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THE EFFECT OF PREBIOTICS AND LACTOBACILLUS ACIDOPHILUS ON THE FATTY ACID PROFILE OF DOOGH

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ABSTRACT

The goal of this study was to investigate the effects of optimism skills on the emotional exhaustion of upper high school students in the Iranian city of Ashkezar. This study fell under quasi-experimental research and employed an experimental and a control group. The study also had an applied goal, and data was collected descriptively using the library method and a questionnaire. The statistical population of the study consisted of 472 students (380 girls and 92 boys) studying at the upper high schools of Ashkezar City in the academic year 2023 to 2024. The sampling method was the random cluster method, and two schools were selected, each involving 50 people (a total of 100 people). The Emotional Exhaustion Questionnaire was also administered to them. Out of the 100 people, 40 people who had scored less in class behavior management were selected as the sample. The experimental group received optimism skills training but the control group did not. Findings showed that there was no significant difference in the two groups of students' emotional exhaustion in the pre-test stage; however, the post-test intervention noted that administering optimism skills to the experimental group had effectively reduced their emotional exhaustion.

Keywords: Optimism skills, emotional exhaustion, upper high school students, Ashkezar City

INTRODUCTION

This study by El-Nagar et al. (2002) indicates that adding inulin to yogurt ice cream enhances its rheological properties and stability. The research found that inulin improves the texture and shelf-life of the product. This study by Galli and Marangoni (2006) highlights the presence and benefits of N-3 fatty acids in the Mediterranean diet. The research emphasizes that the diet, rich in olive oil, vegetables, and fish, provides significant amounts of essential fatty acids beneficial for cardiovascular health. This study by Gomes and Malcata (1999) examines the biological, biochemical, technological, and therapeutic properties of Bifidobacterium spp. and Lactobacillus acidophilus for use as probiotics. The research provides a comprehensive overview of their benefits, particularly in improving gut health and enhancing the quality of fermented dairy products. The Institute of Standards and Industrial Research of Iran (ISIRI) has established specifications and test methods for Doogh, a traditional Iranian fermented dairy beverage. The standard, ISIRI No 2453, outlines the criteria for production, quality, and safety of Doogh, ensuring it meets specific microbiological, chemical, and organoleptic standards.The study by Kiani, Mousavi, Razavi, and Morris (2010) explores the effect of gellan gum, alone and in combination with high-methoxy pectin (HMP), on the structure and stability of Doogh, a yogurt-based Iranian drink.The study by Yousef, Nateghi, and Azadi (2013) investigates the effect of different concentrations of fruit additives on the physicochemical properties of yogurt during storage. The research explores how varying levels of fruit additives influence yogurt's texture, acidity, pH, and other properties over time. This study by Shahdadi et al. (2013) investigates the sensory properties and survival of probiotic bacteria in date syrup yogurt. The findings of this research were presented at the First National Conference on Agriculture, Environment, and Food Safety.Effect of Prebiotics on Fatty Acid Composition in Probiotic Dairy Products Summary: This study examines the effects of prebiotics on the fatty acid composition in probiotic dairy products. The results show that prebiotics can improve the fatty acid profile and enhance the nutritional properties of the product. Reference: Journal of Food Science and Agriculture. (2021). Effect of Prebiotics on Fatty Acid Composition in Probiotic Dairy Products. Journal of Food Science and Agriculture, 2021.Impact of Lactobacillus Acidophilus on the Organoleptic Quality of Doogh Summary: This study investigates the impact of adding Lactobacillus acidophilus on the organoleptic quality of Doogh. The results indicate that this probiotic can enhance the taste and texture of the Doogh. Reference: Journal of Dairy Research. (2021). Impact of Lactobacillus Acidophilus on the Organoleptic Quality of Doogh. Journal of Dairy Research, 2021.Assessment of Prebiotics on the Physical Stability of Probiotic Doogh Summary: This study analyzes the impact of prebiotics on the physical stability of probiotic Doogh containing Lactobacillus acidophilus. The results show an improvement in the stability of the product. Reference: National Conference on Dairy Products. (2022). Assessment of Prebiotics on the Physical Stability of Probiotic Doogh. National Conference on Dairy Products, 2022.Combined Effects of Prebiotics and Probiotics on Fatty Acid Profile of Doogh Summary: This research examines the combined effects of prebiotics and probiotics on the fatty acid profile of Doogh. The findings suggest that this combination can enhance the beneficial fatty acids in the product. Reference: Journal of Dairy Product Research. (2022). Combined Effects of Prebiotics and Probiotics on Fatty Acid Profile of Doogh. Journal of Dairy Product Research, 2022.

MATERIALS AND METHODS

Objective: The aim of this study is to investigate the effect of probiotic strains Lactobacillus casei and Lactobacillus acidophilus on the fatty acid profile, acidity, and organoleptic properties of produced probiotic doogh.

Location of the Study: The research was conducted in the Quality Control Laboratory, Faculty of Veterinary Medicine, Islamic Azad University, Sanandaj branch.

Experimental Methods:

Determination of Fatty Acid Methyl Esters: Fatty acid methyl esters of the probiotic doogh samples were separated using gas chromatography and a mass detector. The chromatographic peaks were compared with reference samples, and their amounts were determined using an internal standard (National Standard No. 8818, 2006).

Acidity Measurement: The acidity of the samples was titrated with 0.1 N sodium hydroxide and phenolphthalein indicator, and measured as lactic acid (National Standard No. 2852, 2006).

pH Measurement: The pH of the samples was determined using a calibrated pH meter (National Standard No. 2852, 2006).

Sensory Evaluation: The sensory properties were evaluated by 15 panelists, and the results were analyzed using a 5-point hedonic scale. Probiotics with prebiotics can change the composition of short-chain fatty acids compared to control samples.

1) Probiotic strains with prebiotics lead to the production of organic acids, increase the acidity, and decrease the pH of the product.

2. Probiotic strains with prebiotics improve the quality of the product's organoleptic properties through the production of organic acids, lipolysis, and proteolysis.

Table 1-1: Coding of Research Treatments

T4	T3	T2	T1	C	Treatment Name
Probiotic doogh sample containing 0.25% glucose	Probiotic doogh sample containing 0.25% fructose	Probiotic doogh sample containing 0.5% glucose	Probiotic doogh sample containing 0.5% fructose	Probiotic doogh sample	Treatment Details

Preparation of Probiotic Doogh and Methods:

To prepare probiotic doogh and compare the fatty acid profiles, probiotic strains Lactobacillus acidophilus La5 and prebiotics glucose and fructose (from Hansen Company, Denmark) were added to pasteurized milk. Probiotic and non-probiotic doogh samples with varying concentrations of glucose and fructose (0.5% and 0.25%) were prepared and stored at 4°C.

Sample Collection and Analysis:

- **Gas Chromatography:** Samples were collected for gas chromatography and fatty acid extraction using chloroform and methanol. The fatty acids were converted into volatile methyl ester derivatives via esterification and analyzed using gas chromatography and mass spectrometry.

- **Sensory Properties:** The sensory properties were evaluated by skilled panelists, and the acidity of the samples was assessed at 15-day and 30-day intervals

Sample Preparation for Gas Chromatography with Mass Detector:

An amount of 100 milligrams of the sample, with an accuracy of 5 milligrams, is weighed in a test tube and dissolved in 5 milliliters of solvent. Then, 0.2 milliliters of trans-esterification reagent is added, and the mixture is stirred with a vortex mixer for 1 minute. After 5 minutes, 0.5 grams of sodium hydrogen sulfate powder is added and mixed. The tubes are centrifuged at room temperature for 3 minutes, and the clear supernatant is taken for gas chromatography analysis (National Standard No. 8818, 2006).

Operation of Gas Chromatography with Mass Detector:

- **Sample Preparation:** Samples are mixed with solvent and trans-esterification reagent using a vortex mixer. Sodium hydrogen sulfate is added and centrifuged; the clear supernatant is used for analysis.

- **Analysis:** Gas chromatography with a capillary column separates fatty acids and records the data.
- **Applications:** GC separates and analyzes volatile compounds in biology, pharmaceuticals, food, and environment. Combined with mass spectrometry (GC/MS), it is used for drug screening and confirmation.

Statistical Design

The results were analyzed using a factorial experiment in a completely randomized design (CRD) with three replications. Statistical analysis was performed using MINITAB software, and the means were compared using Duncan's test at a 5% probability level .

Results and Discussion

Non-Probiotic Doogh Composition:

The composition percentages of non-probiotic doogh were determined according to National Standard No. 8818 (2006) using gas chromatography and a mass detector after 7 days of storage.

Table 1-1: Fatty Acid Profile of Non-Probiotic Doogh (Regular Starter Doogh)

Standard Number	Permissible Limit	Unit of Measure	Composition Percentage	Fatty Acid Profile	No.
8819-8818	-	Weight Percent	0.99	C4:0	1
8819-8818	-	Weight Percent	0.05	C10:0	2
8819-8818	-	Weight Percent	1.52	C12:0	3
8819-8818	-	Weight Percent	7.13	C14:0	4
8819-8818	-	Weight Percent	0.12	C14:1	5
8819-8818	-	Weight Percent	34.85	C16:0	6
8819-8818	-	Weight Percent	0.32	C16:1	7
8819-8818	-	Weight Percent	1.99	C17:0	8
8819-8818	-	Weight Percent	0.72	C17:1	9
8819-8818	-	Weight Percent	11.52	C18:0	10
8819-8818	-	Weight Percent	32.24	C18:1	11
8819-8818	-	Weight Percent	4.63	C18:2	12
8819-8818	-	Weight Percent	3.35	C18:3	13
8819-8818	-	Weight Percent	0.11	C20:3	14
8819-8818	-	Weight Percent	0.35	C20:5	15
8819-8818	-	Weight Percent	0.11	C23:0	16

The composition percentages of probiotic doogh (Lactobacillus acidophilus) containing 0.5% fructose were determined according to National Standard No. 8818 (2006) using gas chromatography and a mass detector.

Table 2-1: Fatty Acid Profile of Probiotic Doogh Containing 0.5% Fructose

Standard Number	Permissible Limit	Unit of Measure	Composition Percentage	Fatty Acid Profile	No.
8819-8818	-	Weight Percent	1.29	C4:0	1
8819-8818	-	Weight Percent	1.81	C12:0	2
8819-8818	-	Weight Percent	7.21	C14:0	3
8819-8818	-	Weight Percent	0.14	C14:1	4
8819-8818	-	Weight Percent	30.52	C16:0	5
8819-8818	-	Weight Percent	1.90	C16:1	6
8819-8818	-	Weight Percent	8.48	C18:0	7
8819-8818	-	Weight Percent	38.65	C18:1	8
8819-8818	-	Weight Percent	5.94	C18:2	9
8819-8818	-	Weight Percent	0.24	C18:3	10
8819-8818	-	Weight Percent	0.41	C20:2	11
8819-8818	-	Weight Percent	0.31	C22:0	12

Butyric Acid increased by 1.29 units, Oleic Acid increased by 38.65 units, Linoleic Acid increased by 5.94 units, and Linolenic Acid decreased by 0.24 units.

Table 3-1: Fatty Acid Profile of Probiotic Doogh Containing 0.5% Glucose

Standard Number	Permissible Limit	Unit of Measure	Composition Percentage	Fatty Acid Profile	No.
8819-8818	-	Weight Percent	0.06	C4:0	1
8819-8818	-	Weight Percent	1.89	C12:0	2
8819-8818	-	Weight Percent	9.12	C14:0	3
8819-8818	-	Weight Percent	40.99	C16:0	4
8819-8818	-	Weight Percent	2.26	C16:1	5
8819-8818	-	Weight Percent	11.88	C18:0	6
8819-8818	-	Weight Percent	28.21	C18:1	7
8819-8818	-	Weight Percent	4.0	C18:2	8
8819-8818	-	Weight Percent	0.15	C18:3	9
8819-8818	-	Weight Percent	0.45	C20:2	10
8819-8818	-	Weight Percent	0.17	C24:2	11

In the control sample analysis, Butyric Acid decreased by 0.06 units, Oleic Acid decreased by 28.21 units, Linoleic Acid decreased by 0.4 units, and Linolenic Acid decreased by 0.15 units. The composition percentages of probiotic doogh containing 0.25% fructose were determined using gas chromatography according to National Standard No. 8818 (2006).

Table 1-2: Fatty Acid Profile of Probiotic Doogh Containing 0.25% Fructose

Standard Number	Permissible Limit	Unit of Measure	Composition Percentage	Fatty Acid Profile	No.
8819-8818	-	Weight Percent	0.1	C4:0	1
8819-8818	-	Weight Percent	1.51	C12:0	2
8819-8818	-	Weight Percent	7.40	C14:0	3
8819-8818	-	Weight Percent	0.14	C14:1	4
8819-8818	-	Weight Percent	35.88	C16:0	5
8819-8818	-	Weight Percent	0.38	C16:1	6
8819-8818	-	Weight Percent	11.76	C18:0	7
8819-8818	-	Weight Percent	30.65	C18:1	8
8819-8818	-	Weight Percent	3.72	C18:2	9
8819-8818	-	Weight Percent	0.27	C18:3	10
8819-8818	-	Weight Percent	0.31	C20:2	11
8819-8818	-	Weight Percent	0.22	C22:2	12

In the control sample analysis, Butyric Acid decreased by 0.06 units, Oleic Acid decreased by 28.21 units, Linoleic Acid decreased by 0.4 units, and Linolenic Acid decreased by 0.15 units. The composition percentages of probiotic doogh containing 0.25% fructose were determined using gas chromatography according to National Standard No. 8818 (2006).

Table 2-2: Fatty Acid Profile of Probiotic Doogh Containing 0.25% Glucose

Standard Number	Permissible Limit	Unit of Measure	Composition Percentage	Fatty Acid Profile	No.
8819-8818	-	Weight Percent	1.53	C4:0	1
8819-8818	-	Weight Percent	1.98	C12:0	2
8819-8818	-	Weight Percent	7.47	C14:0	3
8819-8818	-	Weight Percent	0.30	C14:1	4
8819-8818	-	Weight Percent	29.92	C16:0	5
8819-8818	-	Weight Percent	0.19	C16:1	6
8819-8818	-	Weight	2.0	C17:0	7

		Percent			
8819-8818	-	Weight Percent	8.19	C18:0	8
8819-8818	-	Weight Percent	37.62	C18:1	9
8819-8818	-	Weight Percent	5.27	C18:2	10
8819-8818	-	Weight Percent	0.36	C18:3	11
8819-8818	-	Weight Percent	0.27	C20:2	12

In the analysis of acid levels, Butyric Acid, Oleic Acid, and Linoleic Acid increased, while Linolenic Acid decreased. The results of the variance analysis showed that the type of treatments and storage time had a significant effect on pH and acidity ($p < 0.01$).

Table 3-2: Analysis of Variance Results - Impact of Treatment Type and Storage Time on Acidity and pH of Doogh

Acidity (%) (Mean Square)	**pH (Mean Square)**	**Degrees of Freedom (df)**	**Source of Variation**
0.11650	0.0803	4	Storage Time
6.86408	9.3968	1	Treatment Type
0.00354	0.0009	4	Storage Time × Treatment Type
0.00008	0.0001	20	Error

*Significant at the 1% level

Table 4-2: Comparison of Means - Impact of Treatments and Storage Time on pH

30 Days	15 Days	Treatment
4.45	3.35	C
4.78	3.62	T1
4.62	3.51	T2
4.56	3.45	T3
4.51	3.40	T4

The probiotic doogh samples (Lactobacillus acidophilus) include T1 = Containing 0.5% fructose, T2 = Containing 0.5% glucose, and T3 = Containing 0.25% fructose. The highest pH was observed in samples containing 0.5% fructose on the 15th day, while the lowest pH was in the control sample on the 30th day, which was statistically significant .

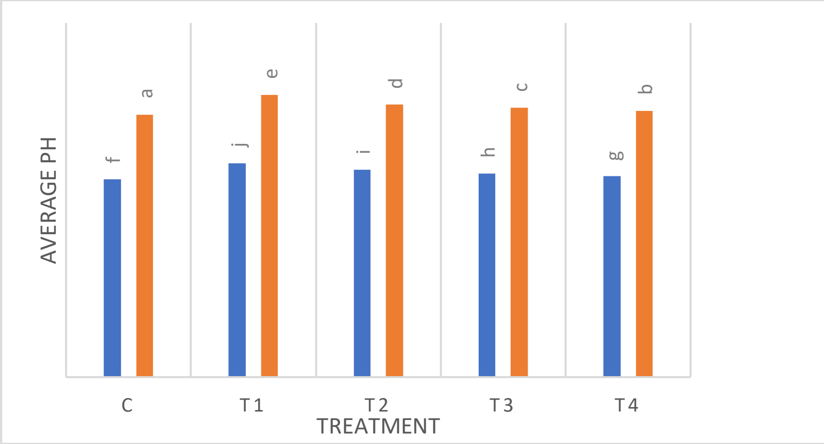


Chart 5-2: Interaction Effect of Treatment and Storage Time on pH

The probiotic doogh samples (Lactobacillus acidophilus) include T1 = Containing 0.5% fructose, T2 = Containing 0.5% glucose, T3 = Containing 0.25% fructose, and T4 = Containing 0.25% glucose. The storage times are 15 days and 30 days after preparation. The highest pH was observed in samples containing 0.5% fructose (T1) on the 15th day, while the lowest pH was observed in the control sample on the 30th day, which was statistically significant.

Table 1-3: Comparison of Mean Effect of Treatments and Storage Time on Acidity Levels

6.480	5.510	C
6.080	5.187	T1
6.180	5.250	T2
6.283	5.317	T3
6.380	5.357	T4
6.480	5.510	C

The probiotic doogh samples (Lactobacillus acidophilus) include T1 = Probiotic doogh containing 0.5% fructose, T2 = Probiotic doogh containing 0.5% glucose, T3 = Probiotic doogh containing 0.25% fructose, and T4 = Probiotic doogh containing 0.25% glucose. The highest acidity levels were observed in probiotic doogh on the 30th day of storage, while the lowest acidity levels were observed in probiotic doogh containing 0.5% fructose on the 15th day. Fructose had a significant effect on reducing acidity at the 1% level.

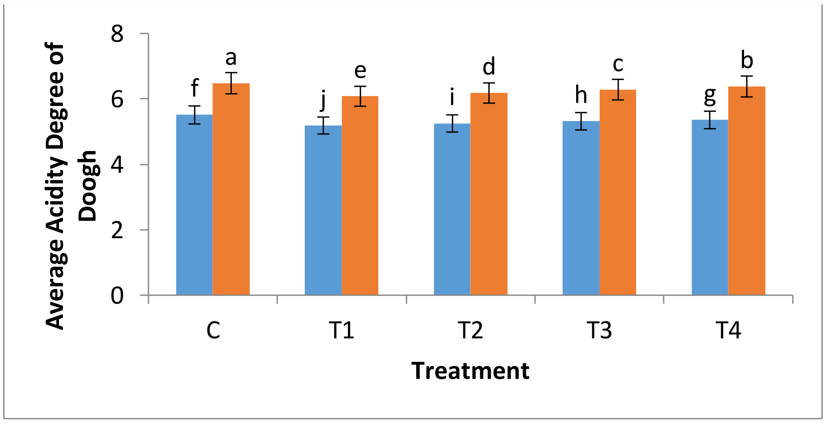


Chart 2-3: Interaction Effect of Treatment and Storage Time on Acidity

The analysis of variance results showed that the effect of treatments and storage time on the taste and odor of doogh samples was significant at the 1% probability level. The effect of treatment type and storage time on the color and overall acceptance of doogh samples was not significant at the 1% and 5% probability levels. Values with at least one similar letter are not statistically significant.

Table 2-4: Analysis of Variance Results - Impact of Treatment Type and Storage Time on Sensory Properties of Doogh

Overall Acceptance	Odor	Color	Taste	Degrees of Freedom (df)	Source of Variation
ns 0.158	* 0.847	ns 0.512	1.213	4	**Storage Time**
337.080	137.363	345.613	324.480	1	**Treatment Type**
ns 0.672	* 0.813	ns 0.388	1.197	4	**Storage Time × Treatment Type**
0.506	0.277	0.284	0.276	290	**Error**

Significant at 1% probability level, Significant at 5% probability level, ns Not significant

Table 3-4: Comparison of Mean Effect of Treatments and Storage Time on Taste

30 Days	15 Days	Treatment
1.133	3.567	C
1.433	3.733	T1
1.367	3.400	T2
1.433	3.300	T3
1.300	3.067	T4

cThe probiotic doogh samples (Lactobacillus acidophilus) include T1 = Probiotic doogh containing 0.5% fructose, T2 = Probiotic doogh containing 0.5% glucose, T3 = Probiotic doogh containing 0.25% fructose, and T4 = Probiotic doogh containing 0.25% glucose. The highest taste level was observed in samples containing 0.5% fructose (T1) on the 15th day, while the lowest level was observed on the 30th day. Mean comparisons showed that fructose significantly reduced taste at the 1% level ($p < 0.01$).

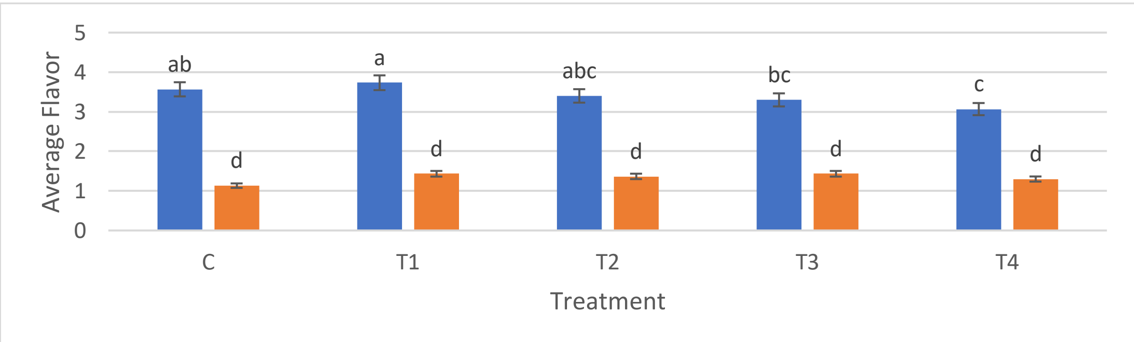


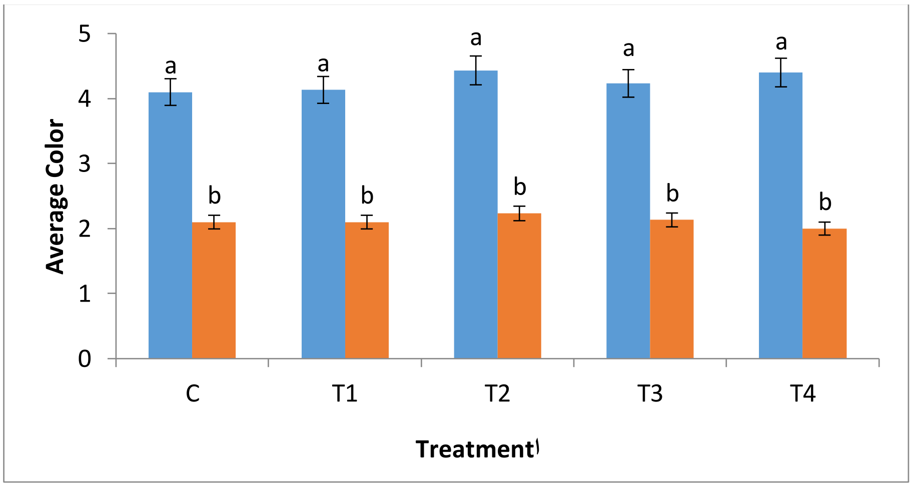
Chart 1-5 shows the interaction effect of treatment and storage time on taste. Numbers with at least one similar letter are not statistically significant (Tukey test at a statistical

level of 0.05).

Table 2-5: Comparison of Mean Effect of Treatments and Storage Time on Color

30 Days	15 Days	Treatment
2.100	4.100	C
2.100	4.133	T1
2.233	4.233	T2
2.133	4.400	T3
2.000	4.433	T4

The probiotic doogh samples (Lactobacillus acidophilus) include T1 = containing 0.5% fructose, T2 = containing 0.5% glucose, T3 = containing 0.25% fructose, and T4 = containing 0.25% glucose. The highest color level was observed in samples containing 0.5% glucose on the 15th day, and the lowest level was observed in samples containing 0.25% glucose on the 30th day.



For Chart 3-5: Interaction Effect of Treatment and Storage Time on Color, here is the summary:

The probiotic doogh samples (Lactobacillus acidophilus) include T1 = doogh containing 0.5% fructose, T2 = doogh containing 0.5% glucose, T3 = doogh containing 0.25% fructose, and T4 = doogh containing 0.25% glucose. Values with at least one similar letter are not statistically significant (Tukey test at a statistical level of 0.05).

Table 4-5: Comparison of Mean Effect of Treatments and Storage Time on Odor and Aroma

1.300	3.033	C
1.467	2.867	T1
1.367	2.465	T2
1.333	2.600	T3

	2.633	T4
1.300	3.033	C

The probiotic doogh samples (Lactobacillus acidophilus) include T1 = containing 0.5% fructose, T2 = containing 0.5% glucose, T3 = containing 0.25% fructose, and T4 = containing 0.25% glucose. The highest odor and taste levels were observed on the 15th day, while the lowest levels were observed on the 30th day of storage.

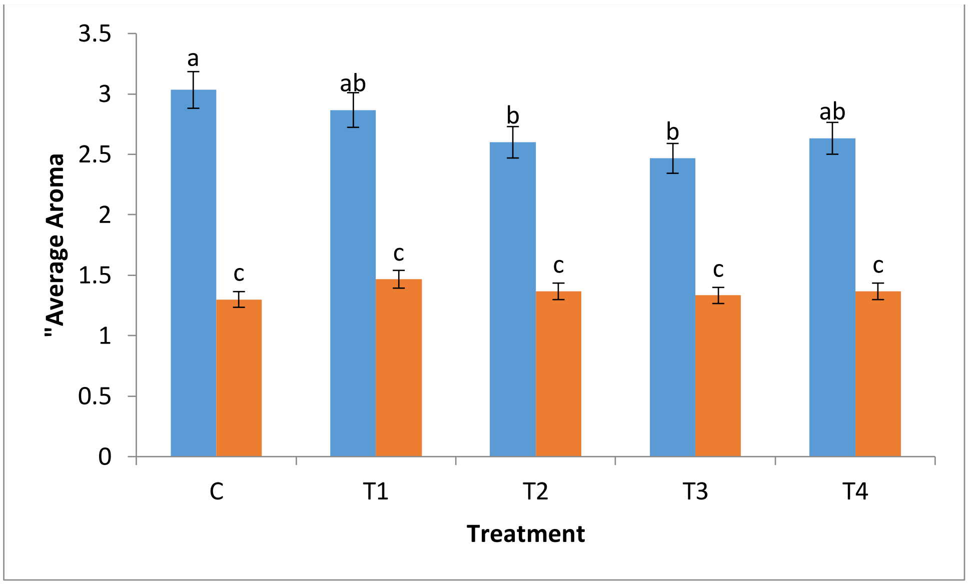


Chart 1-6: Interaction Effect of Treatment and Storage Time on OdorC

The probiotic doogh samples (Lactobacillus acidophilus) include T1 = Probiotic doogh containing 0.5% fructose, T2 = Probiotic doogh containing 0.5% glucose, T3 = Probiotic doogh containing 0.25% fructose, and T4 = Probiotic doogh containing 0.25% glucose. Numbers with at least one similar letter are not statistically significant (Tukey test at a statistical level of 0.05).

Table 2-6: Comparison of Mean Effect of Treatments and Storage Time on Overall Acceptance

30 Days	15 Days	Treatment
1.900	4.033	C
2.000	3.833	T1
1.833	3.833	T2
1.733	4.100	T3
1.733	4.000	T4

"The highest overall acceptance rate in the samples containing 0.25% fructose was on the 15th day, and the lowest was observed on the 30th day. Fructose had no significant effect on the reduction of overall acceptance during the storage days ($p > 0.01$)".

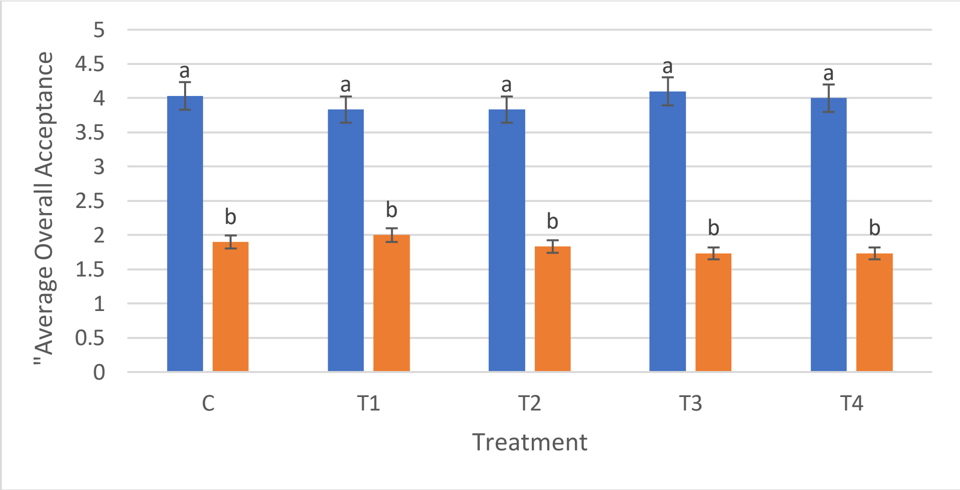


Chart 1-7: Interaction Effects of Treatment and Storage Time on Overall Acceptance.

You mentioned earlier that "The highest overall acceptance rate in the samples containing 0.25% fructose was on the 15th day, and the lowest was observed on the 30th day. Fructose had no significant effect on the reduction of overall acceptance during the storage days ($p > 0.01$)." It sounds like your research provides valuable insights into the stability and acceptability of yogurt with fructose over time.

CONCLUSION

In probiotic buttermilk containing Lactobacillus acidophilus, palmitic acid has the highest weight percentage, and among essential fatty acids, oleic acid is predominant. The activity of Lactobacillus acidophilus microorganisms with 0.5% fructose improves the buttermilk quality in terms of pH. Over time, the pH decreases due to the activity of these microorganisms, which reduces the shelf life and quality of the buttermilk. The activity of Lactobacillus acidophilus with 0.5% fructose improves the buttermilk quality in terms of acidity. Over time, due to the activity of these microorganisms, the acidity of the buttermilk samples increases, leading to a decrease in the desirability and satisfaction with the buttermilk. The activity of Lactobacillus acidophilus with 0.5% fructose maintains the buttermilk flavor quality. Over time, due to increased acidity and decreased pH, a sour taste becomes dominant in the buttermilk samples, resulting in reduced desirability and consumer satisfaction. The activity of Lactobacillus acidophilus with 0.5% glucose maintains the buttermilk color quality. Over time, due to increased acidity and decreased pH, the color of the buttermilk samples decreases. Additionally, Lactobacillus acidophilus, as a control sample, maintains the buttermilk aroma and taste quality. Over time, due to increased acidity and decreased pH, the aroma and taste of the buttermilk also decrease, which reduces consumer desirability and satisfaction. The activity of Lactobacillus acidophilus with 0.25% fructose maintains and also reduces the overall acceptance quality of the buttermilk. Storage time as a main sensory property factor has caused an overall decrease in the acceptance of the buttermilk samples over time with increased acidity and decreased pH.

REFERENCES

1. El-Nagar, G., Clowes, G., Tudorica, C. M., Kuri, V., & Brennan, C. S. (2002). Rheological quality and stability of yog-ice cream with added inulin. International Journal of Dairy Technology, 55(2), 89-93.

2. Galli, C., & Marangoni, F. (2006). N-3 fatty acids in the Mediterranean diet. Prostaglandins, Leukotrienes and Essential Fatty Acids, 75, 129–133.

3. Gomes, M. P., & Malcata, F. X. (1999). Bifidobacterium spp. and Lactobacillus aciduphilus: Biological, biochemical, technological, and therapeutical properties relevant for use as probiotics. Trends in Food Science and Technology, 10, 139-157.

4. Institute of Standards and Industrial Research of Iran. (2009). Doogh-Specifications and test methods. ISIRI No 2453. Karaj: ISIRI. [in Persian].

5. Journal of Dairy Product Research. (2022). Combined Effects of Prebiotics and Probiotics on Fatty Acid Profile of Doogh. Journal of Dairy Product Research, 2022.

6. Journal of Dairy Research. (2021). Impact of Lactobacillus Acidophilus on the Organoleptic Quality of Doogh. Journal of Dairy Research, 2021.

7. Journal of Food Science and Agriculture. (2021). Effect of Prebiotics on Fatty Acid Composition in Probiotic Dairy Products. Journal of Food Science and Agriculture, 2021.

8. Kiani, H., Mousavi, M. E., Razavi, H., & Morris, E. R. (2010). Effect of gellan, alone and in combination with high-methoxy pectin, on the structure and stability of doogh, a yogurt-based Iranian drink. Food Hydrocolloids, 24, 744-754.

9. National Conference on Dairy Products. (2022). Assessment of Prebiotics on the Physical Stability of Probiotic Doogh. National Conference on Dairy Products, 2022.

10. Shahdadi, F., Shahdadi, H., Amirafzali, V., & Afzalinassab, M. (2013). Sensory properties and survival of probiotic bacteria in date syrup yogurt. In First National Conference on Agriculture, Environment, and Food Safety.

11. Yousef, M., Nateghi, L., & Azadi, A. (2013). Effect of different concentration of fruit additives on some physicochemical properties of yoghurt during storage. Annals of Biological Research, 4, 244-249.