Textural and Sensory Characteristics of Whole and Skimmed Flavored Set-Type Yogurt During Long Storage

A. Salvador and S. M. Fiszman

Instituto de Agroquímica y Tecnología de Alimentos (CSIC)
Apartado de correos 73, 46100 Burjassot, Valencia, Spain

ABSTRACT

A study of refrigerated storage (10°C for 91 d) of whole and skimmed flavored set-type yogurt was made. Comparison with storage at 20°C for 21 d and 30°C for 3 d (accelerated) was also carried out. Refrigerated storage yogurts were assessed by a trained panel and by a consumer panel. Trained-panel scores were correlated to instrumental data, and the acceptability data for long storage were studied using consumer criteria. In all cases, after-storage pH values barely changed over storage time, indicating that the yogurt samples did not develop much acidity under any of the storage conditions studied. The profile of the instrumental texture curves obtained corresponded to a firm gel, which broke after a plunger penetrated the sample, and the firmness values of the whole yogurt were lower than for the skimmed yogurt under all the storage conditions studied. From a microbiological point of view, the viability of the yogurts was adequate at the different storage times and temperatures studied, although those stored at 10°C for long periods would not comply with some countries' minimum requirements. Logistic regression of the data from a 50-consumer sensory evaluation showed that the probability of the whole yogurt being accepted after 91 d storage at 10°C was around 40%, whereas for the skimmed yogurt it was only 15%, largely because the skimmed yogurt developed certain negative attributes at an earlier stage of storage than the whole yogurt.

(Key words: yogurt, storage, sensory properties, texture)

INTRODUCTION

Knowledge of the behavior of yogurt during long storage is important because its shelf life is based on whether the products display any of the physical, chemical, or sensory characteristics that are unacceptable

for consumption. Studies of changes in these quality characteristics during storage would enable producers to predict the shelf life of the product more accurately.

Several investigations into the shelf life of different yogurts have been conducted. Yadav et al. (1994) studied the sensory attributes and biochemical changes of yogurt made with soymilk and buffalo milk blends with additives (alginate, carboxymethylcellulose, or potassium sorbate) during 15-d storage at 7°C. They concluded that potassium sorbate increased soy yogurt shelf life by up to 15 d at 7°C, influenced biochemical and microbiological aspects, and demonstrated a positive relationship with sensory characteristics. Gueimonde et al. (2003) studied the chemical, microbiological, and sensory properties of a yogurt made with refrigerated CO₂-treated pasteurized milk during long cold storage; they found a slight decrease in pH, no significant differences in viable bacteria, and no sensory differences between the controls (yogurts made with fresh and refrigerated milk) and the CO₂-treated samples at the end of a 24-d storage period. Previously, other authors (Karagül-Yuceer et al., 1999) studied the characteristics of carbonated and noncarbonated yogurt samples during 45 d of storage; carbonation had no significant effect on the acceptability of yogurt during its shelf life and did not alter the sensory characteristics of yogurt as noted by expert panelists or consumers. Vargas et al. (1989) focused their study on shelf life prediction for soy-whey yogurt, based on combined sensory, chemical, and microbiological studies during a storage period of 35 d at 5 and 15°C. They found that flavor (among the sensory parameters) or tyrosine value (among the physicochemical ones) could be used to determine the endpoint of storage; microbiological counts demonstrated a storage life of 5 wk at 5°C.

No investigation has been made of sensory, biochemical, and textural changes during accelerated and refrigerated storage of set-style yogurts with no additions. This investigation aimed to study these changes and compare both types of storage of whole and skimmed set-type yogurt. Additionally, sensory evaluation by a trained panel was correlated to instrumental analyses, and microbiological analyses were carried out in all samples.

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Corresponding author: S. M. Fiszman; e-mail: sfiszman@iata.csic.es.

MATERIALS AND METHODS

Samples

Samples of whole (3.5 g of protein, 13.4 g of carbohydrates, and 1.9 g of fat/100 g) and skimmed (4.4 g of protein, 4 g of carbohydrates, and 0.1 g of fat) artificially sweetened, strawberry flavored, set-style yogurts were obtained from a local store. Given the large number of samples required and to avoid differences in their manufacture, the order placed with the store specified that each of the 2 sets of yogurt (whole and skimmed) was to be from a single batch. According to the labels, the samples contained no addition to the normal ingredients of such yogurts (apart from those already mentioned). The degrees Brix were 18 for whole yogurt and 8 for skimmed yogurt samples.

Storage

To study their shelf life, the yogurts were stored at 10°C and samples were taken for analysis after 15, 35, 49, 63, 77, and 91 d. For accelerated storage, the samples were placed at 20 and 30°C and taken for analysis after 7, 14, and 21 d, and 1, 2, and 3 d, respectively. A control (fresh) sample was also analyzed. Sensory analyses were performed only on the refrigerated storage samples.

Syneresis

Whey that separated from samples during storage was removed using a syringe. The amount of whey drained off [expressed as milliliters per container (125 g) of initial sample] was calculated as the syneresis index.

Titrateable Acidity and pH

Titrateable acidity was measured according to IDF Standard (1991). It is expressed as grams of lactic acid per one hundred grams of the product, using the equation:

$$\text{Titrateable acidity} = V \times 0.9/m, \quad [1]$$

where V = volume (in mL) of 0.1 M sodium hydroxide solution required to titrate a sample of yogurt to a pH of 8.3, m = mass (in g) of the test portion, and 0.9 is the conversion factor for lactic acid.

The pH was obtained by direct measurement with a micropH 2001 pH-meter (Crison Instruments, S.A., Barcelona, Spain).

Penetration Tests

Tests were performed with a TA.XT.plus Texture Analyzer (Stable Micro Systems, Godalming, UK). A penetration test was performed to determine the gel force. A 20-mm penetration was made with a 0.5-inch diameter probe with a flat base (TA/0.5) at a speed of 1 mm/s. The following parameters were recorded: firmness, as the force at breaking (in N), defined as the first significant discontinuity produced in the curve as the plunger penetrated the gel during a total displacement of 20 mm; and the distance at which breaking took place (in mm). Complete profiles of the curves were also recorded. Registration of complete curves made it possible to compare the slopes and check for atypical behavior patterns.

Microbiological Analyses

Samples for counts of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* were spread plated on M17 and MRS agar (Scharlau Chemie, S.A., Barcelona, Spain), respectively. The first culture was incubated for 24 h at 42°C and the second culture was incubated anaerobically for 5 d at 37°C. Microbiological count data are expressed as a log of colony-forming units per milliliter of yogurt (IDF Standard, 2003).

Trained Sensory Panel

The samples were evaluated by a trained panel of 10 assessors, all of who had used Descriptive Sensory Methodology (ISO, 1993) on a regular basis over the past 2 yr. The panel was calibrated in the use of the chosen attributes during five 45-min training sessions. The authors received permission from their institution for the yogurt samples stored for 91 d at 10°C to be tasted by humans. Three yogurt samples (fresh, stored at 10°C for 30 d, and stored at 10°C for 60 d) were used for the training sessions. Panel members discussed and agreed upon the definitions and how to qualify the attributes on the scale. Whey separation ("syneresis"), "color," "firmness," "maintenance of shape" (the panelists were asked to evaluate if the sample maintained its shape after a portion of sample had been removed with a teaspoon), "flavor intensity," "acidity," "sweetness," "astringency," and "chalky taste" were rated using a 100-mm linear semistructured scale with the end values labeled as "weak" and "strong". Seven samples (fresh, and 15, 35, 49, 63, 77, and 91 d of storage at 10°C), served in a randomized order, were evaluated in duplicate over 2 formal sessions. Mineral water was used to rinse out the testers' mouths between consecutive samples. Tests were conducted in a standardized room (ISO, 1988).

Consumer Panel

Fifty consumers who liked and were willing to consume yogurt for lunch were recruited among persons between the ages of 20 and 60, approximately balanced between females and males. They were students and staff of the Instituto de Agroquímica and the Universidad de Valencia. Each consumer was given the 7 yogurt samples, presented monadically in random order. After tasting the samples they answered the question: "Would you normally consume this product? Yes or no?" To make sure that consumers fully understood the question, the question was reiterated with the explanation that "this meant that if they bought the product for their own consumption or it was served to them at their homes, would they consume it or not?" (Hough et al., 2002).

Statistical Analyses

Generalized Procrustes Analysis was used to monitor good assessor panel performance; it was conducted with the Genstat program, version 7.0 (Lawes Agricultural Trust, VSN International Ltd., Hemel Hempstead, UK).

The instrumental sets of data were subjected to a one-way ANOVA and the sensory sets of data to a 2-way ANOVA (assessor, sample), separately for each type of yogurt, to establish whether significant differences in each of the instrumental results or sensory scores were attributable to storage as the sole source of variation among the samples. The means were compared using Fisher's least significant difference (LSD) test and the statistical significance was determined at $P < 0.05$. The correlation between instrumental and sensory attributes was also calculated. Principal component analysis was carried out using the significant attributes. A logistic regression was carried out to calculate the probability of acceptance according to storage time for each type of yogurt; for this regression, the consumer response (coded 1 = rejection, 0 = acceptance) was taken as an independent variable and the storage time as a dependent variable. All statistical analyses were performed using the Statgraphics Plus program, version 2.1 (Manugistics Inc., Rockville, MD).

RESULTS AND DISCUSSION

Syneresis, pH, and Titratable Acidity

Syneresis values for yogurts stored at the 3 temperatures studied (10, 20, and 30°C) are shown in Figure 1. A significant increase in syneresis values could be observed at the 3 different storage temperatures. This increase was more noticeable during the first days of

Figure 1. Syneresis values for whole (circles) and skimmed (triangles) yogurt as function of storage time at the 3 different temperatures.

Figure 2. Texture curve profiles of fresh whole yogurt and whole yogurt stored for 91 d at 10°C, 21 d at 20°C, and 3 d at 30°C.

storage. When samples were stored at 30°C, a far greater degree of syneresis was found in both types of yogurt (whole and skimmed), probably because the high temperature favored greater contraction of the coagulum. The exact cause of whey separation in yogurts is not clear (Lee and Lucey, 2004). However, it would be interesting to investigate whether longer storage at 10°C might lead to greater syneresis to discover whether the cause is a combination of temperature and time.

The titratable acidity values (from 0.82 to 1.10, and from 0.82 to 1.15 for whole and skimmed yogurt, respectively) and pH values (ranging from 4.21 to 3.96, and from 4.27 to 4.01 for whole and skimmed yogurt, respectively) of the yogurts stored at the 3 temperatures studied showed little variation. Gueimonde et al. (2003) found similar results in pH and titratable acidity when they studied the quality of plain yogurt stored at 4°C for 44 d.

Firmness

Yogurt firmness values were obtained for the different storage temperatures and times. Firmness significantly increased with storage at all 3 temperatures. The firmness values for whole yogurt were lower than for skimmed yogurt under all storage conditions studied (Figures 2 and 3). This finding could be attributable to the lower fat and higher protein content of skimmed

yogurt. A high protein content gives higher firmness values, as discussed in a previous study by Becker and Puhon (1989). It should be mentioned that firmness values only varied by a few tenths of a Newton in whole yogurt and from 0.55 to 0.73 N in skimmed yogurt, indicating that this characteristic was not greatly affected by the different storage conditions. Figures 2 and 3 show the profiles of the curves obtained. The curves indicate a similar pattern to those obtained in previous studies of set-style yogurts (Fiszman et al., 1999; Fiszman and Salvador, 1999) and no atypical feature was registered. The profiles correspond to a moderately firm gel, which broke during penetration tests; the gel was deformed by compression before it broke, suffering considerable damage to its structure, as indicated by the size of the fall in the force value. Although in general the shape of the profiles of all the samples was similar, storage time and temperature would appear to have a combined effect, as a decrease in the value of the slopes and a greater distance to breaking point (deformability) was observed as the storage temperature rose or the storage time increased. This effect was more noticeable in the skimmed yogurt, indicating a more deformable structure.

Sensory Analysis

Sensory evaluation was only conducted on yogurts stored at 10°C. The assessor plot derived from the gen-

Figure 3. Texture curve profiles of fresh skimmed yogurt and skimmed yogurt stored for 91 d at 10°C, 21 d at 20°C, and 3 d at 30°C.

eralized Procrustes analysis showed the assessors close together on the assessor space, which means that they all had similar perceptions of the samples. Furthermore, the values of the assessor residuals were similar (ranging between 0.19 and 0.27 for whole yogurt, and between 0.17 and 0.26 for skimmed yogurt), which indicates good agreement on the position of the samples in the space; large residuals for an assessor would indicate lack of fit (Sivertsen and Risvik, 1994). As these 2 criteria indicated good panel performance, all 10 assessors were retained for subsequent data analyses. ANOVA showed that between-assessor variations were nonsignificant ($P > 0.05$), as were assessor-sample variations.

The average data for whey separation ("syneresis"), "color," "firmness," "maintenance of shape," "flavor intensity," "acidity," "sweetness," "astringency," and "chalky taste" of yogurts in refrigerated storage (10°C), as well as their significance, are summarized in Table 1. The panelists' scores for "syneresis," "firmness," "maintenance of shape," and "chalky taste" showed significant increases in relation to storage time for both types of yogurt. For most of these parameters, the changes were greatest during the first days of storage and subsequently tended to level out. Sodini et al. (2004) recently reviewed the effect of long-time storage on some yogurt texture characteristics; over-acidification and an increase in the hydration of casein were the main possible causes reported by these authors.

Major changes during the first week of storage have been reported by other authors (Martin et al., 1999), and it would be interesting to examine in detail the factors that influence this tendency. Instrumental and sensory "syneresis" correlated well, and sensory "firmness" and "maintenance of shape" correlated well with instrumental firmness. Whole yogurt sensory "firmness" vs. instrumental firmness was the only nonsignificant correlation, probably due to the greater difficulty in evaluating the firmness of this type of yogurt, which is softer, although there was good correlation with sensory "maintenance of shape" (Table 2). Indeed, because of this difficulty, "maintenance of shape"—which is evaluated by sensory means—was selected to provide an additional texture attribute.

No significant changes in relation to storage time were found in "color," "flavor intensity," or "sweetness" for either type of yogurt. The only differential behavior between the 2 types of yogurt was that skimmed yogurts showed increases in "acidity" and "astringency" with time. These 2 parameters, which together with "chalky taste", are generally perceived as negative attributes (especially astringency and chalky taste), scored higher in skimmed yogurts than in whole yogurts at almost all the storage times analyzed.

According to the results of the principal components analysis carried out (Figure 4, PC1 vs. PC2), the yogurt samples appear to be separated into 2 well-defined

Table 1. Mean values for sensory evaluation parameters of whole and skimmed yogurts stored at 10°C as a function of storage time.¹

Parameters	Storage time (d) at 10°C													
	Whole yogurt							Skimmed yogurt						
	0	15	35	49	63	77	91	0	15	35	49	63	77	91
Syneresis	0.8 ^a	2.9 ^b	6.3 ^c	6.1 ^c	6.1 ^c	6.2 ^c	6.7 ^c	1.7 ^a	3.9 ^b	4.9 ^{bc}	5.7 ^c	4.8 ^{bc}	6.0 ^{cd}	6.2 ^d
Color	3.9 ^a	4.0 ^a	4.5 ^a	4.2 ^a	4.3 ^a	4.4 ^a	3.8 ^a	4.3 ^a	4.4 ^a	4.1 ^a	4.5 ^a	4.6 ^a	4.4 ^a	4.5 ^a
Firmness	2.8 ^a	5.0 ^b	5.5 ^b	5.5 ^b	5.3 ^b	5.8 ^b	5.8 ^b	5.9 ^a	6.6 ^{bc}	7.2 ^{cd}	7.5 ^{de}	7.6 ^{de}	7.9 ^e	7.4 ^{de}
Maintenance of shape	3.1 ^a	5.1 ^b	5.8 ^{bc}	6.1 ^c	6.1 ^c	6.3 ^c	7.3 ^d	4.7 ^a	6.1 ^b	7.1 ^c	6.9 ^c	6.7 ^{bc}	6.9 ^c	7.3 ^c
Flavor	5.8 ^a	6.0 ^a	5.2 ^a	5.7 ^a	5.7 ^a	5.6 ^a	5.8 ^a	5.5 ^a	5.6 ^a	5.4 ^a	5.6 ^a	5.6 ^a	5.8 ^a	5.4 ^a
Acidity	5.0 ^a	5.3 ^a	4.6 ^a	5.1 ^a	4.5 ^a	4.9 ^a	4.8 ^a	4.9 ^a	5.8 ^{ab}	5.8 ^{ab}	6.2 ^{bc}	6.4 ^{bc}	6.6 ^{bc}	6.8 ^c
Sweetness	5.1 ^a	4.7 ^a	4.7 ^a	4.4 ^a	4.4 ^a	4.4 ^a	4.2 ^a	4.7 ^a	4.7 ^a	4.3 ^a	4.8 ^a	4.6 ^a	4.1 ^a	4.4 ^a
Astringency	4.3 ^a	4.1 ^a	4.4 ^a	4.4 ^a	4.5 ^a	4.3 ^a	4.3 ^a	3.1 ^a	4.7 ^b	5.1 ^b	5.0 ^b	5.5 ^b	5.4 ^b	5.8 ^b
Chalky taste	1.5 ^a	2.5 ^{ab}	2.6 ^{ab}	3.4 ^b	3.8 ^b	3.7 ^b	3.4 ^b	3.1 ^a	4.5 ^{ab}	5.1 ^{bc}	5.2 ^{bc}	5.3 ^{bc}	5.4 ^c	5.8 ^c

a,b,c,d,e Means in the same row and type of yogurt without a common letter differ ($P < 0.05$) according to the least significant difference multiple range test.

¹Mean values from 10 panelists.

groups: moving left to right along the first component (which accounts for 81.06% of explained variance), the whole yogurts are separate from the skimmed samples. Figure 4 also represents the selected attributes on the plane defined by the first 2 components. The longest-stored skimmed yogurt samples were those with the highest scores for “firmness,” “maintenance of shape,” and “chalky taste,” which are all related to texture/mouthfeel, and for “syneresis,” which also had a major component of PC2 (accounting for 16.24% of explained variance). Skimmed yogurt samples with shorter storage times and fresh samples go in the opposite direction to these vectors. The whole yogurt samples follow a similar distribution: again, the control sample is the one furthest to the left and the other samples move increasingly to the right as the storage time rises, although they are all further to the left in Figure 4.

Consumer response for each type of yogurt, coded by assigning 0 or 1 to each negative or positive answer respectively, was expressed as a probability of consumption and was related to storage time using a logistic regression (Figure 5). The fitted equations were:

$$\text{Probability of acceptance} = \frac{e^{(2.33-0.03t)}}{1 + e^{(2.33-0.03t)}} (\chi^2 = 51.52, P = 0.0000) \quad [2]$$

and skimmed yogurt:

$$\text{Probability of acceptance} = \frac{e^{(2.65-0.05t)}}{1 + e^{(2.65-0.05t)}} (\chi^2 = 126.50, P = 0.0000) \quad [3]$$

where t = storage time.

According to these predictive equations, the probability of acceptance half-way through the storage period at 10°C (45 d) would be 75% for the whole yogurts and 60% for the skimmed ones, whereas at the end of the storage time (91 d) the probability would be 40% for the whole yogurts and 15% for the skimmed yogurts. Greater firmness and the rise in negative attributes such as “astringency” or “chalky taste” were associated with the lower acceptability of the skimmed yogurts.

Microbiological Analyses

Yogurt consumption is beneficial to human health because of the bacteria the yogurt contains. Although quantitative standards for yogurt bacteria differ (Tamine and Death, 1980), it is generally accepted that the yogurt should contain 10^7 cfu of viable bacteria (*Streptococcus thermophilus* and *Lactobacillus bulgaricus*) per mL of yogurt. Consequently, there has been considerable research into ways to maintain the viability of

Table 2. Regression values for correlation between instrumental parameters and the corresponding sensory attributes.

Sensory parameter	Instrumental parameter	Whole yogurt		Skimmed yogurt	
		Correlation coefficient	P	Correlation coefficient	P
Syneresis	Syneresis	0.96	0.0007	0.76	0.047
Firmness	Firmness	0.32*	0.49*	0.86	0.013
Maintenance of shape	Firmness	0.95	0.0012	0.88	0.009

*Nonsignificant correlation.

Figure 4. Principal components product scores plot from the sensory analyses of yogurt samples (W = whole yogurt; S = skimmed yogurt; numbers = storage days), and principal components significant attributes loadings plot from the sensory analyses of yogurt samples.

these organisms to ensure that the live bacteria are still present in the yogurt when it is consumed. Table 3 summarizes the counts of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* found in stored yogurts in relation to temperature and time. At 10°C, a considerable reduction in both cultures was observed at the end of the storage period. At 20 and 30°C, the reduction was more evident for *Lactobacillus*, probably because the higher temperatures favor their growth. In Japan, the Fermented Milks and Lactic Beverages Association has established a standard that requires the presence of $\geq 10^7$ viable bacteria/mL in dairy products (Ishibashi and Shimamura, 1993). The Swiss Food Regulation along with the International Standard of FIL/IFD (1991) requires that such products contain $\geq 10^6$ cfu/g, and the Spanish Yogurt Quality Standard requires 10^7 cfu/mL (Ministerio de Presidencia, 2003). Harmann and Marth (1984), after extensive study of the survival of these 2 bacteria in commercial and experimental yogurts, recommended that yogurt should contain at least 1 million viable organisms per gram at the time of sale. Although there are no reports on the changes in yogurt flora during storage of fermented soy milk in the investigations of Vargas et al. (1989), their work does shed

some light in this regard, indicating that these organisms could survive in appreciable numbers in soy-yogurt until its spoilage by yeasts and molds.

Our studies indicate that the microbiological viability of the yogurts was adequate at the different storage times and temperatures studied, although those stored at 10°C for long periods would not comply with some countries' minimum requirements.

CONCLUSIONS

A study of yogurt storage at refrigeration temperatures (10°C) was made to determine whether the instrumental parameters measured over the storage time would evolve along the same lines as in accelerated storage at 20 and 30°C, which would enable changes in the characteristic attributes of the yogurt to be predicted without prolonged storage. The results obtained indicate that the samples evolved differently at the 3 temperatures studied, although to some extent the changes observed over the storage periods could be considered the result of a combination of time and temperature. Consequently, these storage temperatures could

Figure 5. Logistic regression to predict consumer acceptability (thick lines) and their confidence intervals (thin lines) of whole yogurt (continuous lines) and skimmed yogurt (dotted lines) with storage time.

have good predictive value for the physical characteristics of yogurt in refrigerated storage.

Results obtained for physical properties and from sensory and microbiological analyses showed that cer-

tain attributes that are considered negative, such as syneresis or the appearance of atypical texture/mouth-feel characteristics, increase with storage time. The data from a 50-consumer sensory evaluation showed

Table 3. Viability (in log cfu/mL) of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* of whole and skimmed yogurt during storage at 10, 20, and 30°C.

Temp	Time (d)	Whole yogurt		Skimmed yogurt	
		<i>S. thermophilus</i>	<i>L. bulgaricus</i>	<i>S. thermophilus</i>	<i>L. bulgaricus</i>
10°C	0	8.6 (0.3) ^a	8.6 (0.1) ^a	8.9 (0.1) ^a	9.0 (0.1) ^a
	15	8.6 (0.3) ^a	7.8 (0.2) ^b	8.7 (0.1) ^b	8.7 (0.1) ^b
	35	8.5 (0.1) ^a	8.1 (0.2) ^{ab}	8.6 (0.2) ^b	6.6 (0.1) ^d
	49	8.3 (0.1) ^a	7.1 (0.4) ^c	7.8 (0.2) ^c	7.4 (0.2) ^c
	63	6.7 (0.1) ^b	4.7 (0.2) ^d	7.0 (0.1) ^d	6.8 (0.1) ^d
	77	5.2 (0.2) ^c	3.5 (0.3) ^e	6.2 (0.2) ^e	5.4 (0.2) ^e
	91	4.2 (0.7) ^d	4.2 (0.1) ^f	5.9 (0.2) ^f	5.2 (0.5) ^e
20°C	0	8.6 (0.3) ^a	8.6 (0.1) ^a	8.9 (0.1) ^a	9.0 (0.1) ^a
	7	8.7 (0.1) ^a	6.6 (0.3) ^b	8.2 (1.2) ^{ab}	8.5 (0.2) ^b
	14	7.9 (0.1) ^b	5.6 (0.2) ^c	7.8 (0.4) ^b	6.7 (0.2) ^c
	21	...	...	6.5 (0.1) ^c	5.8 (0.1) ^d
30°C	0	8.6 (0.3) ^a	8.6 (0.3) ^a	8.9 (0.1) ^a	9.0 (0.1) ^a
	1	8.7 (0.1) ^a	6.6 (0.1) ^b	8.9 (0.1) ^a	9.0 (0.1) ^a
	2	8.7 (0.1) ^a	6.0 (0.1) ^c	8.9 (0.1) ^a	8.8 (0.5) ^a
	3	8.8 (0.2) ^a	6.2 (0.2) ^c	8.8 (0.2) ^a	6.9 (0.2) ^b

^{a,b,c,d,e,f}Means in the same column and temperature without a common letter differ ($P < 0.05$) according to the least significant difference multiple range test.

that the probability of acceptance after 91 d storage at 10°C was around 40% for the whole yogurt and only 15% for the skimmed yogurt. These samples were probably less acceptable because they presented higher asstringency, syneresis, or a chalky taste, although other physical properties measured were similar in both types of yogurt during the storage time studied.

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