbiology.*

## INTRODUCTION

Yoghurt is one of the few dairy products that are universal and distinctive. This distinction is due to the symbiotic fermentation process used in the production of yoghurt. Yoghurt is prepared in a variety of ways across the world, each with its own name (Tarakçi & Kucukoner, 2003). This fermented product is a novel functional food made from the lactic acid fermentation of milk with the inclusion of *Streptococcus* and *Lactobacillus* species as starter cultures (Deepa *et al.*, 2016). Yoghurt is a functional food that can help to enhance the digestive system of the human (Agustini *et al.*, 2017).

There has been a rise in interest in incorporating medicinal herbs into food in recent years. The food industry has also utilized medicinal plants as a source of functional foods with a variety of treatments. (Azari-Anpar *et al.*, 2017).

The Liliaceae family has been utilized as a functional agent in various cuisines for over a century, as well as a traditional medicine for the treatment of digestive and viral illnesses (Kaur *et al.*, 2015). Aloe

Vera is a cactus-like perennial plant that is drought succulent and resistant. It is a member of the Liliaceae family, which comprises over 360 different species. The plant's tall, pointed leaves generate two different things: a clear mucilaginous gel called exudate and a yellow latex known as exudate (Aloe Vera - gel). Aloe Vera gel may be seen once the thick outer cuticle has been removed (Goudarzi *et al.*, 2015). The gel is currently the most commonly used component of the Aloe Vera plant, but a portion of its peel is still underutilized (Mashau & Jideani, 2020). Because of its use in the food industry, Aloe Vera gel has become a significant business all over the world. It's used in functional foods, particularly in the manufacture of non-laxative health beverages (Ahlawat & Khatkar, 2011). Mucilage, fibrous particles that are very viscous and scientifically defined as muco polysaccharides, is found in Aloe juice or gel. These substances can absorb a lot of water and combine all of the food they've eaten into a single, well-hydrated mass (Alessandro & Stefano, 2005).

Selective antibacterial properties are present in Aloe Vera. Moreover, it has a special quality in that it can suppress some pathogenic bacteria while having no impact on benign and non-pathogenic germs. (Khorasany & Shahdadi, 2021).

The aim of this study was applying Aloe Vera to the manufacturing of yoghurt with a high level of acceptance. Additionally, study the effect of Aloe Vera on physicochemical, microbiological and sensory properties of yoghurt.

## MATERIALS AND METHODS

The experiments were carried out in Department of Dairy Science and Technology at Alexandria University's Faculty of Agriculture. All samples were analysis in triplicate during storage period (zero, 7, and 15) day.

### Materials

The buffalo milk was brought fresh from local market in Alexandria (Dar-El-Defrawy market). Samples of Aloe Vera were purchased from the Faculty of Agriculture, Department of floriculture, ornamental horticulture and landscape gardening Alexandria University, and were multiplied and planted on the ground directly for a period not less than two months,

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until they were adapted to the environment and soil, before starting to use them. Commercial freeze dried lactic acid bacterial cultures (Thermophilic) contain *Streptococcus thermophiles* and *Lactobacillus delbrueckii* subsp. *bulgaricus* (Lyofast Y259 A – ITALY) was used for yoghurt manufacturing.

#### Extraction of Aloe Vera gel

Aloe Vera gel prepared according to (Kaur *et al.*, 2015) with minor modification. With a sharp knife, fresh and developed Aloe Vera leaves were removed from the bottom of the plant and carefully cleaned. The rough edges were then removed with a sharp knife. The sticky mucilage and translucent gel were scraped out of the Aloe Vera leaf using a spoon. It was ensured that the

yellow sap secreted from the leaf's green portion was appropriately removed. This substance is known as aloin, and it produces inflammation. The juice was extracted from the Aloe Vera - gel by macerating it in a grinder. It was separated into two batches, the first of which was freeze dried and stored at  $-80^{\circ}\text{C}$ , and the second of which was stored in sterile dark bottle at  $-20^{\circ}\text{C}$  for future use as fresh Aloe Vera gel.

#### Manufacture of yoghurt

The procedure for making yoghurt is depicted in Fig.1 according to (Atallah *et al.*, 2020) with minor modification. Yoghurt analyzed after zero, 7, and 15 days of storage.

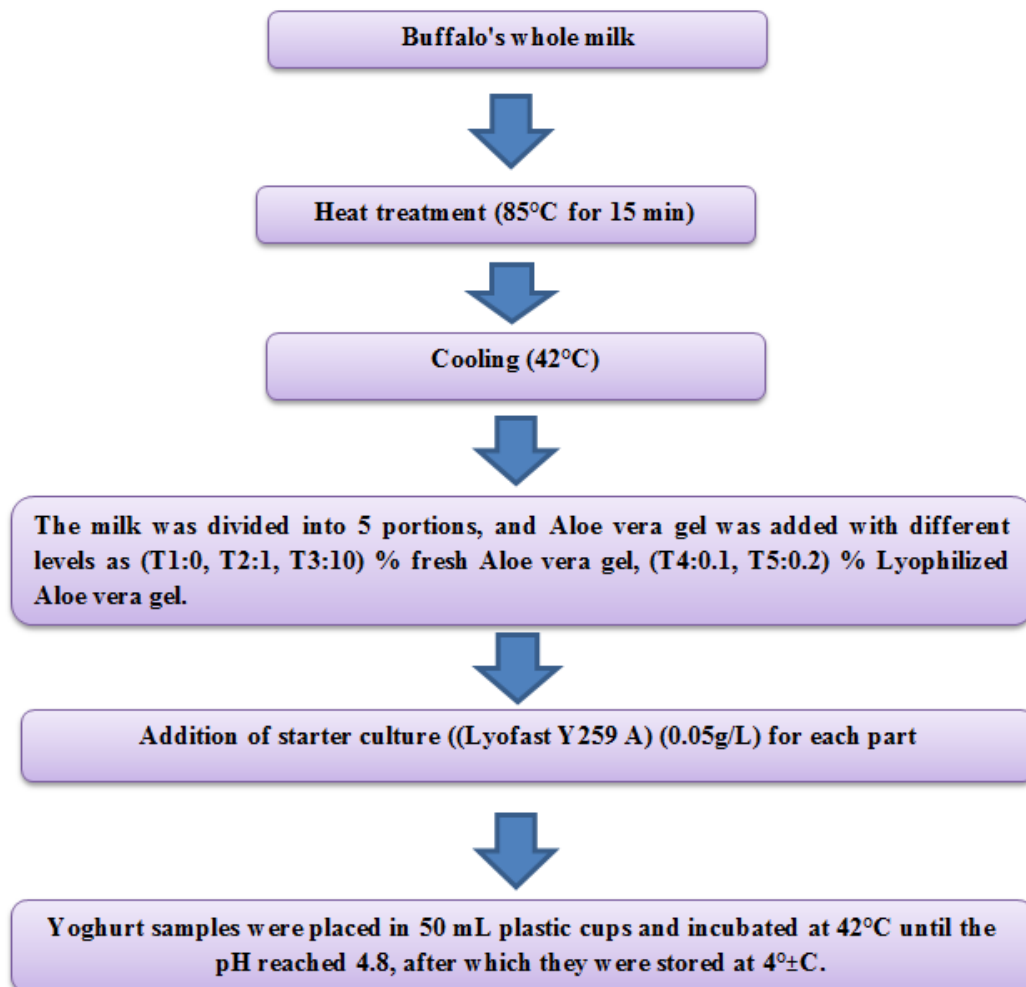


Fig 1. The flow chart of yoghurt production

### Physicochemical analysis

pH values were measured with a pH meter (Martini, Italy), Acidity was determined by titration with 0.1N sodium hydroxide solution. Moisture content%, Total solids% , Total Ash% ,were conducted according to (Kaur *et al.*, 2015).The Kjeldhal and Gerber methods were used to determined protein and fat respectively according to (A.O.A.C, 2005).

### Microbiological quality

Microbiological test was done for (milk, Aloe Vera gel and yogurt samples). Microbial determination was done using the method described by (Farinde *et al.*, 2009) with minor modification. Each sample was serially diluted with sterile Ringer's solution. Samples were inoculated using the pour plate technique. Total viable microorganisms were plated on nutrient agar, whereas lactic acid bacteria were counted on MRS agar plates. Violet red bile agar was utilized for coliform count, and acidified Potato dextrose agar was used for yeast and mold count. Bacterial growth plates were incubated at 37 for 48 hours, except total count were incubated in 32°C ,whereas yeast growth plates were incubated at 25°C for 5-7 days. A colony counter was used to count the colonies. The results were represented as colony forming units per milliliter Log<sub>10</sub> (cfu/mL).

### Water-holding capacity (WHC)

Water-holding capacity of yoghurt samples were determined using the technique described by (Yadav *et al.*, 2018). A 20 g yoghurt sample(Y), was centrifuged for 30 minutes at 1250 g and 20 °C. WE (whey ejected) were extracted and weighed. The water-holding capacity (WHC) was calculated as follows:

$$WHC\% = 100 \times \frac{Y - WE}{Y}$$

### Sensory evaluation

Sensorial evaluation was conducted on 15 participants (Faculty members - students) from the Department of Dairy Science and Technology, Faculty of Agriculture, Alexandria University. They are well experienced in the sensory evaluation of dairy products. The samples were evaluated for body and texture, flavor, taste, appearance and overall acceptability (Yadav *et al.*, 2018).

### Statistical analysis

All data analyses were performed using Statistical analysis system (SAS) software program (SAS Institute 2004) was performed using two way analysis of variance(ANOVA) at (P≤0.05)being statistically significant difference, all data were expressed as mean values ±SD.

## RESULTS AND DISCUSSION

### Chemical analysis of Aloe Vera gel and milk

The quality of the milk and Aloe Vera gel used to manufacture the yoghurt was examined before usage. Moisture, total solids, fat, ash, protein, acidity, pH, and microbiological quality were all assessed. The findings of the chemical analysis are shown in (Table 1). From this table the moisture content of fresh aloe Vera gel is 97.8% and this result is in agreement with those reported by Eshun & QIAN (2004), Boudreau & Beland (2006), Ahlawat & Khatkar (2011), (Kaur *et al.*, 2015) and Hingne & Chavan (2021) who stated that Aloe Vera's moisture content was ranged from 96.4 to 99.5 %.

Aloe Vera variety, harvesting stage, and juice extraction procedure can all be held responsible for the variance in Aloe Vera moisture content. Similar results were also reported by (Khan *et al.*, 2020) who showed that the Aloe Vera gel contains 99% water and only about 1% total solids (dry matter). Additionally, while having a titratable acidity value that showed it was acidic, the juice had a very low fat content of only approximately (0.1) %.

Data in (table 1) also shows the chemical analysis of buffalo milk used in yoghurt manufacturing .The results obtained from table 1 is in harmony with those of (El Attar *et al.*, 2021) . Their results revealed that Buffalo milk is suitable for generating various varieties of yoghurt because it has nearly twice as much butterfat as cow milk, producing yoghurt with rich, creamy textures and flavor profiles. Recent study by (Dhawi *et al.*, 2020) indicated to similar results of buffalo milk that fat content about 6.1%, the protein content was 3.9 %, and the total solids content (TS) was 14.9 %. Similar findings were also obtained by (Ikram *et al.*, 2021) who investigated how replacing milk fat with Aloe Vera gel affected the quality of the yoghurt, and they stated that a physicochemical analysis of buffalo milk revealed that the average value of pH is 6.70, acidity is 0.15 %, while the protein and fat contents are 4.5% and 6.9%, respectively and they stated that the ash and total solids are 0.78% and 17.88% respectively. These variances may be influenced by the length of lactation, the animal's nutrition, and the environment.

This result is also consistent with those of (Razaq & Huma, 2020), their results stated that the pH of buffalo milk was 6.74. The values for acidity, crude protein, fat, ash, and total solids were (0.12, 3.80, 2.96, 0.46, and 12.74) % respectively. Ahmad *et al.*, (2009) and Khalifa & Zakaria (2019 ) demonstrated that buffalo milk has a high total solids content, which ranges from 14.5 to 18%, enables it to produce yoghurt with a high

yield and little synergy without the addition of hydrocolloids or milk powder. It has the highest fat content of any ruminant milk with a 7.06 -8% fat content.

### Physicochemical characteristics of yoghurt samples

The presence of lactic and organic acids is indicated by pH value, which is a crucial ingredient in determining the yoghurt quality (Mencia , 2018) and (Azari-Anpar *et al.*, 2017). The findings of this investigation, as shown in (Table 2) demonstrated that the interactive effect between treatment and storage period had not significant impact ( $P \geq 0.05$ ) in case of pH value, Acidity, total solids, moisture, fat, protein and Ash content . Whereas all of these parameters are significantly ( $P \leq 0.05$ ) affected by main effect of (storage period and Aloe Vera gel concentration) with the exception of pH and acidity both of them were not affected ( $P \geq 0.05$ ).

The pH values in all five samples decreased over the storage period, ranging from (4.66 - 4.45) form zero time till the end of storage. The low pH values achieved throughout the storage period are essential since most bacteria, particularly hazardous microorganisms, struggle to live at low pH values, providing microbiological protection as well as improving shelf life (Mashau & Jideani, 2020). This drop in pH value may be due to Lactose - fermentation action of lactic acid bacteria in yoghurt. These operate by using the already present carbohydrates and lactic acid activity created by bacteria during fermentation, which may result in acids that ultimately increase the H<sup>+</sup> concentration in the culture (Álzate *et al.*, 2021).

When making yoghurt, the robust metabolic activity of the yoghurt bacteria decreases with cooling, yet enzymatic activity remains. After the incubation time is through, lactic acid levels rise and pH levels drop, which is why these changes are observed during storage (Arslaner *et al.*, 2021).

This result is consistent with that of (Matter *et al.*, 2016), they found that all yoghurt samples had their pH values drop during storage. This shows that the highest pH values in the control and fruit yoghurt were related to the first day of manufacture as well as acidity, respectively, the lowest pH value was detected in day nine.

These results contradict with (Mencia, 2018), who demonstrated that when added to fermented dairy products, Aloe Vera gel caused to lower pH . This variance in finding may be due to that this researcher used combination between Aloe Vera gel and inulin, beside the high concentration addition of Aloe vera (15%). Also, he mentioned that, bacteria breakdown inulin and boost the probiotic bacteria's metabolism, speeding up the fermentation process in yoghurt.

The results also showed that titratable acidity of yoghurt samples increased significantly ( $p \leq 0.05$ ) during storage, and it varied between 0.77 and 1.00%. This finding is agreed with (Mashau & Jideani, 2020) who concluded that the addition of Aloe Vera - gel powder had no effect on the acidity of treated samples.

It was also shown that total solid and Ash contents are significantly affected by adding Aloe Vera gel. Total solid is ranging from (15.08±0.29) to (17.08±0.36)-and ash content ranges from (0.67±0.01) to (0.82±0.06). Therefore, the highest TS and ash contents (17.08 ± 0.36 and 0.82±0.06 %) was noticed for lyophilized Aloe Vera - gel (0.2%) yoghurt sample, respectively. This attributed to high content of TS and ash in Aloe Vera lyophilized gel (Table 1). On the other hand, the Aloe Vera - gel (10%) yoghurt sample had the lowest TS% all the storage days (15.08±0.29, 16.15±0.77 and 16.19±0.77) respectively. This lowering effect might be due to high moisture content in fresh Aloe Vera - gel that leads to diluent effect of the gel.

**Table 1. Chemical analysis of Aloe Vera - gel and buffalo milk used in yoghurt manufacturing**

PARAMETER	BUFFALO MILK	FRESH-ALOE VERA - GEL	LYOPHILIZED-ALOE VERA - GEL
<b>PH</b>	6.70	4.38	ND
<b>ACIDITY %</b>	0.14	1.20	ND
<b>TS%</b>	15.88	2.20	85.85
<b>MOISTURE%</b>	84.12	97.80	14.15
<b>FAT%</b>	6.75	0.17	6.33
<b>PROTEIN%</b>	4.48	0.57	22.24
<b>ASH%</b>	0.65	0.43	16.78

**Table 2. Effect of treatment and storage period-(days) on physicochemical characteristics (Means  $\pm$  SD) of Aloe Vera yoghurt**

Parameter	Storage (days)	Treatment				
		T1	T2	T3	T4	T5
pH	0	4.61 $\pm$ 0.01	4.62 $\pm$ 0.06	4.59 $\pm$ 0.10	4.59 $\pm$ 0.07	4.66 $\pm$ 0.05
	7	4.56 $\pm$ 0.03	4.52 $\pm$ 0.02	4.57 $\pm$ 0.03	4.53 $\pm$ 0.03	4.57 $\pm$ 0.07
	15	4.53 $\pm$ 0.03	4.49 $\pm$ 0.03	4.45 $\pm$ 0.08	4.46 $\pm$ 0.01	4.47 $\pm$ 0.03
Acidity%	0	0.81 $\pm$ 0.03	0.81 $\pm$ 0.05	0.80 $\pm$ 0.01	0.78 $\pm$ 0.03	0.77 $\pm$ 0.02
	7	0.82 $\pm$ 0.07	0.81 $\pm$ 0.06	0.86 $\pm$ 0.03	0.93 $\pm$ 0.03	0.86 $\pm$ 0.05
	15	1.00 $\pm$ 0.12	0.88 $\pm$ 0.05	0.89 $\pm$ 0.05	0.99 $\pm$ 0.05	0.92 $\pm$ 0.08
Protein%	0	4.17 $\pm$ 0.46	4.16 $\pm$ 0.07	4.06 $\pm$ 0.09	4.17 $\pm$ 0.07	4.41 $\pm$ 0.06
	7	4.54 $\pm$ 0.09	4.47 $\pm$ 0.03	4.33 $\pm$ 0.01	4.64 $\pm$ 0.14	4.76 $\pm$ 0.27
	15	4.42 $\pm$ 0.03	4.48 $\pm$ 0.04	4.37 $\pm$ 0.16	4.51 $\pm$ 0.01	4.55 $\pm$ 0.44
Total solid%	0	16.67 $\pm$ 0.72	16.38 $\pm$ 0.23	15.08 $\pm$ 0.29	16.42 $\pm$ 0.11	16.67 $\pm$ 0.01
	7	16.73 $\pm$ 0.07	16.52 $\pm$ 0.16	16.15 $\pm$ 0.77	16.64 $\pm$ 0.08	17.01 $\pm$ 0.17
	15	16.84 $\pm$ 0.06	16.66 $\pm$ 0.06	16.19 $\pm$ 0.77	16.73 $\pm$ 0.31	17.08 $\pm$ 0.36
Fat%	0	6.90 $\pm$ 0.10	6.85 $\pm$ 0.13	6.67 $\pm$ 0.21	6.93 $\pm$ 0.12	7.13 $\pm$ 0.15
	7	6.90 $\pm$ 0.10	6.85 $\pm$ 0.13	6.60 $\pm$ 0.10	6.97 $\pm$ 0.06	7.17 $\pm$ 0.15
	15	6.87 $\pm$ 0.12	6.75 $\pm$ 0.25	6.52 $\pm$ 0.10	6.93 $\pm$ 0.06	7.10 $\pm$ 0.17
Ash%	0	0.67 $\pm$ 0.01	0.74 $\pm$ 0.01	0.71 $\pm$ 0.02	0.67 $\pm$ 0.01	0.75 $\pm$ 0.01
	7	0.68 $\pm$ 0.01	0.78 $\pm$ 0.01	0.78 $\pm$ 0.02	0.68 $\pm$ 0.01	0.79 $\pm$ 0.06
	15	0.76 $\pm$ 0.02	0.78 $\pm$ 0.02	0.78 $\pm$ 0.01	0.77 $\pm$ 0.02	0.82 $\pm$ 0.06
WHC%	0	49.96 $\pm$ 1.07 <sup>Ac</sup>	41.48 $\pm$ 2.51 <sup>Bb</sup>	37.51 $\pm$ 2.22 <sup>Cb</sup>	37.81 $\pm$ 1.42 <sup>Cb</sup>	43.41 $\pm$ 0.30 <sup>Bc</sup>
	7	53.39 $\pm$ 0.17 <sup>Ab</sup>	47.79 $\pm$ 1.58 <sup>Ba</sup>	44.05 $\pm$ 1.60 <sup>Ca</sup>	46.66 $\pm$ 0.29 <sup>Ba</sup>	51.27 $\pm$ 1.25 <sup>Ab</sup>
	15	59.92 $\pm$ 3.43 <sup>Aa</sup>	49.74 $\pm$ 1.63 <sup>Ba</sup>	47.10 $\pm$ 0.01 <sup>Ba</sup>	48.71 $\pm$ 0.01 <sup>Ba</sup>	58.90 $\pm$ 3.50 <sup>Aa</sup>

Capital letters; Average values with different letters are statistically significant ( $P \leq 0.05$ ) within each row. Small letters: Average values with different letters are statistically significant ( $P \leq 0.05$ ) within each column. T1: Control /T2:1% fresh Aloe Vera - gel /T3:10% fresh Aloe Vera - gel /T4:0.1% lyophilized Aloe Vera - gel/T5:0.2% lyophilized Aloe Vera - gel.

The addition of lyophilized Aloe Vera - gel had a positive effect on the protein content. The highest protein content was observed in lyophilized Aloe Vera (0.2%) yoghurt sample followed by lyophilized Aloe Vera (0.1%) yoghurt sample all over the storage period. There was increasing in protein until day 7 and then decrease slightly for all treatments with exception of T2 and T3. The fermentation process that occurs during yoghurt manufacturing may potentially have an impact on protein content (Agustini *et al.*, 2017). So that decreasing of protein in day 15 might be due to the protein analysis and consuming them by LAB.

The highest fat content was observed for lyophilized Aloe Vera gel (0.2%) yoghurt sample at zero and 7 days of storage (7.13 $\pm$ 0.15 and 7.17 $\pm$ 0.15) respectively. While, the Aloe Vera - gel (10%) yoghurt sample showed the lowest fat value (6.52%) after 15 days of storage. There was a decrease of fat content during all the storage period at 4C for all studied treatment samples. This observation may be due to normal lipolysis of milk fat by enzyme. Yoghurt must have a minimum fat content of 3%, whereas minimum results (4%). As a result, the yoghurt generated in this study is regarded as suitable fat yoghurt.

This experiment shows that adding Aloe Vera gel to yoghurt can increase its nutritional content, particularly in terms of protein as well as fat.

During the storage period, the water holding capacity (WHC) of yoghurt is crucial criteria for consumer acceptability. It also indicates the network's stability and the degree of fermentation (curd). WHC is often defined as the proportion of concentrated yoghurt (w/w) obtained by static or dynamic (centrifugation) drainage (Akram, 2018). Data in table 2 also showed that WHC affected significantly with interaction between treatment and Storage period, therefore WHC decrease with increasing in concentration of Aloe Vera - gel. But it was significantly increase with increasing in time in all treatment. The control sample had the highest % of WHC on the end of storage (59.92 $\pm$ 3.43), whereas the yoghurt samples with 10% Aloe Vera - gel had the minimum level of WHC on the first day (37.51 $\pm$ 2.22) of refrigerated storage. This finding is agreed with (Azari-Anpar *et al.*, 2017) they mentioned that increasing the quantity of Aloe Vera - gel concentration enhanced syneresis in all samples (that means decreasing WHC). These outcomes might be attributable to a number of factors, including: First, in yoghurt, there is a clear link

between acidity and syneresis. The presence of Aloe Vera - gel (due to higher gel contraction) and the high TTA generated by yoghurt starters reduce colloidal stability of casein micelles, increasing yoghurt Syneresis. (Yadav *et al.*, 2018) reported that with increased Aloe Vera concentration, the amount of fat, protein, ash, carbohydrate, total solids, moisture, total soluble solids, pH, and acidity in the yoghurt samples decreased. This is because Aloe Vera has high moisture content and few other chemical characteristics.

### Microbiological quality

Concerning the microbiological analysis of Aloe Vera gel of this study, there were no growths on violet red bile agar, Baird-Parker agar, nutrient agar and potato dextrose agar. (Vega-Gálvez *et al.*, 2012) reported that fresh Aloe Vera gel had an initial microbial load of  $1.95 \pm 0.048$  log CFU/mL for yeasts and  $2.37 \pm 0.140$  log CFU/mL for aerobic mesophilic microorganisms, and there were no visible molds.

As shown in table (3) there were a main significant difference ( $p \leq 0.05$ ) for treatment and time on total bacterial count. Increase in Aloe Vera concentration decrease the total bacterial count in yoghurt sample. In respect of the storage period, log (cfu/ml) increases gradually during the storage period.

The interaction effect between treatment and storage period on total bacterial count was not significant ( $p \geq 0.05$ ). Bacterial count decreasing with increasing of Aloe Vera concentration may be due to antimicrobial effect of Aloe Vera gel and increasing in concentration of antimicrobial compounds.

As for lactic acid bacteria, data in table (3) also showed that it was significantly ( $p \leq 0.05$ ) affected by the interaction between the storage period and the addition of different concentration of Aloe Vera gel. This demonstrates that adding Aloe Vera - gel to yoghurt has impact on total lactic acid but still in the acceptable range. Both Aloe Vera gel addition and storage period significantly affected ( $P \leq 0.05$ ) lactic acid bacteria counts of the yoghurt samples.

Lactic Acid bacteria count in all yoghurt samples during storage were in the range of (6.00 – 9.28) log cfu/ml. The addition of Aloe Vera gel generally reduced lactic acid bacteria count in yoghurt samples. Adversely, an increase in this group of microorganisms was observed during storage period.

Although the addition of Aloe Vera gel reduced the lactic acid bacteria (LAB) count, there were no statistically differences between control, T2 and T4 with the end of storage. In addition to that T5 outperformed the control in the (LAB) count at the beginning of the storage period, also in all yoghurt samples LAB count was above 6 Log cfu /ml during the storage. The lowest LAB count was detected in the T2 sample (6.00 log cfu/ml) on zero time of storage whereas the highest LAB count was found in the T4 sample (9.28 log cfu/ml) on the 15 day of storage. This may be control acidification and fermentation of yoghurt during storage period leading to extend shelf life of yoghurt.

This conclusion is consistent with that of (Adnan, 2006), who noted that due to continued growth activity during this time, an increase in *Lactobacillus delbrueckii* subsp. *bulgaricus* populations was observed after 7 days of storage, and at this point, the ratio between the species was around 1: 1. Its capacity to adapt to the environment, including the micro-Europhilic and acidic conditions created by *Streptococcus thermophilus* during fermentation, is shown by *Lactobacillus delbrueckii* subsp. *bulgaricus*.

This investigation is agreed with (Azari-Anpar *et al.*, 2017) who found that, The addition of Aloe Vera - foliar gel to yoghurt formulations resulted in a reduction in probiotic bacteria viable counts, which - was more pronounced in *Bifidobacterium lactis* than in *Lactobacillus acidophilus*. Similar finding also by (Mencia, 2018) he reported that, although the viable LAB count were within the permissible limit agreeing to FAO ( $10^6$ - $10^7$  CFU  $g^{-1}$ ). Increasing the amount of fresh Aloe Vera in yoghurt may reduce the amount of lactose and milk proteins available for lactic acid bacteria. According to the findings by (Yadav *et al.*, 2018),

**Table 3. Effect of Aloe Vera - gel on total bacterial count and Lactic Acid bacteria Log<sub>10</sub> (cfu/ml)**

Log (cfu/ml)	Storage (days)	treatment				
		T1	T2	T3	T4	T5
TBC	0	5.08±0.35	4.44±0.36	3.12±0.64	4.32±0.28	3.20±0.0.17
	7	5.27±0.18	4.62±0.28	3.98±0.11	4.45±0.50	3.56±0.07
	15	6.00±1.73	5.77±0.81	4.43±0.75	5.20±0.91	4.41±0.11
LAB	0	6.25±0.02 <sup>Bb</sup>	6.00±0.01 <sup>Cc</sup>	6.05±0.06 <sup>Cc</sup>	6.84±0.05 <sup>Ac</sup>	6.67±0.13 <sup>Ac</sup>
	7	9.08±0.03 <sup>Aa</sup>	8.63±0.12 <sup>Bb</sup>	6.51±0.20 <sup>Db</sup>	8.47±0.04 <sup>BCb</sup>	8.30±0.01 <sup>Cb</sup>
	15	9.04±0.12 <sup>Aa</sup>	9.23±0.15 <sup>Aa</sup>	8.79±0.08 <sup>Ba</sup>	9.28±0.28 <sup>Aa</sup>	8.89±0.06 <sup>Ba</sup>

TBC: Total bacterial count, LAB: lactic acid bacteria. Capital letters: Average values with different letters are statistically significant ( $P \leq 0.05$ ) within each row. Small letters: Average values with different letters are statistically significant ( $P \leq 0.05$ ) within each column. Sample T1: Control /T2:1% fresh Aloe Vera - gel /T3:10% fresh Aloe Vera - gel /T4:0.1% lyophilized Aloe Vera - gel /T5:0.2% lyophilized Aloe Vera - gel.

Aloe Vera probiotic yoghurt may be utilized as a good carrier of probiotic bacteria with counts higher than the recommended level. The same outcomes were attained using (Panesar & Shinde, 2012) they mentioned that yogurt contains Aloe Vera, that has been used successfully when coupled with probiotic bacteria. According to the findings of (Yadav *et al.*, 2018), probiotic yoghurt enriched with Aloe Vera gel may be used as an excellent carrier of probiotic bacteria with counts higher than the recommended amount.

All yoghurt samples have a coliform count less than 1 cell. Coliforms were employed as an indicator organism for proper hygiene during the fermentation of milk and packing material handling. Also for yeast and mold there were not found in all yoghurt samples during storage period. These findings are consistent with those of (Ibrahim *et al.*, 2020), they observed that all yoghurt samples treated with pomegranate peels were free of coliform bacteria, yeast, and molds after storage at refrigerator temperature for 21 days. It signifies that the bio-stirred yoghurt has beyond its specified shelf life due to pomegranate peels. Pomegranate peels' antimicrobial properties are related to the lack of bacteria-stirred yoghurt when they are added to food. Similar findings were made by (Mukhekar *et al.*, 2018). In their investigation of the antibacterial properties of Aloe vera in connection to the yoghurt's microbiological

composition, they discovered that neither yeast nor molds were detected at all.

### Sensory Evaluation

Results concerned to sensory properties presented in table (4) showed Adding Aloe Vera - gel has not negative impact sensorial characteristics, with the exception of appearance where results show that there was significant difference of interaction of time and treatment. The yoghurt appearance was enhanced by the high concentration of both fresh Aloe Vera - gel and lyophilized Aloe Vera - gel, which had the accepted appearance over all the storage period.

Similar results were noticed by (Khorasany & Shahdadi, 2021) who revealed that increasing the amount of Aloe Vera - gel in probiotic yoghurt had no detrimental impact on the sensory characteristics of the probiotic yoghurts. On the contrary, increasing the concentration of Aloe Vera up to 10 % led to the significantly ( $p \leq 0.05$ ) improve the texture scores (uniformity and hardness) of the yoghurts, and hence their overall acceptance.

The percentage of Titratable acidity (TA) is used as a reference to predict how acidic the product will taste (Mashau & Jideani, 2020). Other result was obtained by (Azari-Anpar *et al.*, 2017) who mentioned that the Aloe Vera - gel had a substantial impact on flavor, texture, and overall acceptability, with the effect being more pronounced at greater concentrations.

**Table 4. Effect of treatment and storage period on sensory characteristics of Aloe Vera yoghurt**

Sensory characteristics	Storage (days)	Treatment				
		T1	T2	T3	T4	T5
Body and texture(5) score	0	4.20±0.68	3.73±0.88	3.40±1.18	3.93±1.33	2.47±1.41
	7	4.07±1.28	3.60±1.30	4.07±0.88	4.33±1.54	3.13±1.36
	15	3.47±1.30	4.27±1.10	3.73±0.96	4.07±0.70	2.40±1.06
Flavor score	0	8.27±1.03	8.47±0.64	6.33±2.69	7.67±2.13	5.67±3.04
	7	8.33±1.63	7.73±2.15	6.07±2.22	7.13±2.42	6.20±2.14
	15	8.13±1.81	8.53±1.68	6.87±1.85	7.93±1.75	4.80±2.14
Taste-10 score	0	8.40±1.40	8.67±0.90	5.80±2.76	7.20±2.31	5.07±2.91
	7	8.60±1.80	7.73±2.22	6.27±2.60	7.07±1.94	6.53±3.07
	15	8.27±1.91	8.53±1.96	7.27±1.62	7.87±1.77	5.13±2.75
Appearance-5 score	0	4.00±0.85 <sup>ABa</sup>	3.47±0.99 <sup>Ba</sup>	4.13±0.74 <sup>ABa</sup>	4.60±0.74 <sup>Aa</sup>	2.60±0.99 <sup>Cab</sup>
	7	3.40±1.24 <sup>Aa</sup>	3.40±1.45 <sup>Aa</sup>	3.73±0.96 <sup>Aa</sup>	3.73±1.44 <sup>Ab</sup>	3.13±1.46 <sup>Aa</sup>
	15	3.40±0.91 <sup>Aa</sup>	3.93±1.22 <sup>Aa</sup>	3.87±0.99 <sup>Aa</sup>	3.60±0.74 <sup>Ab</sup>	2.07±0.70 <sup>Bb</sup>
Overall acceptability-20 scores	0	16.53±2.77	15.93±2.46	12.53±4.29	15.73±3.84	10.13±4.85
	7	15.93±3.92	14.73±3.45	14.07±2.94	14.73±4.13	12.80±4.52
	15	15.73±3.08	16.73±3.90	15.13±2.88	15.47±2.17	9.87±4.07

Capital letters:—Average values with different letters are statistically significant ( $P \leq 0.05$ ) within each row. Small letters: Average values with different letters are statistically significant ( $P \leq 0.05$ ) within each column. T1: Control /T2:1% fresh Aloe Vera - gel /T3:10% fresh Aloe Vera - gel /T4:0.1% lyophilized Aloe Vera - gel/T5:0.2% lyophilized Aloe Vera - gel.

Whereas all garden cress seeds level revealed a significant increase in SRBC compared to the control group, meanwhile after 7- or 21-days significant difference were recorded with the highest levels of garden cress seeds compared to the control. The phytohemagglutinin test did not affected by dietary treatment of garden cress seeds.

Qusti *et al.* (2016) observed that immunoglobulins increased significantly with dietary garden cress seeds in comparison with control group.

## CONCLUSION

Aloe Vera gel might be success fully employed in the production of yoghurt with an increased Nutritional, compositional and Functional properties. Among the yoghurts created in this investigation, the yoghurt fortified with 0.1 % lyophilized Aloe Vera - gel is the best in all qualitative areas. Yoghurts with 1% Fresh Aloe Vera gel are also acceptable in terms of quality. 0.2% lyophilized Aloe Vera gel has different organoleptic characteristics than others and is low in overall acceptability. This formulation and quality findings may be beneficial to the yoghurt industry in developing new yoghurt varieties. The use of Aloe Vera - gel slowed the creation of a homogeneous and cohesive texture. According to sensorial quality from this study, we recommend more research to improve the flavor and general acceptance with an increase in the proportion of Aloe Vera. As well as the need for more studies on the effect of the active substances present in Aloe Vera - gel.

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## المخلص العربي

### تقييم الخواص الكيميائية والميكروبيولوجية والحسية للزبادي المدعم بجل الألوفير

رحاب الغزالي محمد الطائف، ابراهيم محمد السيد، سامح عوض، عيشة العطار

الزبادي الفيزيوكيميائية. وأن م<sup>٣</sup> وم<sup>٥</sup> أعطت أفضل النتائج للعد الكلي للبكتريا. وجد ايضا ان الزبادي المدعم بتركيز ٠,١% من الجل المجفد انه الافضل علي الاطلاق لنمو بكتيريا حمض اللاكتيك . تم الحصول على الزبادي ذو الخصائص الحسية الممتازة باضافة ٠,١% من جل الالوفيرا المجفد. يمكن أن تؤدي إضافة جل الالوفيرا إلى الزبادي إلى تحسين جودة المنتج ، لا سيما من حيث الصفات الغذائية والوظيفية خلال فترة التخزين.

الكلمات المفتاحية: جل الالوفيرا ، الفيزيوكيميائية، التقييم

الحسي ، علم الأحياء الدقيقة

الزبادي هو أحد منتجات الألبان المتخمرة الأكثر شهرة في العالم. لديه إقبال كبير في السوق بسبب قيمته الغذائية وكذلك فوائده الصحية. تم تدعيم زبادي حليب الجاموس المستخدم في هذه الدراسة بتركيزات متفاوتة من جل الالوفيرا الطازج أو المجفد كالاتي : (م<sup>١</sup>:كنترول م<sup>٢</sup>: ١% جل الالوفيرا الطازج أو م<sup>٣</sup>:١٠% جل الالوفيرا الطازج م<sup>٤</sup>: ٠,١% من جل الالوفيرا المجفد م<sup>٥</sup>: ٠,٢% من جل الالوفيرا المجفد. تمت دراسة الخواص الفيزيوكيميائية،الميكروبيولوجية والحسية للزبادي الناتج خلال فترات التخزين عند ٤ °م لتحديد أفضل تركيز للالوفيرا . أظهرت النتائج ان العينه م<sup>٥</sup>لها افضل الخصائص