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Investigation of the physicochemical and textural properties of yogurt made from milk with different somatic cell count

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ABSTRACT

In dairy cows, infection of the mammary gland leads to a significant increase in the somatic cell count (SCC) in the milk. This increase has a negative effect on the physical and chemical composition of the milk. The aim of this study was to analyze the effect of three different SCC content on the physicochemical and textural properties of yogurt during a 28-day storage period. For this purpose, yogurts were made from milk with three different SCC values: low (<100,000 cells/ml), medium (100,000-500,000 cells/ml) and high (>500,000 cells/ml). Analyses were performed on days 1, 7, 14, 21 and 28 of storage.

The SCC content of the milk had a significant effect on the pH value, titratable acidity (TA) and syneresis values of the yogurts, but no significant effect on water holding capacity (WHC), dry matter (DM) and fat content. The highest acidity values were found in yogurts made from milk with a low SCC content. The evaluations of the color parameters in the yogurts were only influenced by the storage time. The color parameters (L* a* b*) decreased during storage. In particular, significant effects were observed on the color parameters after 21 days of storage. The SCC content of the milk had no significant effect on the color parameters (L*, a*, C*) of the yogurts. The SCC content of the milk had a significant effect on the texture parameters (hardness, adhesiveness, cohesiveness, resilience). Yogurt made from milk with a higher SCC value had lower values for hardness and adhesiveness values, and consequently had unsatisfactory texture.

Keywords: Somatic cell count (SCC), Syneresis, Yogurt quality, Yogurt texture.

INTRODUCTION

Somatic cells (SC) are nano-sized cells found in milk and consist of dead epithelial cells from the mammary gland as well as leukocytes from the blood. Epithelial cells appear in milk as a result of the natural process of cell turnover and repair, although their number increases towards the end of lactation or after mastitis-related inflammation.[1,2] Additionally, the number of leukocytes increases, especially in case of mastitis-related infections or trauma. Leukocytes are immune cells that combat invading organisms. The ratio of epithelial cells to SCs varies between 35% and 70%; in normal milk, epithelial cells typically constitute 65–70 % of SCs.[1] Mastitis is an infectious disease characterized by an increased number of SCs.[3] In mastitis, the number of leukocytes in the milk increases and the proportion of epithelial cells decreases. Leukocytes are therefore a more important factor in the assessment of SCC. SCC is widely used for evaluating milk quality.[4] According to the Turkish Food Codex "Raw Milk and Heat-Processed Drinking Milk Communiqué," the maximum number of somatic cells in raw cow milk should be 500,000 per ml. Elevated SCC in milk is associated with mastitis however current knowledge on the relationship between milk quality and SCC is limited.[5]

Yogurt is the most widely consumed dairy product and is made by fermenting milk with *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus*. These two bacteria are lactic acid bacteria and are famous for their antimicrobial, antiviral and immunomodulatory properties and play a role in the treatment of many gastrointestinal diseases.[6–8] Possible health benefits of regular yogurt consumption include lowering cholesterol levels, aiding digestion, reducing weight gain, reducing gastrointestinal infections and risk of colon cancer, as well as preventing obesity, strengthening the immune system, preventing diabetes, promoting calcium absorption, and eliminating symptoms of lactose intolerance.[9–11]

Current knowledge of the relationship between elevated SCC in milk and the physicochemical quality, color characteristics and shelf life of yogurt is limited. The aim of the present study was to investigate the relationship between different SCC values in milk and yogurt quality. The study was formulated as plain yogurt. In the study, yogurts were produced from milk samples with three different SCC values, and an investigation was conducted into their physicochemical, textural and color properties.

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METHODS

Materials

The raw milk used in the study came from the herd at the Atatürk University Food and Livestock Application Centre. The cows were in the middle lactation and showed no clinical signs of mastitis. The analysis of milk batches from cows was conducted using a DeLaval cell counter (DeLaval International, Sweden). This device was used for the precise measurement of SCC value in milk. The raw milk samples were collected in three groups according to the SCC status: low SCC value (LSCC, < 100,000 cells/ml), medium SCC value (MSCC, 100,000 – 500,000 cells/ml) and high SCC value (HSCC, > 500,000 cells/ml). Commercial yogurt culture, YC-381, containing *S. thermophilus* and *L. bulgaricus* was purchased from Chr. Hansen (Hørsholm, Denmark). The cultures were freeze-dried and inoculated according to the manufacturer's recommendations.

Manufacture of Yogurts

Each batch of milk sample (2.5 L, per SCC value) was standardised by evaporation to 11 % non-fat milk solids. The standardised batches were heated to 90°C for 10 minutes and cooled to 43 ± 1 °C for the incubation phase. To inoculate the milk with the starter culture according to the manufacturer's recommendations, half of the sachet containing 50 units of starter culture YC-381 (Chr. Hansen, Denmark) was dissolved in 250 ml of sterilised milk and 12 ml was used to inoculate each 2.5 l batch. The inoculated milk was filled into sterile 170-ml glass jars and left at 43 ± 1°C for a final fermentation. The yogurt groups were coded according to the three different SCC values they contained: low SCC value (LCY), medium SCC value (MCY) and high SCC value (HCY). Fermentation was terminated when pH 4.5 was reached. After fermentation, the yogurt batches were transferred to a refrigerator at a temperature of 4 ± 1°C and kept and stored at this temperature. Each group consisted of 15 jars of yogurt and weekly samples were taken from different jars for physicochemical, microbiological and textural analysis.

Physicochemical analyses

The yogurt samples were analysed 24 hours after production and after storage for 7, 14, 21 and 28 days. DM and fat content were determined according to AOAC by the drying method and the Gerber method, respectively.[12] The pH was measured using a digital benchtop pH meter (pH 211, Hanna Instruments, Portugal). The TA and pH were determined according to Kurt et al.[13]. The TA was determined after mixing 10 g yogurt with the same volume of distilled water and titrating it with 0.1 N NaOH. The TA is calculated by the following formula 1.

$$\text{TA (\%)} = \frac{V(ml)*0.009}{m} x100 \tag{1}$$

V is the volume of 0.1 NaOH spent in the titration and m is the mass of the sample.

Syneresis is the separation of the whey phase from the yogurt, and WHC is the term for its retention. The syneresis of analysed yogurts was determined according to the drainage method described by Turgut and Diler.[11] For syneresis, 25 g of the sample was weighed and filtered through filter paper (Whatman No 1, UK) for 2 h at 4°C. The syneresis values were calculated using the following formula 2.

$$\text{Syneresis (\%)} = \frac{\text{Whey volume}}{\text{İnitial volume}} \times 100 \tag{2}$$

For water holding capacity, a 10 g sample was weighed and centrifuged (4500×g, 30 min at 4°C). The WHC was calculated using the following formula 3.

$$\text{WHC (\%)} = [1 - \frac{\text{Whey weigh}}{\text{initial weight}}] * 100 \tag{3}$$

Colorimetric Analysis

The color parameters were measured with a colorimeter (PCE XXM-20, PCE GmbH, Germany) and LED lighting at a viewing angle of 45°. The results were expressed as L* a* b* values using the CIELAB color system (L*a*b* color space). L* value indicates lightness and is expressed on a vertical axis with values from 0 to 100. The value zero means completely black, i.e., no light transmission, while 100 is completely white. The a* and b* values are chromaticity coordinates and characterize a point in the three-dimensional color space in which the colors flow from the red axis (a*) to the yellow axis (b*) and from the green axis (–a*) to the blue axis (-b*).[14] The chroma C* value stands for the clarity or saturation of the color. The line obtained by connecting the coordinate centre of the axes to a point in space is called chroma C*. ΔE is used to express the range of difference between the current color and the ideal whiteness. The ΔE and chroma C were calculated in the CIELCh color space using the following equations.[15]

$$(\Delta E) = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2} \tag{4}$$

$$C^* = \sqrt{(a^*)^2 + (b^*)^2} \tag{5}$$

$\Delta L = L_i - L_0$. The i stands for the observed value for each storage time and the index 0 for the references used. In the study, we have the color parameters of the white standard (L: 100)

Texture Analysis

Texture is a general term and encompasses the physical properties of the product that can be perceived by the human senses.[16] Texture properties were determined on the 1st, 7th, 14th, 21st and 28th day of storage using the TA-XTPlus Texture Analyzer (Stable Micro System, Surrey, UK) calibrated with a 500 g load cell and equipped with a cylindrical P/25P probe (Ø25 mm, perspex). The pre-test temperature of the yogurt samples was approximately 10°C. The penetration depth was set at 30 mm and the constant test speed of the probe was set at 1 mm/s during the compression and relaxation cycle.[17] Instrumental texture profile analysis (TPA) was used to determine texture parameters such as hardness, adhesiveness, cohesiveness, gumminess and resilience. Instrumental TPA analysis is the quantification of texture properties obtained from areas under force or force-time curves. TPA analysis is the quantification of tissue features obtained from areas under force or force-time curves. Hardness corresponds to the maximum force (N) in the first compression cycle in the TPA diagram and is used instead of firmness. Adhesiveness refers to the force required to overcome the adhesion between the probe and samples. Cohesiveness is defined as the internal stickiness of the samples. Gumminess is a textural characteristic of semi-solid foods that have low hardness and high cohesion. Force-time diagrams were plotted for these three texture parameters and the areas under the curves were determined using Exponent (4.0.9.0) software. All measurements were performed in two replicates.

Statistical Analysis

The results of the analyses on days 1, 7, 14, 21, and 28 were evaluated using univariate statistical analyses. All analyses were performed twice. The data obtained from the study were compared by Duncan's multiple range tests ($P < .05$) using SPSS 20.0 (IBM SPSS Corp., Armonk, NY, USA) software for Windows.

RESULTS and DISCUSSION

Measurement of pH and Titratable Acidity (TA)

Table 1 summarizes some physicochemical analysis results of the yogurt varieties produced from milk with different SCC values. The effect of storage time on pH and TA values was significant ($P < .05$). The TA value of the yogurt samples ranged between 1.164 % and 1.273 %. The lowest TA value was on day 1 and the highest was on day 28. The mean pH value, which was 4.28 at the beginning of storage, decreased to 4.19 on day 28. After day 21, however, the differences between the mean values were statistically significant ($P < .05$). The increase in the acidity of the yogurt samples during storage is due to the post-acidification process in which the yogurt bacteria become active during the storage period. Donkor et al.[18] reported that yogurt cultures are responsible for the decrease in pH and increase in the acidity of yogurt during storage. Najaf Najafi et al.[19] reported that the effect of SCC on the TA or pH of yogurt was significant ($P < .05$) after 7 days. The TA values in the study were higher than the results of Fernandes et al.[20].

The influence of the SCCs on the pH and TA was found to be significant ($P < .01$). Yogurts made from milk with high SCC content had higher pH values and lower TA values (Table 1). The mean TA values of the yogurts ranged from 1.172 % to 1.337 %. The lowest TA value was determined in MCY yogurt, while the highest was observed in LCY yogurt. Fernandes et al.[20] reported that high SCC content in milk had no significant effect on the acidity or pH of yogurt during storage. Vivar-Quintana et al.[21] reported that the pH of yogurt made from milk with high SCC content was significantly lower than the pH of yogurt made from milk with low SCC content. The mean pH of the yogurts ranged from 4.17 (LCY yogurt) to 4.28 (HCY yogurt). Fernandes et al. [20] reported that the TA values of yogurts made from milk with different SCC content ranged from 0.7% to 0.74%. In the present study, the TA values were found higher than these reported results. At the end of storage, the pH and TA values of HCY and MCY yogurts were statistically different ($P < .01$) from those of LCY yogurts. The SCC value had no significant influence on the pH of the yogurts up to day 7. The pH of yogurts in the study was lower than the results of Fernandes et al.[20].

Syneresis, Water Holding Capacity (WHC)

Syneresis is the separation of serum from the structure of yogurt and is considered a quality parameter for yogurt.[22] The influence of the storage period on the syneresis values was significant ($P < .05$).

Table 1. The changes in physicochemical characteristics of yogurt samples during storage

		Total Solids $\bar{x} \pm SD$	Fat $\bar{x} \pm SD$	Syneresis $\bar{x} \pm SD$	WHC $\bar{x} \pm SD$	LA $\bar{x} \pm SD$	pH $\bar{x} \pm SD$
Yogurt samples							
LCY		14.36 ± 0.533	3.92 ± 0.556	30.14 ± 3.307^{ab}	52.14 ± 4.834	1.337 ± 0.062^{a}	4.17 ± 0.056^{a}
MCY		14.92 ± 0.537	4.28 ± 0.553	27.94 ± 3.327^{a}	50.03 ± 4.834	1.172 ± 0.061^{b}	4.24 ± 0.055^{b}
HCY		14.66 ± 0.546	4.096 ± 0.570	32.41 ± 3.388^{b}	50.61 ± 4.954	1.181 ± 0.063^{b}	4.28 ± 0.057^{b}
Storage time (days)							
1		14.72 ± 0.536	3.79 ± 0.559	29.95 ± 3.323^{a}	46.90 ± 4.858^{a}	1.160 ± 0.062^{a}	4.28 ± 0.056^{a}
7		14.74 ± 0.540	4.16 ± 0.556	30.63 ± 3.333^{a}	58.82 ± 4.858^{b}	1.195 ± 0.061^{ab}	4.26 ± 0.056^{a}
14		14.63 ± 0.546	4.39 ± 0.553	30.75 ± 3.326^{ab}	49.57 ± 4.858^{a}	1.228 ± 0.062^{abc}	4.24 ± 0.054^{ab}
21		14.77 ± 0.538	4.02 ± 0.559	27.65 ± 3.343^{b}	49.21 ± 4.858^{a}	1.255 ± 0.063^{bc}	4.22 ± 0.056^{ab}
28		14.38 ± 0.543	4.13 ± 0.557	33.43 ± 3.323^{a}	52.28 ± 4.858^{ab}	1.273 ± 0.061^{c}	4.19 ± 0.056^{c}
Source	**D.F**						
SCC value	2	NS	NS	**	NS	**	**
Storage time	4	NS	NS	*	*	*	*
Error	27						
Total	34						

LCY= low SCC value; MCY= medium SCC value; HCY= high SCC value

^{a,b,c} means in the same column without a common superscript different ($P < .05$).

* is significant at 0.05; ** is significant at 0.01 probability levels; NS: not significant

The syneresis values ranged from 27.65% to 33.43%, with a decrease observed during the storage period. The lowest syneresis value was on day 21, and differences between the means were not statistically significant until day 28 ($P > .05$). The SCC content of the milk significantly affected the syneresis values of the yogurt varieties ($P < .01$). The yogurt produced from milk with medium SCC had the lower ($P < .01$) syneresis values than high SCC yogurt. The highest syneresis value was found in HCY yogurt (32.41%), this result indicates that the consistency of the HCY yogurt is weak or the gel is unstable. The syneresis values of HCY yogurt were not statistically different from LCY yogurt, but were significantly different from MCY yogurt ($P < .01$). Vivar-Quintana et al.[21] also reported similar results for yogurts produced from milk with high SCC content.

The influence of storage time on WHC values was significant ($P < .05$). The lowest WHC value was found on day 1, and WHC values increased a little after that, but the differences between the means were not significant after day 7 ($P > .05$). The WHC values of the yogurt varieties ranged from 50.03% to 52.14%. The WHC values of the yogurts made from milk with medium and high SCC content were lower than those of the LCY yogurts (Table 1). As the SCC content of the milk increased, the WHC value decreased, but the differences were not significant ($P > .05$). The MCY yogurt had the lowest WHC value, followed by the HCY yogurt. The WHC values in the study were similar to the results of Bakırcı et al.[23].

Color analysis

Color is one of the first characteristics perceived by the human senses. It is an important factor for the quality of yogurt and thus influences its acceptance[24] The color parameters of the yogurt varieties are shown in Table 2. The L* value, which expresses the lightness, was between 84.51 and 85.42 for all yogurt varieties. The L* values were very close to each other. The influences of SCC content and storage time on the L* values were not significant ($P > .05$). The highest L* value was found on day 1, and it was found that L* values decreased on the following days of storage. This result is consistent with the findings of Nguyen and Hwang et al.[25], who reported that the L* values of yogurts decrease during storage. Scibisz et al.[24] stated that L* values increased during storage of fruit yogurts.

The a* value, which expresses the redness/greenness, ranged between -32.49 and -38.51 for the yogurt varieties. Yogurts made from milk with high SCC content had lower a* values. The highest a* value was found for MCY yogurt and the lowest value for LCY yogurt. However, the differences between the mean values were not significant ($P > .05$). A general decrease in a* values was observed during the storage period. All yogurt varieties showed the loss of redness during storage by the change in a* values. This result is consistent with the findings of Scibisz et al.[24]. The influence of the SCC content was found to be significant only on the b* values ($P < .01$). Yogurts made from milk with the highest SCC content had the lowest b* values (Table 2). The b* value, which expresses yellowness, ranged from 7.83 to 9.68 for the yogurt varieties. The influence of the storage period on the b* values was significant ($P < .05$). The b* values ranged from 7.22 to 9.23 with a small decrease observed during the storage period. The lowest b* value was on day 28, but differences between the mean values were not important until day 28 ($P < .05$). The C* value, which expresses the saturation of color, was between 34.11 and 39.58 for the yogurt varieties. The C* values increased significantly ($P < .05$) during storage, indicating that the color became more vivid. The increase in the C* value is consistent with the increase in acidity of the yogurt during storage.

Textural Analysis

Textural properties are significant indicators of the yogurt quality.[16] The changes in TPA parameters (such as hardness, adhesiveness, cohesiveness, springiness) during storage are shown in Table 3.

Table 2. The color properties of the yogurt samples during storage

		L* $\bar{x} \pm SD$	a* $\bar{x} \pm SD$	b* $\bar{x} \pm SD$	ΔE $\bar{x} \pm SD$	C* $\bar{x} \pm SD$
Yogurt samples						
LCY		84.51 ± 4.449	-38.51 ± 6.963	8.60 ± 1.128^{a}	42.53 ± 7.566	39.58 ± 6.542
MCY		85.40 ± 4.456	-32.49 ± 6.973	9.68 ± 1.126^{b}	37.32 ± 7.566	34.11 ± 6.545
HCY		85.42 ± 4.559	-34.38 ± 7.135	7.83 ± 1.155^{a}	38.23 ± 7.753	35.31 ± 6.703
Storage time (days)						
1		87.81 ± 4.461	-29.03 ± 6.998^{a}	9.07 ± 1.133^{a}	32.99 ± 7.604^{a}	30.59 ± 6.574^{a}
7		84.05 ± 4.471	-37.11 ± 6.987^{ab}	9.23 ± 1.130^{a}	41.51 ± 7.602^{ab}	38.29 ± 6.576^{ab}
14		86.98 ± 4.473	-32.53 ± 6.978^{ab}	8.92 ± 1.132^{a}	36.39 ± 7.604^{ab}	33.96 ± 6.572^{ab}
21		83.46 ± 4.468	-36.28 ± 6.967^{ab}	8.46 ± 1.129^{a}	41.09 ± 7.606^{ab}	37.28 ± 6.578^{ab}
28		83.47 ± 4.470	-40.15 ± 6.989^{b}	7.22 ± 1.130^{b}	44.05 ± 7.601^{b}	40.81 ± 6.573^{b}
Source	**D.F**					
SCC value	2	NS	NS	**	NS	NS
Storage time	4	NS	*	**	*	*
Error	27					
Total	34					

LCY= low SCC value; MCY= medium SCC value; HCY= high SCC value

^{a,b,c} means in the same column without a common superscript different ($P < .05$).

* is significant at 0.05, ** is significant at 0.01 probability levels, NS: not significant

Table 3. The textural properties of yogurt samples during storage

		Hardness $\bar{x}$ ± *SD*	Adhesiveness $\bar{x}$ ± *SD*	Springiness $\bar{x}$ ± *SD*	Cohesiveness $\bar{x}$ ± *SD*	Gumminess $\bar{x}$ ± *SD*	Resilience $\bar{x}$ ± *SD*
Yogurt samples							
LCY		25.20 ± 1.878^{a}	-48.20 ± 12.079^{a}	0.96 ± 0.011	0.83 ± 0.025^{a}	21.002 ± 1.619^{a}	0.17 ± 0.053^{a}
MCY		25.14 ± 1.876^{a}	-47.39 ± 12.077^{a}	0.96 ± 0.012	0.83 ± 0.025^{a}	20.89 ± 1.616^{a}	0.16 ± 0.052^{a}
HCY		22.16 ± 1.925^{b}	-25.90 ± 12.377^{b}	0.97 ± 0.010	0.86 ± 0.026^{b}	19.560 ± 1.658^{b}	0.23 ± 0.054^{b}
Storage time (days)							
1		21.88 ± 1.887^{a}	-28.62 ± 12.139^{a}	0.97 ± 0.012	0.82 ± 0.025^{a}	18.398 ± 1.627^{a}	0.21 ± 0.063^{a}
7		24.03 ± 1.878^{ab}	-31.03 ± 12.130^{a}	0.97 ± 0.010	0.86 ± 0.025^{b}	21.011 ± 1.627^{b}	0.23 ± 0.062^{a}
14		22.46 ± 1.882^{ab}	-33.87 ± 12.139^{a}	0.96 ± 0.011	0.83 ± 0.025^{a}	18.984 ± 1.627^{a}	0.19 ± 0.060^{ab}
21		24.38 ± 1.880^{ab}	-41.88 ± 12.134^{a}	0.97 ± 0.012	0.86 ± 0.025^{b}	21.314 ± 1.627^{b}	0.20 ± 0.061^{ab}
28		26.64 ± 1.877^{b}	-56.66 ± 12.136^{b}	0.96 ± 0.011	0.84 ± 0.025^{ab}	22.707 ± 1.627^{b}	0.14 ± 0.062^{b}
Source	**D.F**						
SCC content	2	**	**	NS	*	*	**
Storage time	4	**	**	NS	*	**	*
Error	27						
Total	34						

LCY= low SCC value; MCY= medium SCC value; HCY= high SCC value

^{a,b,c} means in the same column without a common superscript different (P < .05).

* is significant at 0.05, ** is significant at 0.01 probability levels, NS: not significant

The hardness and adhesiveness increased during storage and the differences between the mean values were significant (P < .05). The lowest hardness value was found on day 1, and the hardness of yogurts increased inversely to the syneresis values on the following days of storage. Hardness is the most important parameter for evaluating yogurt texture and is regarded as a measure of yogurt firmness.[26] The hardness values ranged from 22.16 to 25.20, depending on the SCC values. The yogurt made from milk with a high SCC had the lowest hardness values. The lowest hardness value was found in HCY yogurt. This result indicates that the consistency of the HCY yogurt is weak or the gel firmness is not very strong. The decrease in hardness values associated with the increase in SCC content was statistically consistent. The hardness values in the study were lower than the results of Mudgil et al.[27] and Kose et al.[26].

Adhesiveness refers to the strength required to overcome the attractive forces between the surface of the food and the surface of the material in contact with it (probe). The lowest hardness value (-28.62) was found on day 1, and the highest value (-56.66) was found on the last day of storage. The SCC content of the milk significantly affected the adhesiveness value of the yogurt varieties (P < .05). The mean adhesiveness value of the yogurt varieties ranged from -25.90 to -48.20, depending on SCC values of milk. The yogurt made from milk with the highest SCC content had the lowest adhesiveness value. The adhesiveness value of LCY yogurt was not significantly different from MCY yogurt but was significantly different from that of HCY yogurt (P < .01). Yogurt made from milk with high SCC had the lowest hardness and adhesiveness, while the highest values for hardness were observed in LCY yogurt. The adhesiveness values we found are consistent with the findings of Mudgil et al.[27]. Cohesiveness refers to the force required to overcome the internal stickiness caused by the structure of the food. The storage time had a significant effect on the cohesiveness values of the yogurts (P < .05). The lowest cohesiveness value (0.82) was found on day 1 and the highest value (0.86) on day 7. The SCC content of the milk significantly affected the cohesiveness values of the yogurt varieties (P < .05). The cohesiveness value of yogurts ranged from 0.82 to 0.86, depending on the different SCC values. The yogurt made from milk with a medium SCC value had the lowest cohesiveness values. The cohesiveness values of the MCY yogurt were not statistically different from those of the LCY yogurt but were significantly (P < .01) different from those of the HCY yogurt. It is possible that yogurts with high adhesiveness and low cohesiveness values would stick to the probe during the test. However, since the cohesiveness values were low, there was no sticking to the probe. In the present study, the cohesiveness values were higher than the findings of Domalaga et al.[16].

CONCLUSION

The results showed that the effects of different SCC levels in the milk on the physicochemical and textural properties of the yogurts were important. The pH, TA and syneresis values of the yogurt varieties are significantly influenced by the SCC value of the milk. In contrast, the WHC value was not significantly affected by the SCC of the milk. With increasing SCC content in the milk, the pH of the yogurt varieties increased and the TA values decreased during storage. A high SCC content of the milk led to a significant reduction in the stability of the yogurt and the serum retention capacity.

It was found that the color parameters (L* a* C*) were not significantly affected by the SCC value of the milk. Increasing the SCC value of the milk above 500,000 cells/ml had no significant effect on the L*, a* and C* values of the yogurts. The SCC value of the milk of more than 500,000 cells/ml had a significant negative effect on the texture parameters of the yogurts. A high

SCC value of the milk led to a significant reduction in the hardness and adhesiveness value of the yogurt. Yogurt from milk with the highest SCC value showed the lowest values for hardness and adhesiveness, while the highest values were observed in LCY yogurt. Based on these results, we can say that the SCC in cow's milk for yogurt production should not exceed 500,000 cells/ml, especially with regard to texture quality.

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