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DETERMINATION OF CHEMICAL AND RHEOLOGICAL QUALITY OF YOGURT IN BABIL GOVERNORATE MARKETS IN IRAQ

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Abstract

This study was conducted to determine the chemical and rheological quality of locally produced yogurt displayed in the markets of the Babil governorate. 336 samples of commercial yogurt were collected from Al-Hilla, Al-Mahawil and Al-Hashimiyah districts, in 6 different brands, at two different seasons; summer and winter, represented by the treatments (T_1, T_2, T_3, T_4, T_5, T_6), in addition to the control treatment (C) that is made of whole bovine milk by the college of Food Sciences laboratories/department of Dairy Science and Technology. The chemical analysis of the treatments included the percentages of; moisture, fat, protein, carbohydrates, ash and total acidity, and pH estimation. While the rheological tests included the viscosity, water holding capacity, and spontaneous whey separation. The results showed a variation in the percentage of moisture, total solids, total acidity, and pH for all the commercial treatments under study. The results also showed; a decrease in pH values, an increase in the percentage of total acidity with storage, a variation in the rheological characteristics values of the treatments immediately after manufacturing, an increment in both viscosity values and water holding capacity, and a decrease in spontaneous whey separation values with storage. Rheological evaluation results were variable for all the commercial treatment in comparison to the control treatment.

Key words : Chemical quality, Rheology, Yogurt.

Introduction

Yogurt is one of the main products of milk and is used in human food directly as it is natural and available in all countries of the world and has medical uses at times (Hanak *et al.,* 2004). Yogurt has been defined as the food product produced by lactic acid bacteria, which includes one or more of the following ingredients for the lactobacilli: cream, sorting milk and whole milk containing the farm of bacteria started produced for *lactobacillus delbrueckii subsp bulgaricus* and *Streptococcus Salivarius Subsp thermophilus*. The user used to produce yogurt is 3.5% as a minimum of milk fat and 8.25% of non-fat solids. The milk must be homogeneous and pasteurized before adding the starter to verify any microorganism (FDA, 2009). The quality of any food product can be determined according to a wide range of criteria, including chemical, physical, microbiological, and nutritional properties, or simply about its overall attractiveness to potential consumers (Tamime and Robinson, 1999). Milk additives can affect the chemical and physical properties of yogurt. This is due to its effect on the time of fermentation, the activity of bacteria starter, and their interaction with the milk proteins that form the basic building blocks of the yogurt gel network. Many researchers mentioned many products that are characterized by high viscosity with a more solid tissue when their protein content increases (Magenis *et al.,* 2006; Abd El-Khair, 2009). The increase in the protein content in the yogurt led to an increase in the level of the water-bound, which leads to the yogurt being more hardness and higher viscosity. The whey often appears on the surface of a solid in yogurt and gives an unwanted impression to the consumer because it alters the texture and affects some sensory properties. Whey exudation is prevented or reduced during the thermal treatment of milk, which leads to the denaturation of whey proteins and increases its hydrophobic properties. According to this, these proteins are linked to Kaba casein, which leads

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to an increase in its ability to retain water and form a more hardness gel network (Abd El-Khair, 2009; Whtte, 1995). This study aimed to Determination the physicochemical and rheological properties of yogurt found in the markets of Babel governorate and compare it with the control sample immediately after production and during storage at a temperature of (5 ± 1) m for 14 days to determine the differences in the chemical composition and determine the nutritional value of the product through a study of the chemical composition and extent Its compliance with the requirements of the Iraqi standard for the production of (yogurt).

Materials and Methods

Materials

In the manufacture of yogurt the control treatment was used raw cow's milk from the fields adjacent to the College of Food Sciences - Al Qasim University Green. As for powdered milk used to adjust the percentage of total solids, it was obtained from local markets in the city of Hilla and was of the French origin Rigeli brand. He also used a yogurt starter produced by (Danisco French).

Collection of samples: A comprehensive survey was conducted of the local types of yogurt available in the local markets in Al-Hilla, Al-Hashimiah and Al-Mahawil districts in Babil Governorate. 6 models were chosen from different brands: Al-Rafidain, Khayrat obtain, Zahrt al-Arabia, Huda ster, Canon and Dahab and differential symbols were given (T_1, T_2, T_3, T_4, T_5, T_6), respectively, and in two seasons (summer and winter), and they were kept cool at a temperature of (5±1) °C.

Yogurt manufacture

Yogurt is made according to the method followed by (Tamime and Robinson,1999). Milk was treated at a temperature of 90 ° C. for 10 minutes and then cooled to a temperature of 42 ° C and pollinated with the starter consisting of Streptococcus Salivarius thermophilus and Lactobacillus delbrueckii bulgaricus by direct addition method and by the quantity indicated by the producing company (Danisco French) by 0.002% and packed in 150ml plastic packages and incubated At a temperature of 42 ± 2 ° C until the coagulation was complete, then it was removed from the incubator and transferred to the refrigerator for cooling and preserving at a temperature of (5 ± 1) °C until the necessary tests were performed after 1, 3, 7 and 14 days had passed.

Physiochemical tests of yogurt

The percentage of moisture is estimated according to (AOAC, 2005). The ash content was estimated by the direct burning method described in (AOAC, 2008). Total nitrogen was estimated according to the method mentioned in (Fssai, 2015), while the fat percentage was calculated by Kerber method according to (Ling, 2008), and the percentage of carbohydrates was calculated mathematically according to what he mentioned (Ihokoronye,1985) (% carbohydrates = 100 -% (ash + protein + fat + moisture)). Total acidity, according to (AOAC, 2000). The pH was estimated by placing a pH meter sensor ((Model 211 HANNA (Instruments Microprocessor)) of Roman origin, directly into the yogurt sample after dilution with a little distilled water before the measurement.

Viscosity Determination

The apparent viscosity of yogurt samples was estimated at a temperature of 10 °C after the passage of 1, 3, 7 and 14 days from the refrigerated storage using the Brookfield DVII + viscometer produced by (Brookfield Engineering Lab Inc., Stoughton, Mass) according to the method mentioned by (Donkor *et al.,*2007) with some modifications, Using the axial spindle No. 4 and the number of revolutions of 10 revolutions per minute and the size of 150 ml for the sample, the spindle was left to rotate inside the sample for 60 seconds after mixing the sample well by moving it ten times clockwise and ten times in the opposite direction, and the reading was taken in centipoise units.

Water holding capacity

It was estimated according to the method mentioned (Parnell-Clunies *et al.,* 1986).

Spontaneous Whey separation

It was estimated according to the method mentioned (Amatayakul *et al.,*2006).

Results and Discussion

Chemical composition of yogurt

Moisture

The results shown in table 1 and 2 show the percentage of Moisture for each of yogurt Control treatments C and T_1, T_2, T_3, T_4, T_5, T_6 For the summer and winter seasons respectively. As its value immediately after manufacturing, the control treatment was 86.98 and 86.95% for the two seasons respectively, and these ratios are considered close to what (Dosh and Mohamed, 2017; Al-Bedrani, 2019) found for yogurt made from whole milk of 87.03 and 86.80%, respectively, but this result differs from what He found (Nawar *et al.,*2010) of 88.43% and (Sengupta *et al.,* 2014) of 88.19%. The Moisture for commercial yogurt treatments was 88.24, 88.62, 86.50, 89.50, 88.75, and 89.00%, respectively, for the summer season, 88.00, 88.25, 86. 00, 89.12, 88.21, 88.86%, respectively, for the winter season. It is noted from the results a decrease in the percentage of Moisture with storage and for all treatments, as the values reached after 14 days, so the treatment C was 86.73 and 86.72%, respectively, for the two seasons, and commercial treatments 87.89, 88.29, 86.14, 89.17, 88.42, 88.65% respectively, for the summer season, 87.69, 87.97, 85.68, 88.85, 87.88, 88.53%, respectively, for the winter season. The reason for the decrease in Moisture may be due to the rate of evaporation from the moisture content during storage, and this is consistent with what he found (Qureshi *et al.,* 2011), which indicated a decrease in the percentage of moisture of the yogurt from 84.78 to 84.65% during the cold storage for 15 days. It is noted from the results of the statistical analysis that there were no significant differences (P <0.05) between the treatments in the percentage of moisture immediately after manufacture and during storage.

Protein

Protein Ratio: The results shown in table 1 and 2 show the percentage of protein for the above-mentioned treatments, as its value immediately after manufacturing for the C treatment was 4.20 and 4.26%, respectively for the two seasons, and this result is close to what each of (Dosh and Mohamed, 2017) and (Al-Bedrani, 2017) The full-fat yogurt of 4.31 and 4.30%, respectively, is lower than what he found (Qureshi *et al.,* 2011) of 4.76%. The commercial treatments of the yogurt reached 3.30, 3.52, 4.20, 3.00, 3.20, 3.00%, respectively, for the summer season 3.38, 3.60, 4.10, 3.00, 3.30, 3.20%, respectively, for the winter season,

It is noted from the results of the statistical analysis of the presence of significant differences(P <0.05) between T_1, T_4, T_5, T_6 treatments compared to the control treatment. It is also noticed that the protein percentage increased in all yogurt treatments during storage, as it was after 14 days for treatment C 4.29 and 4.34%, respectively, for the two seasons and commercial treatments 3.42, 3.60, 4.32, 3.09, 3.29 and 3.10%, for the summer season And 3.46, 3.68, 4.19, 3.07, 3.41 and 3.29%, respectively, for the winter season, and this result is consistent with what he found (Al-Bedrani, 2016) which indicated that the percentage of protein in yogurt treatments increased from 4.34% after manufacturing directly to 4.44 % At the end of the 14-day storage period, as agreed with what he found (Qureshi *et al.,* 2011), which indicated that the percentage of protein in garlic yogurt treatments increased from 4.76% immediately after manufacture to 4.80% at the end of the 15-day storage period. The reason for this increase in protein percentage may be due to the decrease in the percentage of moisture, which led to an increase in the percentage of total solids, including protein. It is noted from the results of the statistical analysis of the presence of significant differences(P <0.05) between T_1, T_4, T_5, T_6 treatments, compared to the control treatment C during storage.

Fat

The results shown in table 1 and 2 show the percentage of fat in the various treatments mentioned above for the summer and winter seasons respectively. As the percentage of fat immediately after manufacturing As the percentage of fat immediately after manufacture for yogurt, treatment C was 3.55 and 3.52%, respectively, for the two seasons, and this result is close to what he found (Ziena and Nasser, 2019), which indicated that the percentage of fat in yogurt made from whole milk was 3.50%, which is less than he found (AL-Shaikh, 2018). The rate of 3.70%. As for the percentage of fat in commercial treatments, it was 3.40, 1.80, 3.00, 2.50, 3.00, and 2.94%, respectively, for the summer season, 3.60, 2.00, 3.70, 1.90, 3.40, and 2.90 % Respectively for the winter season. It is noted from the results that the T_2 treatment in the summer season was the lowest percentage of fat compared to other treatments The treatment T_4 in the winter season was the lowest percentage of fat compared to other treatments, and these low percentages for the two treatments are considered to be inconsistent with the manufacturing specifications of the whole fat yogurt. It is also noted from the results of the statistical analysis of the summer season that there are significant differences (P <0.05) in the fat percentage immediately after manufacturing between the treatments of T_2 and T_4 in comparison with C treatment, as for the winter season, the significant differences were clear between the T_2, T_4, T_6 treatments Compared with the control treatment. It is also noticed that while storing, the percentage of fat in the yogurt of all the treatments is noted, as the values after 14 days, for yogurt transaction C are 3.73 and 3.67%, respectively, for the two seasons and commercial treatments 3.58, 1.99, 3.17, 2.64, 3.18, and 3.12%, respectively, for the summer season, 3.70, 2.15, 3.83, 2.05, 3.56, 3.05%, respectively, for the winter season, and this result is consistent with what he found (Al-Bedrani, 2016), which indicated that the fat percentage increased from 3.63% immediately after manufacturing to 3.86% at the end of the 14-day storage period. It is noted from the results of the statistical analysis that there was a significant difference (P <0.05) in the fat percentage between the T_2 and T_4 treatments in the summer season compared to the control treatment C, while in the winter season, the presence of significant differences (P <0.05) were evident between the yogurt of T_2, T_4, T_6 treatments compared to Control treatment during storage.

Carbohydrates

The results shown in table 1 and 2 show the percentage of carbohydrates in the various treatments mentioned above for the summer and winter seasons respectively. As the percentage of carbohydrates immediately after manufacture to treat the C treatment is 4.60 and 4.62%, respectively, for the two seasons, and this result is close to what he found (Sadiq, 2019), which indicated that the percentage of carbohydrates in the yogurt made from whole milk is 4.58%, but it is less than what he found Both (Qureshi *et al.,* 2011) of 5.13% and (Guven *et al.,* 2005) of the whole cow's milk were 5.56%. As for the commercial treatments they were 4.46, 5.48, 5.65, 4.50, 4.50,4.48% respectively for the summer season and 4.48, 5.50, 5.60, 5.45, 4.51, 4.48% respectively, for the winter season. It is noted from the results of the statistical analysis that there was a significant difference ($P <0.05$) in the percentage of carbohydrates between T2 and T4 treatments compared to the control treatment. It is also noted that the percentage of carbohydrates decreased during storage in all yogurt treatments, and this corresponds to what he found (Yilmaz-Ersan and Kurdal, 2014), which indicated a decrease in the percentage of carbohydrates in the therapeutic yogurt from 4.42% to 4.07% during the 25-day storage period, as it is consistent with what he found (Osman *et al.,* 2010; El – Own and Mahgoub, 2012), which indicated a decrease in the percentage of carbohydrates in yogurt during storage, and this may be due to the continued transformation of lactose sugar into lactic acid due to the activity of starter bacteria that continues slowly under cooling conditions, as the carbohydrate ratio values reached 14 days after the transaction C They are 4.50 and 4.53%, respectively, for the two seasons, and commercial treatments are 4.35, 5.41, 5.58, 4.48, 4.40, 4.38% respectively for the summer season, 4.43, 5.44, 5.50, 5.39, 4.38, 4.40%, respectively, for the winter season. It is noted from the results of the statistical analysis that there is a significant difference ($P <0.05$) in the percentage of carbohydrates between T_2 and T_4 treatments compared to the control treatment.

Ash

The results shown in table 1 and 2 show the ash percentage in the various treatments mentioned above for the summer and winter seasons respectively. As this ratio was immediately after manufacture of the C yogurt, it was 0.67 and 0.65%, respectively, for the two seasons, and these ratios are close to what both (Matter *et al.,* 2016) and (Stijepic *et al.,* 2013) found, indicating that the ash content of the processed yogurt from whole milk was 0.68% and 0.70%, respectively, while the ash content of commercial treatments was 0.60, 0.58, 0.65, 0.50, 0.55, 0.58%, respectively, for the summer season, 0.54, 0.65, 0.60, 0.53, 0.58, 0.56% respectively, for the winter season. It is noted from the results of the statistical analysis that there were no significant differences ($P<0.05$) in the ash ratio between all treatments immediately after manufacture. It is also noticed from the results an increase in the ash percentage for all treatments with storage, as the values after 14 days for yogurt of treatment C were 0.75 and 0.74%, respectively, for the two seasons and the commercial yogurt treatments are 0.76, 0.71, 0.79, 0.62, 0.71 and 0. 75%, respectively, for the summer season, 0.71, 0.76, 0.80, 0.64, 0.76, and 0.73%, respectively, for the winter season, and this result is consistent with what he found (Al-Bedrani, 2017), which indicated a higher ash content than in a full-fat yogurt from 0.81% immediately after manufacture to 0.86% at the end of the 14-day storage period. However, it contravened what he found (Ghalem and Zouaoui, 2013b), which indicated that the ash content decreased from 0.92% after manufacturing to 0.70% at the end of the 21-day storage period. From the results of the statistical analysis, there are no significant differences ($P <0.05$) in the ash percentage values between All treatments.

The physical properties of yogurt

PH

The results shown in table 3 and 4 show the pH values of the various yogurt treatments mentioned above for the summer and winter seasons respectively, as these values were immediately after manufacture for the summer season for treatment C are 4.61 and this is consistent with what he found (Matter *et al.,* 2016) For a yogurt of 4.61, and this result is close to what he found (Ibrahim, 2015) for a yogurt of 4.59, either the pH values for the various commercial yogurt treatments were 4.57, 4.58, 4.61, 4.67, 4.58, and 4.57, respectively, while the pH values The winter season for the control treatments C is 4.64 and this corresponds to what he found (Suharto *et al.,* 2016) for the 4.64 yogurts, and this result is close to what he found (Shaghaghi *et al.,* 2013) for the 4.63 yogurts, either the pH values for the commercial yogurt treatments were 4.60, 4.61, 4.62, and 4. 58, 4.61 and 4.59, respectively. It is also noted from the results of statistical analysis that there were no significant differences ($P <0.05$) in pH values immediately after manufacture. The results also show a decrease in the pH values for all treatments during storage, so after 14 days of treatment C it was 4.23 and for commercial treatments 4.20, 4.30, 4.45, 4.60, 4.46, 4.44 respectively,

Table 1: The chemical composition of the control treatment and the various commercial treatments immediately after manufacture and during storage at a temperature of (1 ± 5) C for 14 days in the Summer season.

Treatment	Storage period (day)	Moisture %	Protein %	Fat %	Carbohydrates %	Ash %
C	1	86.98	4.20	3.55	4.60	0.67
	3	86.92	4.22	3.60	4.58	0.68
	7	86.84	4.25	3.65	4.56	0.70
	14	86.73	4.29	3.73	4.50	0.75
T_1	1	88.24	3.30	3.40	4.46	0.64
	3	88.15	3.32	3.43	4.46	0.64
	7	88.03	3.35	3.48	4.44	0.70
	14	87.89	3.42	3.58	4.35	0.76
T_2	1	88.62	3.52	1.80	5.48	0.58
	3	88.53	3.54	1.85	5.47	0.61
	7	88.42	3.57	1.91	5.45	0.65
	14	88.29	3.60	1.99	5.41	0.71
T_3	1	86.50	4.20	3.00	5.65	0.65
	3	86.41	4.22	3.04	5.63	0.70
	7	86.29	4.26	3.10	5.61	0.74
	14	86.14	4.32	3.17	5.58	0.79
T_4	1	89.50	3.00	2.50	4.50	0.50
	3	89.41	3.02	2.54	4.50	0.53
	7	89.30	3.05	2.58	4.50	0.57
	14	89.17	3.09	2.64	4.48	0.62
T_5	1	88.75	3.20	3.00	4.50	0.55
	3	88.65	3.22	3.04	4.48	0.61
	7	88.54	3.25	3.10	4.46	0.65
	14	88.42	3.29	3.18	4.40	0.71
T_6	1	89.00	3.00	2.94	4.48	0.58
	3	88.91	3.02	2.98	4.46	0.63
	7	88.80	3.05	3.04	4.43	0.68
	14	88.65	3.10	3.12	4.38	0.75
LSD (P<0.05)	----	NS	*0.772	*0.803	*0.791	*0.184

*Each number in the table represents a repeater rate.

as it reached 14 days after treatments C is 4.34 For commercial treatments 4.36, 4.50, 4.50, 4.46, 4.49, 4.46 this may be due to the continuation of the activity of the starter bacteria at storage and its analysis of lactose sugar to lactic acid, and these results are consistent with what he mentioned (Mani-López *et al.,* 2014) who indicated that The low pH in the yogurt can be attributed to the residual activity of the starter bacteria. It is also noted from the results of the statistical analysis that there were no significant differences (P <0.05) in the pH values between the treatments during storage.

Total acidity

The results shown in table 3 and 4 show the values of the titratable acidity (calculated based on lactic acid) for the above-mentioned yogurt treatments for the summer and winter seasons, respectively. This percentage immediately after manufacturing for the C treatment was 0.86%, and this result is close to what he found (Hussein and Fadhil, 2017) for the yogurt, which is 0.85%. As for the commercial treatments, it was 0.90, 0.89, 0.83, 0.78, 0.88, and 0.91%, respectively. It is noted from the results of the statistical analysis that there were no significant differences (P <0.05) in this ratio between the treatments. As for the winter season, the treatment C was 0.81%, and this result is consistent with what he found (AL-Shaikh, 2018) for the yogurt, which is 0.81% and is close to what he found (Nawar *et al.,* 2010) for the yogurt, which is 0.80%. As for the commercial treatments, it was 0.89, 0.87, 0.81, 0.90, and 0. 85 and 0.90%, respectively. It is also noted from the results of the statistical analysis that there were no significant differences (P <0.05) in this ratio between the treatments. It is also noted that the high titratable acidity values for all treatments with storage, this is consistent with what he found (Anjum *et al.,* 2007), which indicated that the total acidity of the yogurt treatments increased with the advance of the storage period, and the reason for this may be due to the continued activity of the starter bacteria during storage, even slowly, and their consumption of lactose sugar and its conversion to lactic and formic acids with small amounts of dioxide Carbon, as consistent with what it found (Parmjit and Chetan, 2012) The values of titratable acidity after 14 days of treatment C is 1.11% for the summer season, and this result is consistent with what he found (Suharto *et al.,* 2016) for the 1.11% yogurt.

For commercial treatments it was 1.18, 1.07, 0.99, 0.87, 0.99, 1.01% on Respectively, as noted by the results of the statistical analysis, there were significant differences (P <0.05) between the total acidity values of the T4 treatment compared to the control treatment. As

Table 2: The chemical composition of the control treatment and the various commercial treatments immediately after manufacture and during storage at a temperature of (1 ± 5) C for 14 days in the Winter season.

Treatment	Storage period (day)	Moisture %	Protein %	Fat %	Carbohydrates %	Ash %
C	1	86.95	4.26	3.52	4.62	0.65
	3	86.89	4.28	3.55	4.62	0.66
	7	86.82	4.30	3.60	4.60	0.68
	14	86.72	4.34	3.67	4.53	0.74
T_1	1	88.00	3.38	3.60	4.48	0.54
	3	87.92	3.40	3.63	4.48	0.57
	7	87.81	3.43	3.67	4.46	0.63
	14	87.69	3.46	3.70	4.43	0.71
T_2	1	88.25	3.60	2.00	5.50	0.65
	3	88.18	3.62	2.03	5.50	0.67
	7	88.09	3.64	2.08	5.48	0.71
	14	87.97	3.68	2.15	5.44	0.76
T_3	1	86.00	4.10	3.70	5.60	0.60
	3	85.94	4.12	3.73	5.58	0.63
	7	85.81	4.15	3.77	5.56	0.71
	14	85.68	4.19	3.83	5.50	0.80
T_4	1	89.12	3.00	1.90	5.45	0.53
	3	89.06	3.01	1.93	5.45	0.55
	7	88.97	3.03	1.98	5.43	0.59
	14	88.85	3.07	2.05	5.39	0.64
T_5	1	88.21	3.30	3.40	4.51	0.58
	3	88.14	3.32	3.43	4.48	0.62
	7	88.02	3.36	3.48	4.45	0.68
	14	87.88	3.41	3.56	4.38	0.76
T_6	1	88.86	3.20	2.90	4.48	0.56
	3	88.77	3.22	2.93	4.48	0.60
	7	88.66	3.25	2.98	4.46	0.65
	14	88.53	3.29	3.05	4.40	0.73
LSD (P<0.05)	----	NS	*0.698	*0.548	*0.602	*0.194

*Each number in the table represents a repeater rate.

for the winter season, after the passage of 14 for the treatment of C, it was 1.06%, and this result is close to what he found (Al-Bedrani, 2017) for the yogurt amounting to 1.05%. As for the commercial treatments it was 1.10, 0.98, 0.96, 1.00, 0.98 and 0.99, respectively, It is noted from the results of the statistical analysis that there are no significant differences (P <0.05) between all yogurt treatments. It is noted that there are clear differences in the values of the percentage of titratable acidity between the different treatments at the end of the storage period for the winter and summer seasons, and the reason for that may be due to the type and size of the added starter, and this is consistent with what he found each of (Brown and Chambers, 2015; Chougrani *et al.,* 2008) which indicated that the difference in The acidity is due to the type and size of the added starter strain, where there is a relative relationship between the strain and the acidity as the acidity increases with the increase in the size of the strain used.

The rheological properties of yogurt

Viscosity

The viscosity criterion is an important factor in controlling the quality of yogurt, which has a strong correlation in product stability and the oral taste of fermented milk (Lewis, 1996). The stability of the viscosity of the product is very important to its quality characteristics and according to what he mentioned (Rawson and Marschall, 1997), *Streptococcus Salivarius Subsp Thermophilus* has a major role. In increasing the viscosity of yogurt by producing exopolysaccharides that interfere with protein milk content, increase its viscosity, and improve its quality properties. The results shown in table 3 and 4 show that the viscosity values for yogurt treatments immediately after manufacturing for the summer and winter seasons respectively were for treatment C is 1680 centipoise and this result is close to what he found (Sadiq, 2019) of 1650 centipoise, and the viscosity values for commercial treatments were 3850, 3250, 5900, 2110, 2150, 2200 Centiboys, respectively. The viscosity values for the winter season immediately after manufacture for the C treatment were 1890 Centiboys, and for commercial treatments 5110, 3220, 5410, 2910, 4510, 4420 Centiboys, respectively It is also noted from the results that the treatment T3 recorded the highest viscosity of the two seasons, and the reason for this may be because it contains the highest percentage of total solids, and this is consistent with what he mentioned (Lee and Lucey, 2010), which indicated that the viscosity of yogurt is greatly affected by the total solids content in yogurt milk, especially Protein content. It is also noticed that the viscosity values of the various commercial treatments immediately after manufacture are compared

Table 3: Physical properties of the control treatment and the various commercial treatments immediately after manufacture and during storage at a temperature of (1 ± 5) C for 14 days in the Summer season.

Treatment	Properties					
	Storage period (day)	PH	Acidity %	Viscosity (centipoise)	Syneresis	Water-holding capacity%
C	1	4.61	0.86	1680	5.50	56.22
	3	4.57	0.91	1980	5.00	58.10
	7	4.35	0.96	2150	4.30	61.50
	14	4.23	1.11	2560	3.50	64.85
T_1	1	4.57	0.90	3850	5.90	54.00
	3	4.54	0.94	3930	5.00	55.25
	7	4.46	0.99	4290	4.30	57.37
	14	4.20	1.18	4300	3.95	60.10
T_2	1	4.58	0.89	3250	8.00	34.40
	3	4.51	0.92	3320	7.40	37.75
	7	4.43	0.99	3830	6.20	42.00
	14	4.30	1.07	4150	5.50	49.50
T_3	1	4.61	0.83	5900	5.10	60.00
	3	4.58	0.89	5950	4.60	62.30
	7	4.53	0.94	6100	3.90	65.95
	14	4.45	0.99	6210	3.00	71.33
T_4	1	4.67	0.78	2110	8.50	33.00
	3	4.65	0.81	2350	7.80	35.22
	7	4.62	0.85	2560	6.50	38.50
	14	4.60	0.87	2750	5.70	41.30
T_5	1	4.58	0.88	2150	5.36	42.36
	3	4.55	0.92	2320	5.00	45.12
	7	4.50	0.95	2630	4.50	48.71
	14	4.46	0.99	2950	3.80	52.05
T_6	1	4.57	0.91	2200	5.70	37.20
	3	4.55	0.95	2455	5.10	39.20
	7	4.49	0.98	2680	4.20	44.00
	14	4.44	1.01	2800	3.90	49.10
LSD (P<0.05)	---	NS	*0.207	*0.153.57	*2.419	*9.822

*Each number in the table represents a repeater rate.

to the control treatment, and the reason for this may be due to the nature, quantity, and properties of the additive and this is consistent with what was mentioned by each of (Al-Gurabbi, 2011; Eearly, 1998) who indicated that the viscosity of yogurt is usually improved by adding stabilizers and thickens such as Starch, gel, and pectin to get thick textures at a lower cost and this is a kind of fraud. It is also noted from the results that viscosity values increase for all treatments with storage, as after 14 days of treatment C, they were 2560 and 2450 Centiboys, respectively, for the two seasons and commercial treatments 4300, 4150, 6210, 2750, 2950, 2800 Centiboys, respectively, for the summer season, 5600, 3630, 6900, 3400, 5620, 4780 Centiboys respectively Winter, and this is consistent with what he found (Shaghaghi *et al.,* 2013), which indicated a high viscosity of yogurt treatment from 2123 centipoise immediately after manufacture to 2244 centipoise on day 14 of storage, and the reason for that may be due to the activity of the starter bacteria that leads to a low pH of the yogurt which leads To increase its hardness and thus increase its viscosity (Walstra *et al.,* 2006). It is also noted from the results of the statistical analysis that there are significant differences (P <0.05) in the viscosity values immediately after manufacturing and during storage between commercial yogurt and control treatment.

Syneresis

Is one of the undesirable characteristics in the yogurt, and it occurs as a result of not holding the water by the protein network either because of the lack of total solids or because of insufficient heating (Konhorst,2007). Syneresis is one of the most important criteria that indicates the quality of yogurt during storage (Dönmez *et al.,* 2017). The results shown in table 3 and 4 show the quantities of exuded whey for the aforementioned yogurt treatments for the summer and winter seasons respectively, as they were immediately after manufacturing for the C treatment is 5.50 ml / 50 g and for the yogurt treatments T_1, T_2, T_3, T_4, T_5, T_6 They were 5.90, 8.00, 5.10, 8.50, 5.36, 5.70 mL / 50 g respectively. It is noted from the results of the statistical analysis of the presence of significant differences (P <0.05) between the values of The whey exudation of the treatments of T_4 and T_2 in comparison with the control treatment. As for the winter season, the values for the treatment C were 4.90 mL / 50 g and for commercial treatments 5.00, 6.50, 4.50 and 6. 70, 4.80 and 5.10 mL / 50 g respectively, and this result is consistent with what he found (Al-Bedrani, 2017) which indicated the occurrence of automatic Whey exudation for yogurt treatments

Table 4: Physical properties of the control treatment and the various commercial treatments immediately after manufacture and during storage at a temperature of (1 ± 5) C for 14 days in the Winter season.

Treatment	Properties					
	Storage period (day)	PH	Acidity %	Viscosity (centipoise)	Syneresis	Water-holding capacity%
C	1	4.64	0.81	1890	4.90	57.35
	3	4.61	0.85	2010	4.30	59.65
	7	4.50	0.95	2200	3.60	63.73
	14	4.34	1.06	2450	3.10	67.45
T_1	1	4.60	0.89	5110	5.00	55.25
	3	4.57	0.91	5225	4.60	57.45
	7	4.46	0.97	5350	4.00	60.10
	14	4.36	1.10	5600	3.50	70.25
T_2	1	4.61	0.87	3220	6.50	36.30
	3	4.58	0.90	3360	6.00	39.40
	7	4.54	0.94	3450	5.20	44.11
	14	4.50	0.98	3630	4.80	50.87
T_3	1	4.62	0.81	5410	4.50	61.60
	3	4.59	0.85	5655	3.90	64.80
	7	4.55	0.91	5820	3.00	68.65
	14	4.50	0.96	6900	2.55	74.00
T_4	1	4.58	0.90	2910	6.70	35.10
	3	4.56	0.93	2980	6.00	37.52
	7	4.52	0.95	3220	5.40	40.00
	14	4.46	1.00	3400	5.00	44.25
T_5	1	4.61	0.85	4510	4.80	46.35
	3	4.57	0.89	4730	4.20	50.08
	7	4.53	0.93	4950	3.60	53.73
	14	4.49	0.98	5620	3.00	59.11
T_6	1	4.59	0.90	4420	5.10	40.88
	3	4.56	0.94	4500	4.80	43.75
	7	4.52	0.96	4660	4.00	48.63
	14	4.46	0.99	4780	3.70	54.40
LSD (P<0.05)	---	NS	NS	*209.66	*2.173	*6.408

*Each number in the table represents a repeater rate.

immediately after manufacture. It is also noted from the results of the statistical analysis that there are significant differences (P <0.05) in the values of exuded whey between the T4 treatment and the control treatment. It is also noticed the decrease in the exuded whey with storage as the values after 14 days of treatment C reached 3.50 and 3.10 ml / 50 g respectively for the two seasons, and commercial treatments 3.95, 5.50, 3.00, 5.70, 3.80 and 3.90 ml / 50 g on Respectively for the summer season, 3.50, 4.80, 2.55, 5.00, 3.00, and 3.70 mL / 50 g for the winter season and this is consistent with what he found (Celik, 2007), which indicated a decrease in the percentage of whey exudation for yogurt from 055.8% per day The first to 53.3% on day 14 of storage. It also agrees with what he found (Matter *et al.,* 2016), which indicated high water retention, which means a decrease in whey exudation or control treatment from 26.80% immediately after manufacture to 26.02% after 10 days of refrigerated storage. The reason for this may be due to the metabolic activity of the starter bacteria in addition to a decrease in the net pressure inside the protein mold, which leads to a decrease in the Syneresis..(Güler-Akýn and Akýn, 2007) These results are also consistent with what he found (Lucey *et al.,*1999), which indicated that the lactic ferments exposed their foundations to high thermal factors that are It has a thicker texture with a more branched protein branched network. It is also noted from the results that the T_3 treatment was the lowest amount of whey extracted immediately after manufacture and during the storage period for both seasons, and the reason for this may be due to the high percentage of the total solids in it compared to the rest of the treatments. As for the T4 treatment, it was the most whey exudation and the reason may be due to that. The low percentage of total solids in it compared to other treatments. It is also noted from the results of the statistical analysis that there were no significant differences (P <0.05) between all treatments with storage.

Water-holding capacity

The ability to retain a food protein in water depends on many factors, including the type of amino acids involved in its composition, the nature of the protein formation, the amount of polarity of amino acids and the extent of their hatred to water (Barbut,1999). The results shown in table 3 and 4 values The percentages of water retention for aforementioned yogurt treatments are for the summer and winter seasons respectively, as the ability to retain water immediately after manufacture for treatment C is 56.22% and this result is close to what he found (Arslan and Bayrakc, 2016) which found that the water retention ability for a yogurt treatment reached immediately after manufacturing 56.71% The values for commercial treatments were 54.00, 34.40, 60.00, 33.00, 42.36, 37.20%, respectively. As for the winter season, the treatment C was 57.35%, and for commercial treatments 55.25, 36.30, 61.60, 35.10, 46.35, 40.88% respectively. It is also noticed that the high water retention capacity with the storage for all the treatments was 14 days later, and the C treatment was 64.85 and 67.45%, respectively, for the two seasons and commercial treatments 60.10, 49.50, 71.33, 41.30, 52.05 and 49.10%, respectively, for the summer season and 70.25, 50.87, 74.00, 44.25, 59.11 and 54.40%, respectively, for the winter season, and this is consistent with what he found (Matter et al 2016) which indicated that the water retention capacity of the control treatment increased from 45% immediately after manufacture to 77% after 14 days have passed since cold storage. It is also noted from the results that there are significant differences P <0.05) in the values of the percentage of water retention ability for the summer and winter seasons between T_2, T_4, T_5, T_6 treatments compared with the control treatment immediately after manufacture and during storage.

Conclusions

The commitment of many dairy production plants to the standard specifications and manufacturing conditions required for the product and some laboratories do not adhere to the Iraqi and international standards for the product. The existence of a plant that does not give the quality of the materials involved in manufacturing great importance, which affects the chemical composition proven by legal and specifications regulations and lack of conformity in the proportions of components with what is mentioned on the product. Some trademarks violate the synthetic quality information on the package, especially the fat content.

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