 DOI: /10.5513/JCEA01/20.2.2058

Chracteristics and optimization of Runi hiz production-a forgotten traditional turkish product

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ABSTRACT

Runi hiz or Runi sor is a traditional Turkish product made of a mixture of butter and molasses. The aim of this research was to describe the characteristic properties of Runi hiz and to optimize the production by adjusting butter ratio of the product. For this aim, different butter ratio determined at preliminary study was used in the production of Runi hiz. In this context, the product containing 50 (A), 54 (B) and 58% (C) butter ratios were produced according to the industrial manufacturing procedure and stored at 4±1 °C for 90 days. Also, it was produced in traditional way (G). According to statistical result, titratable acidity and peroxide values of the samples increased significantly, while hydroxymethylfurfural value and redness were decreased as a parallel to the increase in the ratio of butter of the product. Also it was determined that the L* value of the samples decreased, while titratable acidity and peroxide values of the samples increased, during the storage period. Traditional (G) and industrial A samples were preferred by panelists. It was concluded that Runi hiz could be produced industrially with butter ratio lower than 50% and stored safely at +4 °C at least for 90 days.

Keywords: butter, hydroxymethylfurfural, molasses, Runi hiz, traditional products

INTRODUCTION

Turkey is a very rich country in terms of traditional foods. However only some of these products have been commercialized and produced industrially. Most of these products have been almost forgotten because of increased immigration from the village to the city hence their production and comsumption are limited to family farmsteads. It is thought that the registration of this rich heritage, standardized production on an industrial scale and their export will make a great contribution to the economy of the country. In order for these contributions to take place, scientific work on traditional products should be encouraged and supported.

Runi hiz or Runi sor is a traditional product made of a mixture of butter and molasses. It is produced in Adiyaman, Şanlıurfa, Mardin and Diyarbakir cities of Southeastern Anatolia, especially in high altitude plains where animal husbandry and grape cultivation are common. This product is in a cream form and it resembles grape molasses in terms of texture and colour, and molasses of Zile district in terms of consistency.

The traditional production of Runi hiz usually involves the addition of grape molasses on melted butter or heating the mixture of butter and molasses to the boiling point and subsequently cooling to the room temperature. The final product is filled into the skin bags or wooden barrels and after sealing them tightly they are kept in a cool place. It is usually produced in September-October and it is consumed after a storage period of 2-3 months. Runi hiz is an emulsified product with a brown colour and pleasant flavour and mostly consumed at breakfast together with the Çökelek, a traditional Turkish soft cheese.

Due to the high fat and sugar content, the energy value of this product is very high (Taneli, 1990). This product also contains important vitamins and minerals including E, B1, B2, B3 (Ergin, 1978; Gehardt and Thomas, 2006; Samur, 2008) and Ca, Na, K, Mg and Cr (Kavas, 1990; Batu, 1993; Üstün and Tosun, 1997; Rainer and Heiss, 2004). Moreover, it is a natural product that supplies the known positive effects of molasses and butter on human health due to its nutritional value (Cherian et al., 2002; Rainer and Heiss, 2004; Batu, 2006; Samur, 2008).

Identification of the characteristics of traditional products, their introduction to the market and industrial production will contribute to the economy of the region and country. In this context, the traditional product Runi hiz was produced using different butter ratios and it was aimed to investigate some characteristic features of this product during the storage period.

MATERIALS AND METHODS

Materials

The main components involved in Runi hiz production are cow milk butter (Yörsan Food Inc, Turkey) and grape molasses (Şitoğlu Molasses Inc, Turkey). Soy lecithin (Sosa, Spain) was also used as an emulsifier with the aim of preventing possible phase separation in industrial production.

The titratable acidity (lactic acid percentage - LA%), pH, acid number (mg KOH/g) and whiteness (L*), redness (a*) and yellowness (b*) values of the butter used in Runi hiz production is shown in Table 1. Two types of molasses, industrial and traditional, were used in the production and some of their specifications are given in Table 1.

Methods

Runi hiz production

Runi hiz was produced in two different ways; conventional production (Figure 1) and potential industrial production (Figure 2). Based on the result of personal

Table 1. The values of physico-chemical and colour parameters of molasses and butter

Specifications	Industrial molasses	Traditional molasses	Butter
Hydroxymethylfurfural (HMF) (mg/kg)	57.8	35.13	-
pH	4.72	4.55	4.32
Titratable acidity (Lactic acid %)	0.07	0.05	0.27
Acid number (mg KOH/g)	-	-	1.12
Whiteness (L*)	18.2	21.4	78.71
Redness (a*)	0.3	5.97	3.78
Yellowness (b*)	0.77	5.8	24

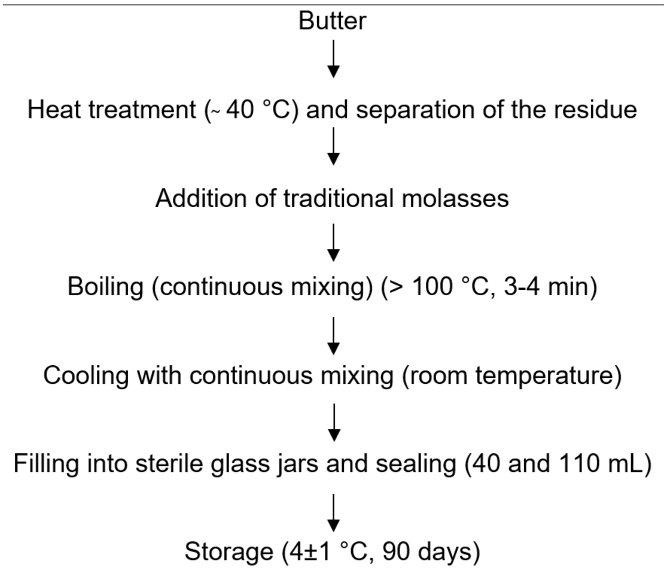

Figure 1. The production flow chart of the traditional Runi hiz

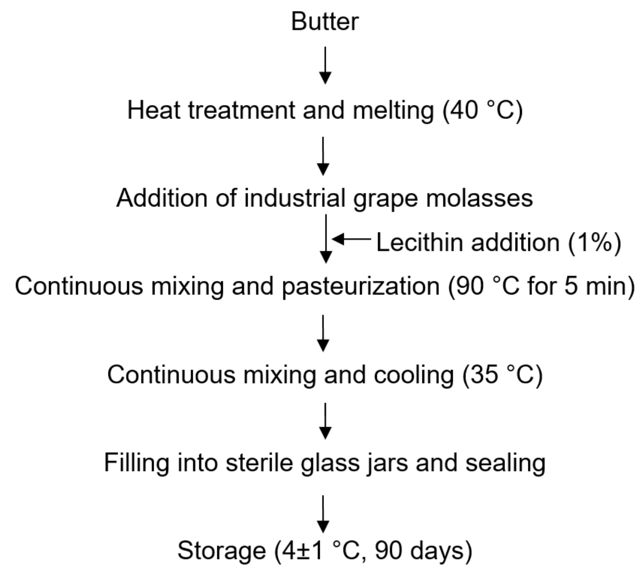

Figure 2. The production flow chart of industrial Runi hiz

interviews with the local population, it was concluded that 50-60% of butter was used in the production of Runi hiz. Preliminary tests showed that the traditional Runihiz with 54% butter was preferred the most. Therefore, traditional Runi hiz contained 54% butter while, industrial one contained 50, 54 and 58% butter. In the traditional production of Runi hiz: first butter was melted in a stainless-steel pot (5 L) which included the sediment in the bottom was removed. After adding the molasses, heat treatment was applied with stirring until boiling. The mixture thus obtained was cooled to room temperature (stirring was applied during cooling to prevent phase separation) and after sterile glass jars (110 and 40 mL) were filled under hygienic conditions, they were closed tightly. For potential industrial production, a double-walled stainless steel (Chromium and nickel mixture) boiler (15 L capacity, Intermak Inc., Konya) capable of heating / cooling and mixing was used. In this production, firstly butter was transferred to the boiler and melted. Soy lecithin was then added to the melted butter and then molasses was added under stirring. The mixture was pasteurized at 90 °C for 5 minutes, then cooled to 35 °C and filled into sterile jars via a filling valve. The product was stored at 4 ± 1 °C for 90 days. The study was organized in 3 replications.

Analyses

Biochemical analyses and yeast-mould counts of the Runi hiz were performed on the 1st, 20th, 40th, 60th and 90th days of the storage period. The pH was measured by directly immersing the probe in the Runi hiz samples (Digital pH meter; WTW pH-340i, Germany) (Turkish Standards Institute, 1974). Titratable acidity (LA%) values were calculated by titration with 0.1 N KOH (International Fruchtsaft Union, 1968). Carrez I and II solutions were used for the detection of the hydroxymethylfurfural (HMF) concentrations of the samples, and the final filtrate was read at 550 nm (Spectrophotometer; Libra, Biochrom, UK) (Turkish Standards Institute, 2002). Peroxide values were calculated by titration of oil extracted from Runi hiz samples (Atamer, 1993). To detect yeast and mould counts, Potato Dextrose Agar (PDA; Merck, Darmstadt, Germany) adjusted to pH 3.5 via tartaric acid (10%), was used and the plates were incubated at 25 °C for 5 days (Atamer, 1993). L* (brightness), a* (red-green) and b* (yellow-blue) colour values were determined with a Hunter Lab (Hunter lab ultra scan xe spectrocolorimeter, S/N: U3745, USA) instrument on the 1st, 40th and 60th days of the storage period (Kramer and Twigg, 1984). The sensory qualities of the Runi hiz were evaluated by a group of 8 trained panelists.

The data obtained from the analyzes were evaluated by one/two-way analysis of variance using the MINITAB statistical software and the significant differences between the averages were subjected to the Tukey multiple comparison test (Yıldız and Bircan, 1994). Sensory evaluation data were subjected to square root transformation prior to statistical analysis.

RESULTS AND DISCUSSION

Physico-chemical parameters

According to the statistical analysis evaluations (Table 2), differences between pH, titration acidity, peroxide and HMF values of Runi hiz samples were found to be very significant (P<0.01) in terms of fat ratio and prodution method. While differences between titratable acidity, peroxide and HMF values were very significant in terms of storage period, differences between pH values were found to be significant (P<0.05). The differences between titratable acidity and peroxide values were very significant (P<0.01) and the difference between HMF values was significant (P<0.05) in terms of fat ratio x storage period interaction.

pH

The increase in the ratio of fat in industrial-produced (A, B and C) Runi hiz samples did not cause a significant change in the pH value. However, the traditional Runi hiz (G) pH value was found to be significantly lower than the other samples (Table 2). This may be due to the low pH value of the traditional molasses used in the production of traditional products. Karaca et al. (2012) reported that the pH value generally increased as the molasses ratio of

Table 2. The mean values of the physico-chemical parameters of the Runi hiz

		Adjusted mean squares			
		pH	Titratable Acidity (LA%)	Peroxide number (meq O_2/kg)	HMF (mg/kg)
Butter ratio (%)	50 (A)	4.767^{a}	0.225^{b}	1.189^{c}	67.067^{b}
	54 (B)	4.765^{a}	0.228^{b}	1.304^{b}	63.063^{c}
	58 (C)	4.673^{a}	0.249^{a}	1.403^{a}	61.4^{c}
	54 (G)	4.566^{b}	0.142^{c}	1.281^{b}	78.23^{a}
	Standard error	0.026	0.002	0.009	0.738
	Significance	**	**	**	**
Storage period (days)	1	4.616^{b}	0.135^{e}	0.448^{e}	68.175^{b}
	20	4.667^{ab}	0.187^{d}	1.005^{d}	69.493^{ab}
	40	4.749^{a}	0.224^{c}	1.437^{c}	71.027^{ab}
	60	4.743^{a}	0.249^{b}	1.698^{b}	72.253^{a}
	90	4.671^{ab}	0.261^{a}	1.882^{a}	56.253^{c}
	Standard error	0.029	0.002	0.01	0.825
	Significance	*	**	**	**

^{a,b,c,d,e} The differences are statistically significant between means marked with different in the same column (*P<0.05, **P<0.01). A, B and C - containing 50, 54 and 58% butterfat, respectively; G - traditional product containing 54% butter.

set type yoghurt with molasses increased whereas Celik and Bakirci (2003) reported that the pH value decreased as molasses ratio of yogurt increased, since the pH of the molasses they used was lower than the pH value of the yogurt.

The average pH value of the Runi hiz increased until the 40th day of storage, then tended to fall but the value at the end of the storage period was higher than the initial pH value (Table 2). This may be caused by alkaline substances that are formed as a result of oxidation and maillard reaction. During the storage period, the pH showed a similar pattern in all samples except the G sample (Figure 3).

Titratable acidity

The titratable acidity increased as the fat ratio increased in the industrial products (A, B and C) (Table 2). This may be due to the higher titratable acidity of the butter.

The titratable acidity of the Runi hiz produced by the conventional method (G) was found to be lower than those of the other samples. In the sample G, the titratable acidity was 0.132% on average, while it was 0.217% in industrial B with the same fat content. This may be due to the lower titratable acidity of traditional molasses. Also, it could be related to the removal of the sediments formed by either denaturation of the proteins that are effective on the acidity of butter or loss of solubility of the minerals due to the heat treatment applied during the production of the conventional product.

As seen in Table 2, the average titratable acidity values of the products increased with the progression of the storage period. It was reported that titration acidity of fat-containing food products increased during storage due to the free fatty acids formed by the activity of the indigenous enzymes (Ergin, 1978; Özünlü and Koçak, 2010). Several groups of researchers reported that titratable acidity of yogurts containing molasses (Celik

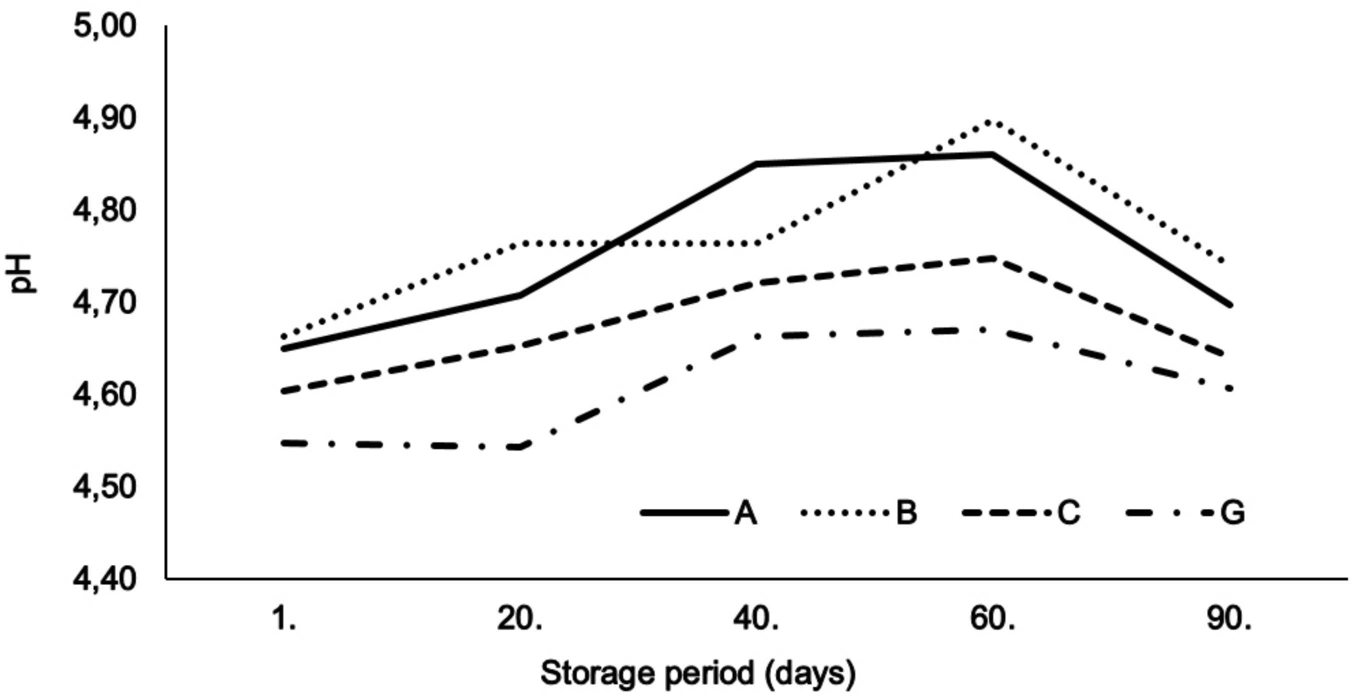

Figure 3. The production flow chart of the traditional Runi hiz Change of pH values of Runi hiz samples during storage period at 4 °C (A – product with 50% butter; B – product with 54% butter; C – product with 58% butter; G – traditional product with 54% butter)

and Bakirci, 2003; Karaca et al., 2012) and plain butter (Meydanoğlu, 1985; Bakırcı et al., 2004; Gürsel et al., 2006) increased during the storage period.

Titratable acidity of all samples increased during storage. However, the increase in titratable acidity value of G sample was found to be lower in comparison to the other samples (Figure 4). The titratable acidity at the beginning of storage of the G sample (0.094 % LA) increased to 0.181% LA on the 90th day of storage whereas the titratable acidity of B with the same fat ratio was 0.15% LA at the beginning of storage and 0.276% LA at 90th day of storage. This could be attributed to either the low the initial titratable acidity of the conventionally produced G sample or the high heat treatment applied (>100 °C) in the production. High temperature causes a considerable damage to the lactic acid bacteria. Thermophilic lactic acid bacteria in dairy products lose their activity by heat treatment at 70-90 °C, whereas temperatures above 100 °C are required for inhibition of thermoduric lactic acid bacteria (Sezgin et al., 2007). Similarly, titratable acidity in yogurts containing molasses at different ratios was reported to increase during the storage period (Celik and Bakirci, 2003).

Peroxide number

As shown in Table 2, the average peroxide level of the Runi hiz increased as the fat ratio increased. Peroxide is a parameter showing the level of degradation in oils and is formed by oxidation in fatty acid chains in unsaturated fats (Atamer, 1993). Therefore, the number of peroxides is a chemical property that depends on the fat content in the food. The average peroxide values of Runi hiz samples increased during the storage period (Table 2). This indicates that oxidation occurs in the unsaturated fatty acid chains due to the presence of oxygen in the environment, and as a result, peroxides are formed increasingly over the storage period (Atamer, 1993). Meydanoğlu (1985) reported that peroxide number increases in butter samples stored at 4 °C in parallel with the storage period. Bakırcı et al. (2004) also noted that peroxide numbers of butters stored under refrigerator conditions increased during storage. In another study, the number of peroxides in butter was reported to be some what lower than the value at the beginning of storage at the end of 30 days of storage and it was stated that the peroxides were intermediates and converted to other substances by further oxidation (Gürsel et al., 2006). Peroxides are formed during storage

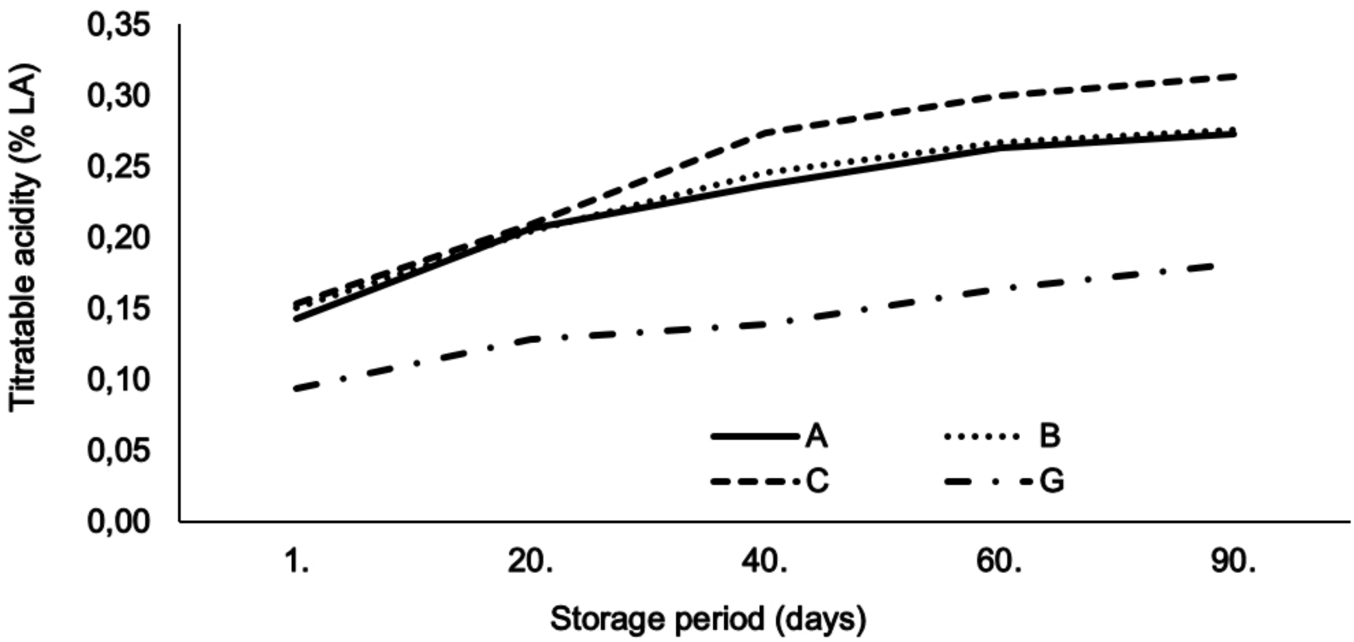

Figure 4. Change of titratable acidity of Runi hiz samples during storage period at 4 °C (A – product with 50% butter; B – product with 54% butter; C – product with 58% butter; G – traditional product with 54% butter)

depending on the oxygen and other conditions present in the environment. However, it should be noted that peroxide is an intermediate product, when the rate of advanced oxidation is higher than the rate of oxidation, the number of peroxides in the environment decreases with respect to the initial amount of peroxide.

During storage the peroxide values of all samples were increased and at the end of the 90-day storage period the highest number of peroxide was detected in sample C with 2.003 meq O_2/kg (Figure 5). It was also determined that the increase in the number of peroxides during storage was the highest in the product with the highest fat ratio, while it was less in the product with the lower fat ratio. To put it in numerical terms, the number of peroxides on the 90th day of storage of A sample with 50% fat reached 4.13 times the initial value, while it reached 4.42 times in the sample of C with 58% fat. Since the Turkish Butter Standard allows the concentration of peroxide to be up to 5 meq O_2/kg butter (Turkish Standards Institute, 1989), these values do not cause any negative effect on the quality of the test products thus they can be stored for more than 90 days.

Hydroxymethylfurfural (HMF)

As the fat content of industrial type Runi hiz increased, HMF value decreased (Table 2). It can be said that this situation is caused by the decrease of the molasses ratio in the product. HMF is formed by heat treatment due to lactose in milk and its products, but it is known that the amount of HMF formed is very low. In this context, HMF values of pasteurized and UHT milk are reported to change between 10.52 and 16 µmol/ L (Metin, 1996). In butter this amount is much lower. On the other hand, HMF is a very important quality criterion in molasses. In the Turkish Food Codex Grape Molasses Notice, it is stated that HMF value of liquid grape molasses must be ≤75 mg/kg (Republic of Turkey Ministry of Agriculture and Forestry, 2007), and significant amounts of HMF are formed by heat treatment (Batu, 2006). When the mean HMF values of the G and B samples (having equal fat ratios) are examined, it is seen that the mean HMF value of the G sample (78.23 mg/kg) is higher than the value of the B sample (63.063 mg/kg) (Table 2). This can be said to be due to the high heat treatment (>100 °C) applied during the production of the traditionally produced G sample. It was reported that molasses produced by conventional

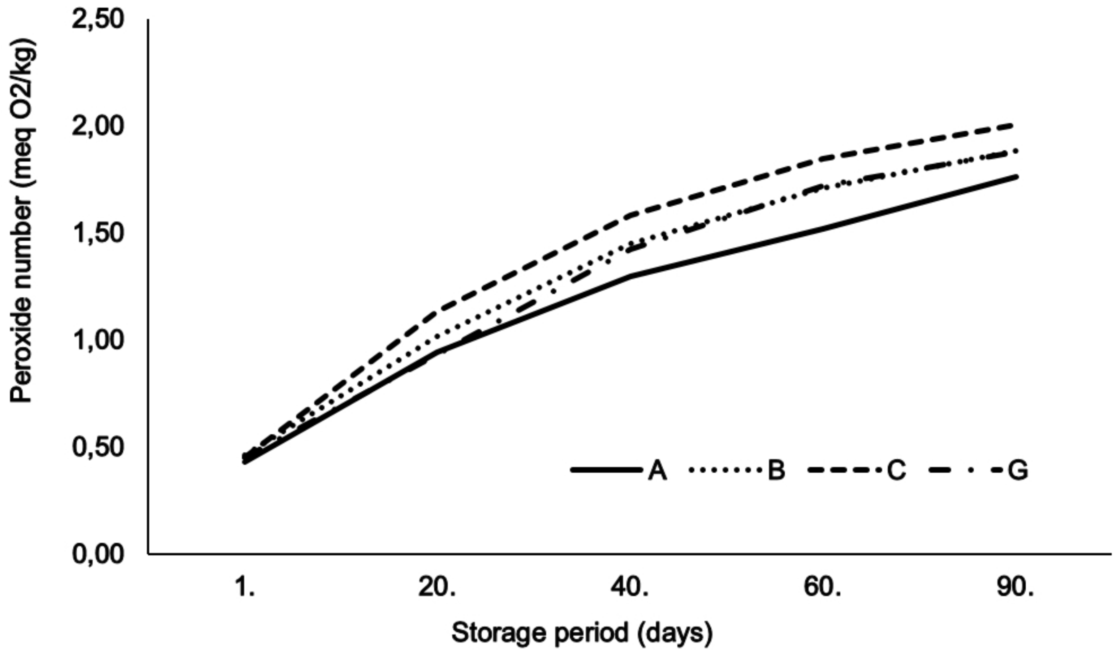

Figure 5. Change of peroxide number of Runi hiz samples during storage period at 4 °C (A – product with 50% butter; B – product with 54% butter; C – product with 58% butter; G – traditional product with 54% butter)

methods at higher temperatures have higher HMF contents than industrial molasses produced by vacuum application at lower temperatures (Batu, 1991).

The average HMF value increased up to the 60th day of storage in Runi hiz samples and on the 90th day of storage it was found that this value fell below the value at the beginning of storage. Similarly, it was reported that in mulberry molasses stored for 90 days in refrigerator conditions, the content of HMF increased at 45 days of storage and decreased at 90 days (Batu et al., 2007). HMF occurs as an intermediate product in acidic media (pH≤5); as a result of reaction of hexoses with amino acids or during Maillard reactions. However, HMF may increase or decrease during storage since HMF and other intermediates can then be transformed into a variety of end products including melanoidins (Morales et al., 1997; Van Boekel, 2006).

According to the Turkish Food Codex Grape Molasses Notice, the HMF content of solid grape molasses can be up to 100 mg/kg (Republic of Turkey Ministry of Agriculture and Forestry, 2007). During the storage period, the HMF contents of Runi hiz samples were found to be lower than this value.

The researchers reported that HMF values increased during storage in molasses stored at different temperatures (Higher HMF values at higher temperatures) (Bozkurt et al., 1998; Tosun, 2004; Gungor and Sengul, 2008; Oral et al., 2012; Toker et al., 2013). Unlike these, it was reported that the content of HMF in grape molasses stored in refrigerator conditions decreased during storage (Karagöz, 2007). Özhan et al. (2010) reported that HMF content increased with storage in carob molasses stored under refrigerator conditions. In the light of these studies, it is concluded that the storage temperature and the type of molasses are considerably effective on the formation of HMF. In general, it can be said that storing at low temperatures is more appropriate to keep the HMF content at lower levels.

Generally, as the fat ratio in the trial Runi hiz product increased, the rate of increase in the HMF content decreased during the 20th, 40th, and 60th days of the storage period, and on the 90th day of storage, the rate of decrease in the HMF content with respect to the beginning of storage increased (Figure 6). In this case, it is plausible to say that the change in the content of HMF is mainly related to molasses.

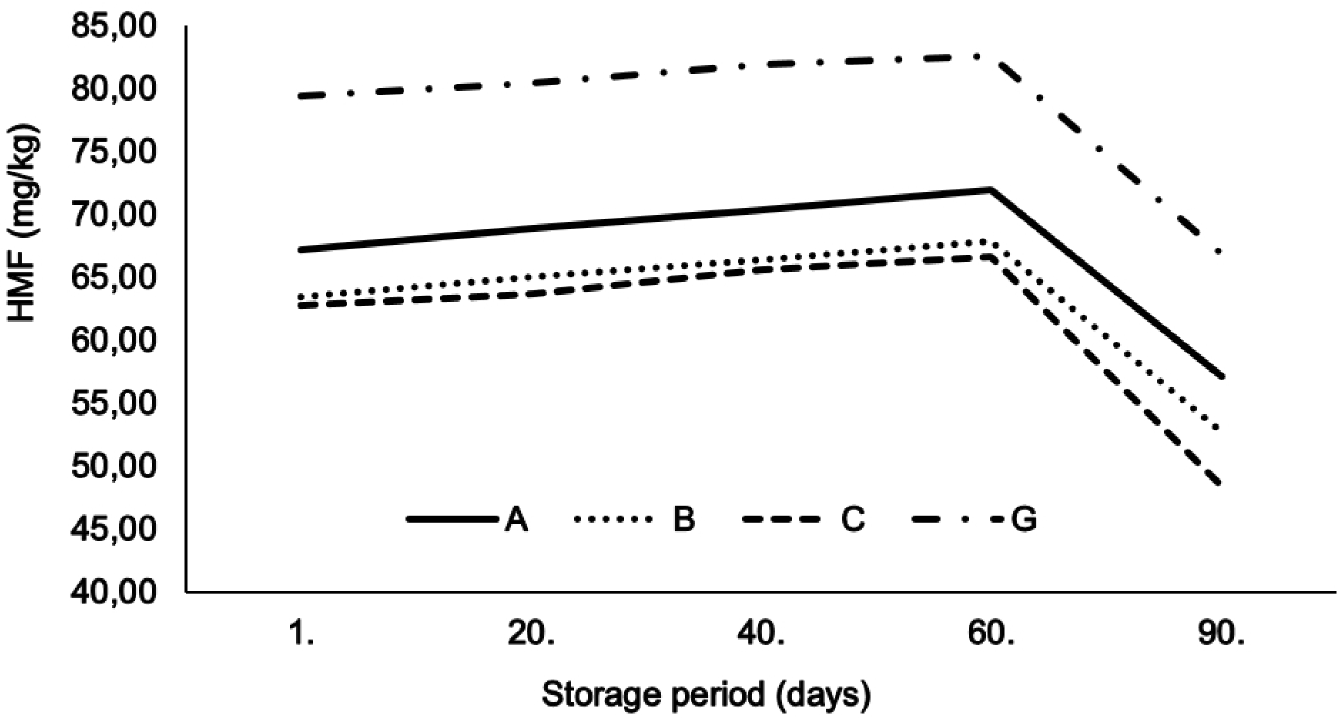

Figure 6. Change of HMF values of Runi hiz samples during storage period at 4 °C (A – product with 50% butter; B – product with 54% butter; C – product with 58% butter; G – traditional product with 54% butter)

Colour parameters

The difference between the a* values of Runi hiz samples in terms of fat ratio and the difference between the L* values in terms of storage period was found to be important at P<0.01 level. The difference between L* values and between a* values was found to be important (P<0.05) in terms of fat ratio x storage period interactions.

In parallel with the increase in the fat ratio, a very significant increase in the a* colour value of traditional Runi hiz (G) (Table 3). The red colour (a* value) of the traditional type Runi hiz sample (G) was more dominant, probably due to the molasses used.

During the storage period, the L* value of the Runi hiz colour values decreased considerably. Reduction in brightness, red and yellow colour values during storage can be attributed to the formation of HMF by disintegration of the monosaccharides present in the grape molasses, or the conversion of leukoanthocyanins into coarse phlobaphenes or the occurrence of maillard products by the reaction of reducing sugars with amino acids (Artık, 1988). Similarly, in molasses, the L* value was reported to decrease during the storage period (Tosun, 2004; Kayışoğlu and Demirci, 2006; Gungor and Sengul, 2008; Özhan et al., 2010). Whereas Batu et al. (2007) reported that L* value increased during storage period in grape molasses. In another study, it was reported that there was no significant change in L*, a* and b* values during storage (14 days) in set type yogurt containing molasses at different ratios (Karaca et al., 2012).

As the fat ratio increases, the amount of change in the L* and a* values of Runi hiz samples decreased during the storage period in general. Also, in general, L*, a* and b* values were found to be lower during the storage period in the sample with the highest molasses ratio (A) (Figures 7, 8, 9). Similarly, Karaca et al. (2012) reported that the L* values were the lowest for yoghurt samples containing the highest concentration of molasses during the storage period.

Avarage a* and b* values of the traditional product (G sample) were higher than the possible industrial products at the beginning of the period and also these values increased until the 40th day of the storage then tended to fall for the rest of the storage period. Due to the

Table 3. The mean values of the colour values of the Runi hiz

		Adjusted mean squares		
		Whiteness (L*)	Redness (a*)	Yellowness (b*)
Butter ratio (%)	50 (A)	26.19	8.403[b]	12.217
	54 (B)	28.99	8.669[b]	13.481
	58 (C)	27.862	8.872[b]	13.206
	54 (G)	27.699	10.033[a]	14.044
	Standard error	0.797	0.208	0.642
	Significance	ns	**	ns
Storage period (days)	1	30.883[a]	9.027	14.213
	40	26.498[b]	9.193	12.896
	60	25.675[b]	8.762	12.602
	Standard error	0.69	0.18	0.556
	Significance	**	ns	ns

[a, b] The differences are statistically significant between means marked with different letters in the same row (*P<0.05, **P<0.01); ns - non significant. A, B and C – products containing 50, 54 and 58% butterfat, respectively; G - traditional products containing 54% butter.

boiling step (>100 °C, 3-4 min) applied in the traditional production, Maillard reaction likely occurred intensively and resulted in more coloured products compared to the mild heat application (90 °C, 5 min) in the industrial production (Hidalgo and Zamora, 2000).

Yeast and moulds

Moderately moist foods (a_w = 0.6-0.9) are said to be suitable for yeast-mould growth (Beuchat, 1978). It was stated that the average water activities of butter and grape molasses were 0.929 and 0.757, respectively makes Runi hiz a moderately moist food (Özay et al., 1993). Moreover, given the high sugar composition and low acidity level, Runi hiz is a suitable environment for development of yeast and moulds. However, no yeast or moulds (<10) were detected in the samples during the storage period for 90 days. Production under hygienic conditions at high temperatures, use of sterile glass jars that do not allow oxygen permeation and finally storage at +4 °C are possible reasons inhibited the development of yeasts and moulds. In this case, it can be said that foodstuffs must be produced under suitable sanitation conditions and packaged in such a way that they do not come into contact with air in order to prevent moulds. In this context, Batu and Yıldırım (2010) reported that they did not observe any mould growth in walnut summer halvah, a sugary product, on the 120th day of the storage unless they were stored at 30 °C.

Sensory parameters

According to the statistical evaluations (Table 4), the difference between the odor values of Runi hiz samples in terms of fat percentage was significant (P<0.05). The differences between colour-appearance, texture-consistency, taste-flavour, taste in mouth and general acceptability values were very significant (P<0.01).

Runi hiz (G sample), produced by the traditional method, received the highest scores in terms of colour-appearance, taste-flavour, taste in mouth and general acceptability but it was smoother than the other samples in terms of structure-consistency. It is believed that the G sample had high scores for taste-flavour and taste in the

Table 4. The mean values of the sensory parameters of the Runi hiz

	Adjusted mean squares					
Butter ratio (%)	Colour and appearance (2.24)	Smell (3.16)	Structure and consistency (2.24)	Taste and aroma (3.16)	Taste left in the mouth (3.16)	General acceptability (2.24)
50 (A)	2.01[b]	2.657[ab]	1.996[ab]	2.63[b]	2.639[ab]	1.967[b]
54 (B)	1.916[bc]	2.446[b]	2.051[a]	2.507[b]	2.417[bc]	1.767[c]
58 (C)	1.772[c]	2.497[ab]	2.118[a]	2.407[b]	2.375[c]	1.727[c]
54 (G)	2.17[a]	2.798[a]	1.922[b]	2.931[a]	2.795[a]	2.118[a]
Standard error	0.04	0.091	0.033	0.06	0.066	0.038
Significance	**	*	**	**	**	**

[a,b,c,d,e] The differences are statistically significant between means marked with different in the same column (*P<0.05, **P<0.01). A, B and C - containing 50, 54 and 58% butterfat, respectively; G - traditional product containing 54% butter.

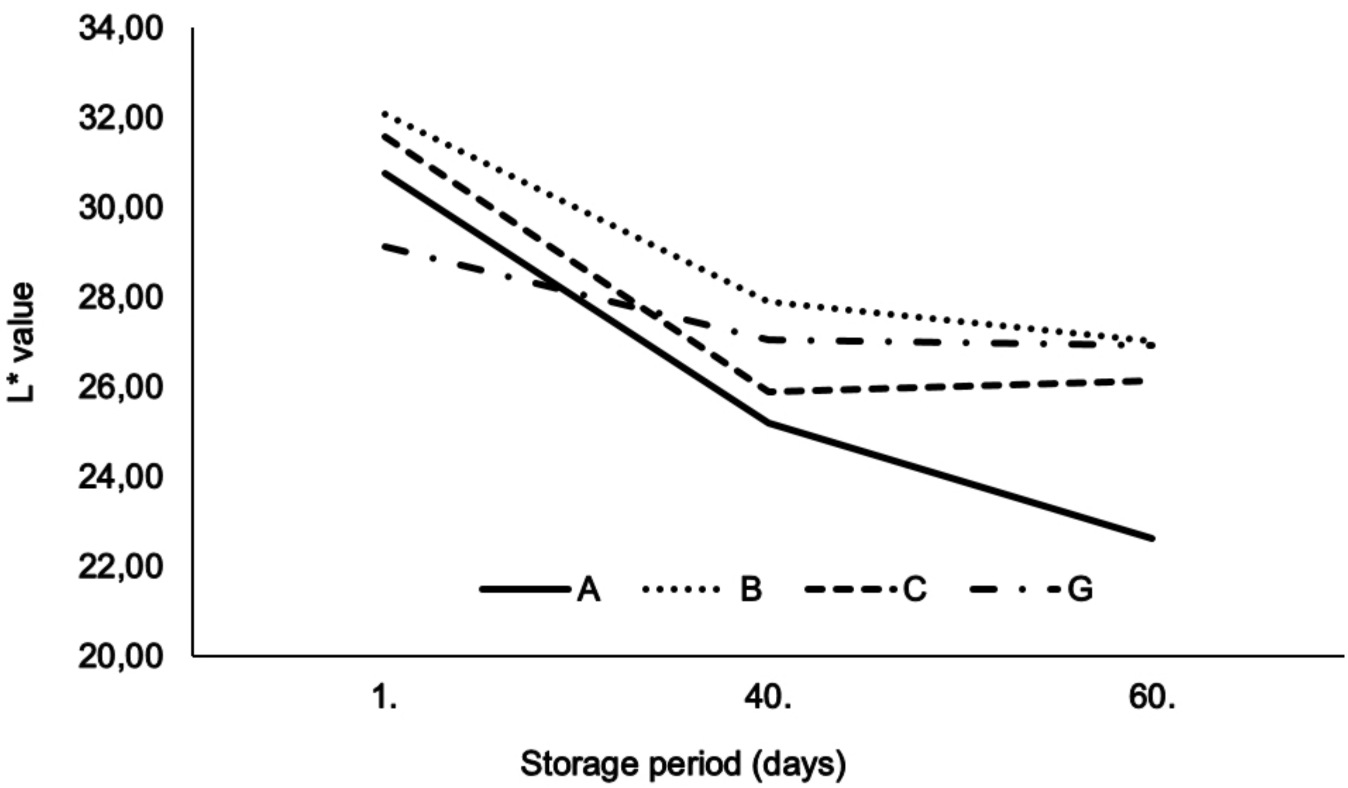

Figure 7. Change of L* values of Runi hiz samples during storage period at 4 °C
(A – product with 50% butter; B – product with 54% butter; C – product with 58% butter; G – traditional product with 54% butter)

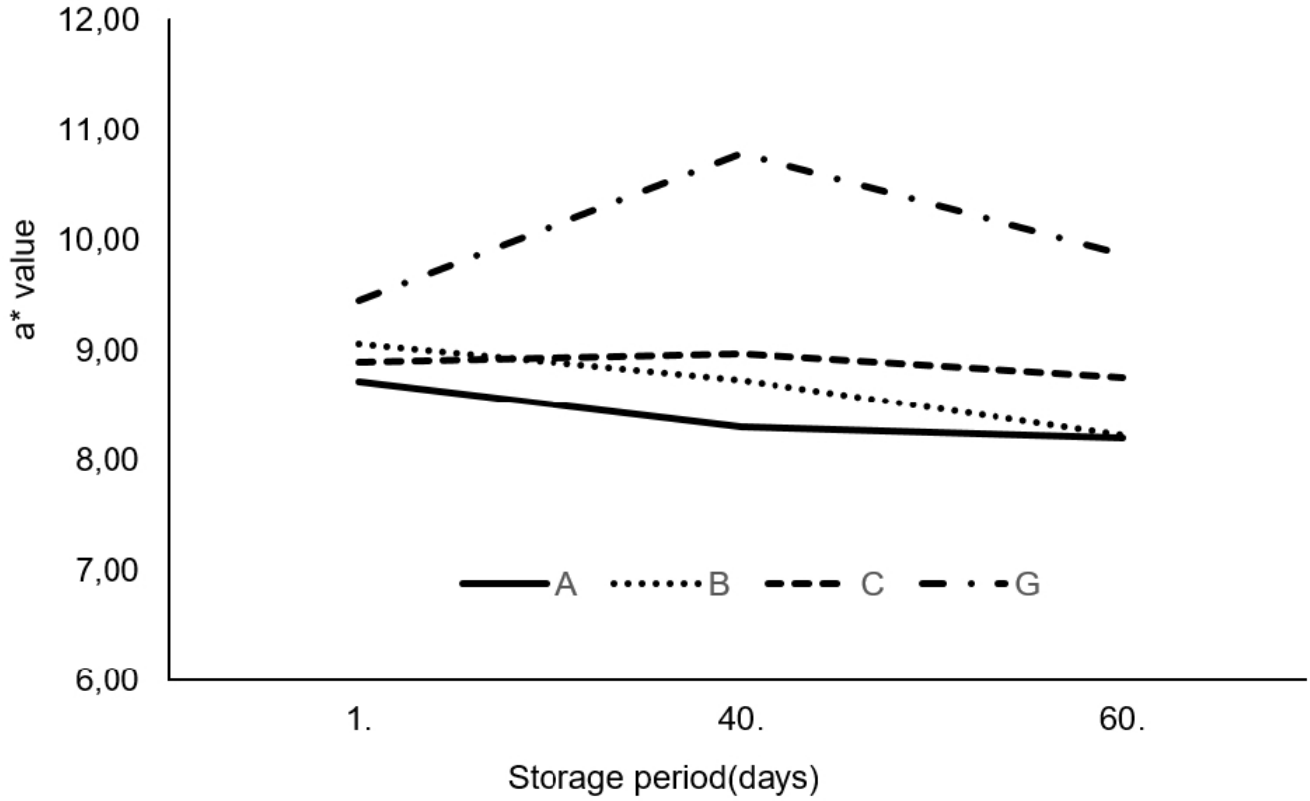

Figure 8. Change of a* values of Runi hiz samples during storage period at 4 °C
(A – product with 50% butter; B – product with 54% butter; C – product with 58% butter; G – traditional product with 54% butter)

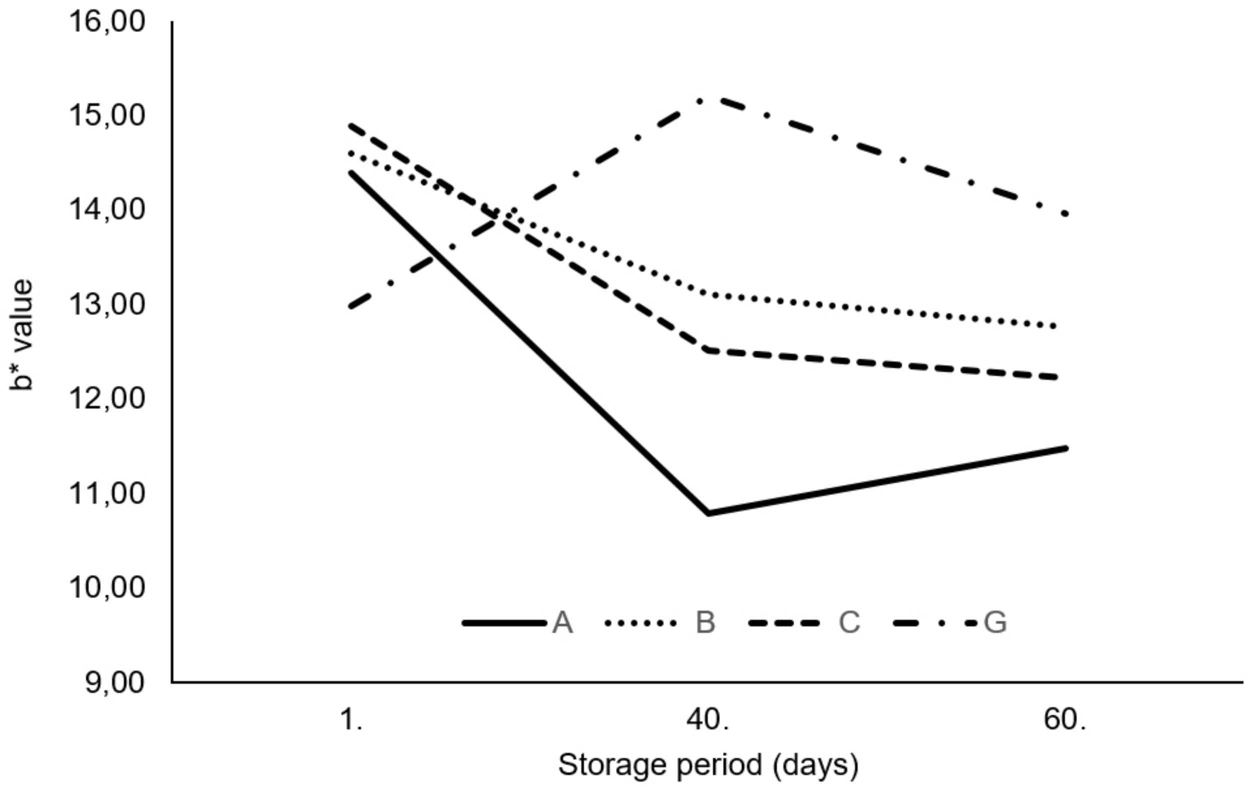

Figure 9. Change of b* values of Runi hiz samples during storage period at 4 °C
(A – product with 50% butter; B – product with 54% butter; C – product with 58% butter; G – traditional product with 54% butter)

mouth, due to the heat treatment at high temperature in production and/or the use of traditional molasses. Due to the effect of heat treatment, Maillard reaction occurs in dairy products (due to lactose) and in molasses, resulting in brown colour and caramel taste. Taste formation can occur as a combination of both Maillard reactions and caramelization. In addition, when heat is applied at a very high level, some of the milk fat is converted into acrolein. Acrolein is a pungent substance and makes the cooked taste more pronounced (Sezgin et al., 2007; Özhan et al., 2010).

Compared to the other Runi hiz samples, the softness of the G sample can be associated with the use of traditional molasses in its production and the lack of lecithin in its composition. In industrial samples (A, B and C), the increase in hardness and structure-consistency, in parallel with the increase in the fat ratio, was also determined by the panelists. According to this, the hardest sample was C and the softest sample was A. It was also confirmed by panelists that all samples, irrespective of their hardness, were driftable.

During evaluation of industrial Runi hiz samples in terms of taste-aroma, taste left in the mouth and general acceptability, it is seen that the most favored example is "A" while the least favored example is "C". This indicates that the high concentration of butter was not preferred by panelists due to the less flavor components formed at low temperature applications. Moreover, the colour-appearance scores (A>B>C) showed that the high butter concentration had a negative effect on the colour-appearance of the products.

CONCLUSIONS

In this study, a traditional and forgotten breakfast product Runi hiz (Runi sor) was produced with traditional and potential industrial methods at various fat ratios in order to optimize its production in terms of fat ratio.

It was concluded that the temperature and duration (90 °C for 5 min) of the heat application in Runi hiz production is sufficient in terms of product safety and the fat content in the product should be reduced to ≤50%. It was determined that this product can be safely stored at 4 °C for at least 90 days in terms of food safety and consumer health. Runi hiz is a healthy and nutritionally valuable traditional product with a potential of industrial standardized production. This research presented important findings not only for industrial and standardized production of Runi hiz but also for introduction of this healthy and nutrititious food to the society. Utilization of natural antioxidants can be the focus of future studies in order to increase its shelflife.

ACKNOWLEDGEMENTS

This work was financially supported as part of the AR-13113 research project by Scientific Research Project Coordination Unit of Harran University (HÜBAK) (Şanlıurfa, Turkey).

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