



Determination of quality properties of Kastamonu pastırma: A dry-cured meat product

Kastamonu pastırmasının kalite özelliklerinin belirlenmesi: Kuru küredilmiş bir et ürünü

Hüseyin GENÇCELEP¹, Barış İHTİYAR², Mustafa Onur YÜZER^{3*}

^{1,2}Department of Food Engineering, Engineering Faculty, Ondokuz Mayıs University, 55139, Samsun, Turkey

^{3*}Department of Food Processing, Aydıntepe Vocational School, Bayburt University, 69500, Bayburt, Turkey

¹<https://orcid.org/0000-0002-8689-7722>; ²<https://orcid.org/0000-0001-6717-9269>; ³<https://orcid.org/0000-0002-8192-2298>

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*Address for Correspondence:

Mustafa Onur YÜZER

e-mail:

mustafaonuryuzer@gmail.com

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ABSTRACT

Pastırma is a Turkish dried meat product that has been produced for centuries with its unique production technology. It is produced from whole muscle and/or muscles obtained from certain parts of beef and buffalo carcasses. This is the first study dealing with some physicochemical properties of Kastamonu pastırma produced mostly sırt and kuşgömü. Significant differences were determined among the pastırma types in all analyses ($P<0.05$). Pastırma type significantly affected moisture amount ($P<0.05$). The average moisture content in the kuşgömü pastırma was determined higher than the sırt pastırma. The total protein amount of all samples was determined over 30%, and it is more valuable in terms of nutrition. However, the salt amount (10% / dry matter) and pH (max. 6.0) in 50% of samples were above the maximum acceptable limit. Also, the water activity values of all samples were above 0.90. TBARS and FFA values of some samples were higher than the values previously determined.

Key Words: Pastırma, Dry-cured meat, Composition, NPN (non protein nitrogen)

ÖZ

Pastırma, kendine has üretim teknolojisi ile yüzyıllardır üretilen bir Türk kuru et ürünüdür. Sığır ve manda karkaslarının belirli kısımlarından elde edilen tüm kas ve/veya kaslardan üretilir. Bu çalışma, Kastamonu pastırma türlerinden en çok üretimi yapılan sırt ve kuşgömü türlerinin bazı fizikokimyasal özelliklerini inceleyen ilk çalışmadır. Tüm analizlerde pastırma türleri arasında önemli farklılıklar tespit edilmiştir ($P<0.05$). Pastırma tipi nem miktarını önemli derecede etkilemiştir ($P<0.05$). Kuşgömü pastırmada ortalama nem içeriği sırt pastırmadan daha yüksek olarak belirlenmiştir. Tüm örneklerin toplam protein miktarı %30'un üzerinde belirlenmiş olup, beslenme açısından oldukça değerlidir. Ancak, numunelerin %50'sindeki tuz miktarı (%10 / kuru madde) ve pH (maks. 6.0) kabul edilebilir maksimum sınırın üzerindedir. Ayrıca tüm örneklerin su aktivite değerleri 0.90'ın üzerindedir. Bazı örneklerin TBARS ve FFA değerleri daha önce belirlenen değerlerden yüksek çıkmıştır.

Anahtar Kelimeler: Pastırma, Kuru et, Bileşim, NPN (proteinsiz nitrojen)

Introduction

Pastırma is a Turkish dried meat product that has been produced for centuries with its unique production technology. Pastırma is obtained by salting in one or two stages, pressing, drying, and

coating with fenugreek, that meat taken in large pieces from certain parts of buffalo and beef carcasses. Pastırma has different names depending on the parts where the raw material used is taken from the carcass. Kuşgömü, sırt, şekerpare, kürek and bohça pastırma varieties are

some of them. The textural, physicochemical and microbiological properties of pastırma may differ depending on the carcass from which the raw material is obtained. It is known that pastırma can be produced from 16 to 20 different muscles in the carcass (Gökalp et al., 2012).

In the Pastırma Standard, “sirt” and “kuşgömü” pastırma varieties are in the first class that the quality classification. For this reason, the production of sirt and kuşgömü pastırma varieties are more common than other types of pastırma because of their high-quality characteristics. These pastırma varieties, which are more tender than other varieties, have a more distinct fat distribution and the color varies from pink to red (Ceylan & Aksu, 2011). A large proportion of the mass of pastırma is moisture. It gives moisture, juiciness, crispiness to pastırma, and also has the property of enhancing the taste and flavor along associated with fat. But because high humidity increases microbiological development in pastırma, it also speeds up spoilage (Çakıcı, 2012). Using salt in pastırma production prevents the development of unwanted microorganisms, reduces water activity and also gives the product a characteristic aroma (Soyer et al., 2011). The ash content of pastırma varies depending on the composition of salt and mineral substances. The fat content is also important for the quality of pastırma. As the fat content increases, the product quality decreases.

The most important feature of pastırma is that no heat treatment and smoking are applied in production (Kaban, 2009). The most typical property of Kastamonu pastırma is that the production is traditionally carried out in completely natural conditions and no additives are used in the production. Kastamonu pastırma is a traditional flavour inherited from ancestors and has an ongoing tradition of being passed down from grandfather to grandson. The most intense period of production is the autumn season when the wind and natural weather are most favorable. The properties of the final product in pastırma may not be of a certain norm.

As a result, there are pastırma with different quality characteristics on the market. In order to overcome this problem, it is necessary to know very well the biochemical events that occur during the production of pastırma and the factors affecting production, and to produce consciously. In this context, it is necessary to determine the limits of physical, chemical and microbiological properties of pastırma and to carry out standard production. The aim of this study is to determine some physical and chemical properties, reveal their composition, determine the suitability of product quality and ensure its recognition of sirt and kuşgömü pastırma, which is the most widely produced pastırma varieties in Kastamonu by traditional and natural means.

Material and Method

Materials

A total of 12 pastırma samples of 6 kuşgömü and 6 sirt types were collected from the six different factories of Kastamonu city of Turkey. All pastırma samples taken as sliced (1–2 mm) were packed in the factories. The samples were transported to the laboratory in iceboxes to prevent changes during transportation, and stored at 4°C until use.

Moisture and ash amount

The moisture value was determined by taking about 5 g of samples into weighed dried containers that had been left in the drying oven for several hours and drying for 24 hours in the drying oven at 105 °C. The containers taken to the desiccator and cooled were weighed and the % moisture value was calculated from the difference between the two weighing. For determination of the ash amount, firstly the porcelain crucible was dried for 2 hours in a drying oven at 105 °C. Ground pastırma samples (approximately 3 g) were added in a porcelain crucible, and then burned in an ash furnace for 18 hours at 550 °C. Ash amount was determined as weight loss (%) (Gökalp et al., 2012).

Total fat content

The fat content of the samples was determined by Soxhlet method. The results were calculated as %. Petroleum ether was used as a solvent (AOAC, 2000).

Total protein content

The amount of protein in the samples was determined according to the Kjeldahl method. First, the % nitrogen amount of the samples was determined, then the % protein amount was calculated using the 6.25 protein factor (AOAC, 2000).

Salt amount

Salt amount of pastırma without çemen samples were determined method by Kirk and Sawyer (1991). For determination of the salt amount were used samples that burned for ash analysis. Results of salt were expressed as a percentage.

Water activity

The water activity (a_w) device (Aqualab, METEK Group, USA) was used in determining the water activity of the samples. The samples (approximately 5 g) were put in plastic sample containers for analysis, they were placed in the measuring cabinet of the device, and a_w value was determined at 25°C.

pH value

Ten g sample was weighed for analysis and homogenized with Ultra-Turrax (IKA T25, Germany) for 1 min by adding 100 ml of distilled water. The pH value was determined by the pH meter (Starter 2100, OHAUS) which was previously standardized with the appropriate buffer solutions (pH 4.00 and 7.00).

Instrumental color

For determination of the colour intensities, a Minolta (CR-400, Minolta Co, Osaka, Japan) colorimeter was used. L^* , a^* and b^* values were measured to the criteria given by the International Commission on Illumination CIELAB.

Accordingly, L^* ; $L^*=0$ indicates the color intensity of black, $L^*=100$ indicates the color intensity of white (darkness/ lightness), a^* ; $+a^*$ = indicates the color intensity of red, $-a^*$ = indicates the color intensity of green, and b^* ; $+b^*$ = indicates the color intensity of yellow and $-b^*$ = indicates the color intensity of blue (Akköse et al., 2018).

Thiobarbituric acid reactive substances value

Thiobarbituric acid reactive substances (TBARS) values of pastırma samples were determined according to the method developed by Lemon (1975). The measured absorbance values were multiplied by the coefficient of 7.2 and the TBARS number was determined as mg malonaldehyde (MA)/kg sample.

Non-protein nitrogenous substance content

Water-soluble proteins were obtained for non-protein nitrogen analysis. For this, about 10 g of samples were homogenized with 50 ml of pure water twice, then centrifuged at 5000 x g at 4 °C for 10 minutes (NF 1200R, Nuve, Ankara, Turkey). The pellet was re-homogenized and centrifuged as mentioned. The supernatant combination Whatman No. 1 filtered through filter paper and obtained water-soluble proteins.

25 ml of the obtained filtrate was taken and 25 ml of 20% trichloroacetic acid was added to it. It was kept at room temperature for 30 min, then centrifuged for 10 min at 4 °C at 5000 x g and Whatman filtered through filter paper. The nitrogen content was determined by the Kjeldahl method over 25 ml of filtrate. The results were expressed as NPN % of samples (Wang, 2001).

Free fatty acid content

Free fatty acid analysis was performed according to AOAC (2000) method. Accordingly, 5 g of the sample was weighed and added from the ethanol/dieter (1:1) mixture. The mixture was homogenized with Ultra-Turrax for 1 min and phenolphthalein was added as an indicator. Titration was performed with 0.1 N NaOH until a permanent pink color was formed. The amount of % free acid was calculated in terms of oleic acid

(Equation 1).

$$FFA (\%) = \frac{\text{The volume of NaOH used (mL)}}{\text{Weight of sample (g)}} \times 2.82 (\text{in \% oleic acid}) \quad (1)$$

Statistical analysis

The study was conducted in two repetitions and the results were given as mean \pm standard deviation. The differences between the averages were determined using the Analysis of Variance (ANOVA). The Duncan Multiple Comparison Test was used to determine the mean that had a different effect. The SPSS statistical package program (SPSS Statistics 26.0, IBM, New York, USA) was used for the analyses and comparisons were made at a significance level of $p < 0.05$.

Results and Discussion

Chemical analysis

The amounts of ash, moisture, total fat, total protein, salt, pH, aw, NPN (non protein nitrogen), FFA (free fatty acid), TBARS (Thiobarbituric acid reactive substances) and color values (L^* , a^* and b^*) properties determined in sirt and kuşgömü pastırma types are shown in Table 1, 2 and 3. The highest moisture was determined in kuşgömü pastırma types in factory B ($p < 0.05$), whereas the lowest moisture was determined in sirt pastırma in factory C (Table 1). According to the notification of meat, prepared meat mixes and meat products of Turkish Food Codex, the maximum moisture amount of pastırma without çemen should be 50.0% (Anonymous, 2019). The moisture in 1 samples of the 6 sirt pastırma (16.6%), in 2 samples of the 6 kuşgömü pastırma (33.3%), were determined to be higher than the moisture limit (50.0%). The average moisture value of kuşgömü pastırma is higher than sirt pastırma and also higher than 50%. There are also differences in the amount of moisture between the same types of pastırma produced by the companies. The moisture content of both sirt and kuşgömü pastırma four companies' products is below 50%. Some results showed that the drying process was not applied as required. Similar

results were reported by Çakıcı et al. (2015). They determined the moisture values between 40.81-58.43% for sirt pastırma and between 35.13-49.73% for kuşgömü pastırma. Ceylan and Aksu (2011) obtained similar results and determined the average moisture amount for sirt and şekerpare pastırma types as mean values $47.17 \pm 5.00\%$ and $47.96 \pm 3.21\%$, respectively.

The amount of ash varies depending on the amount of salt that the muscles used in the production of bacon can take into their structure during dry curing. The average total ash content of pastırma samples was found to be 5.29% in sirt pastırma and 6.54% in kuşgömü pastırma ($p < 0.05$). In the samples where the amount of salt was high, the amount of ash was also high. While an average of 4.85% salt was detected in the sirt pastırma variety, an average of 6.12% salt was detected in the kuşgömü pastırma variety. As with other parameters, there are differences between samples of the same pastırma variety in terms of the amount of salt. These differences are largely due to the method of salting, the amount of salt, the type of salt, the time of soaking the meat in salt and the washing times. These results are consistent with the literature (Aksu, Erdemir, Turan, & Öz, 2022; Çakıcı et al., 2015; Erdemir, 2021; Michel, Mohamed, & Mohamed, 2020). Another factor affecting the amount of ash in pastırma is the amount of residual nitrite. However, since the pastırma produced in Kastamonu is entirely traditional and no additives are used, residual nitrite analysis has not been performed.

Table 1. Average moisture, ash, fat and protein values of pastırma taken from different factories

Factory	Moisture (%)		Ash (%)		Fat (%)		Protein (%)		Salt (%)	
	Sirt	Kuşgözü	Sirt	Kuşgözü	Sirt	Kuşgözü	Sirt	Kuşgözü	Sirt	Kuşgözü
A	40.49±0.07 ^c	47.59±0.91 ^b	5.35±0.04 ^{bc}	5.53±0.29 ^d	19.70±0.19 ^b	5.22±0.28 ^b	33.57±2.03 ^b	41.88±0.12 ^a	5.13±0.12 ^{ab}	5.01±0.08 ^d
B	51.36±2.60 ^a	55.63±1.43 ^a	6.91±0.15 ^a	8.22±0.28 ^a	8.21±0.03 ^d	5.45±0.15 ^b	30.14±0.70 ^b	32.86±0.84 ^b	6.11±0.28 ^a	7.74±0.31 ^a
C	32.08±0.97 ^d	48.79±2.63 ^b	6.22±0.59 ^{ab}	6.50±0.15 ^c	25.09±1.99 ^a	10.69±1.23 ^a	31.75±1.45 ^b	29.72±2.12 ^c	5.64±0.06 ^a	6.26±0.17 ^{bc}
D	44.36±1.17 ^b	53.96±0.91 ^a	4.34±0.95 ^{cd}	7.11±0.11 ^b	13.44±0.85 ^c	3.70±0.21 ^c	33.86±3.83 ^b	35.14±1.52 ^b	4.00±1.08 ^{bc}	6.61±0.05 ^b
E	48.39±2.39 ^a	43.03±0.75 ^c	3.65±0.31 ^d	5.61±0.25 ^d	15.52±0.76 ^c	6.22±0.49 ^b	32.78±3.14 ^b	42.25±1.60 ^a	3.31±0.18 ^c	5.25±0.04 ^d
F	39.17±0.19 ^c	48.27±1.70 ^b	5.28±0.29 ^{bc}	6.28±0.20 ^c	8.77±0.29 ^d	5.29±0.46 ^b	43.37±1.40 ^a	40.83±0.75 ^a	4.92±0.02 ^{ab}	5.86±0.18 ^c
Mean	44.44±6.36	50.14±4.18	5.29±1.18	6.54±0.98	15.12±6.24	6.09±2.33	34.91±5.33	37.69±5.16	4.85±1.05	6.12±0.96

Presented values are means ±SD; ^{a-d} Different letters indicate significant difference ($p < 0.05$) in each column, SD: standard deviation

There were significant differences in total fat and total protein among pastırma types. The total amount of fat and protein in samples of sırt pastırma was determined as 15.12% and 34.91%, respectively. The mean amount of fat was determined as 6.09% and the amount of protein was determined as 37.69% in kuşgömü pastırma samples (Table 1). These differences between the samples are thought to be due to the anatomical location of the muscles used in pastırma production (Çakıcı et al., 2015). The muscles obtained from the loin section have a high fat content. The sırt pastırma type is produced from the muscles of the loin part, so the fat ratio is higher than other types. According to the results of the protein content, it is concluded that the pastırma obtained from Kastamonu is quite nutritious due to the high amounts of protein.

When meat with high pH values is used in pastırma production, it becomes difficult to remove the water and the a_w (water activity) value becomes higher. In addition, when using this type of raw materials, the curing mixture diffuses slowly into the meat and the production time is extended (Kaya & Kaban, 2010). According to the Turkish Food Codex, the pH value of pastırma should not exceed 6.0. The pH values of the samples from 5.74 to 6.52. In this study, pH values of 4 sırt and 2 kuşgömü pastırma samples were higher than 6.0.

Water activity refers to the water involved in biochemical (lipid oxidation, enzymatic browning, etc.) and microbial reactions occurring in meat and meat products. Pastırma is included in the class of medium-moist foods, and the values of its water activity usually range from 0.70 to 0.90. In the current study, the a_w value was determined between 0.895-0.940 for sırt pastırma samples and between 0.909-0.924 for kuşgömü pastırma samples. While there is some difference between different samples of the same pastırma variety in terms of a_w values in sırt pastırma, it is seen that the values are very close to each other in kuşgömü pastırma. Öz, Kaban, Barış, and Kaya (2017) found the a_w values of pastırma obtained from the market between 0.862-0.924. Kaban (2013) reported that pastırma can be stored 9 months without refrigeration for due to its low water activity.

The pH and a_w values of the products examined are generally not suitable for the characteristics of

pastırma. Pastırma is a cured meat product and its a_w should be less than 0.90. When the determined a_w values are examined, it is understood that these products are not completely dry. On the other hand, TBARS values are very high considering that the product is not dried. Based on these results, it would be more appropriate to state that the products are not sufficiently dried. It is thought that this may be due to the production method.

Non-protein nitrogenous substance content (NPN)

Proteolytic and lipolytic degradation products are reported to be highly effective in the development of sensory properties in meat products (Toldra', 1998). For the level of non-protein nitrogenous substances, the raw materials and processing conditions can also be effective is known (Kaban, 2009). The amount of nonprotein nitrogenous substance, which is an indicator of proteolysis, varied between 8.81-17.51% for all samples of pastırma (Table 2), and the type factor was effective on the amount of non-protein nitrogenous substance ($p<0.05$). Akköse et al. (2018) reported the amount of nonprotein nitrogenous substance varied between 3.11-3.83 g/100 g for the pastırma produced from water buffalo meat. Kaban (2009) reported the average final value of nonprotein nitrogenous substance 3.83 g/100 g for the pastırma samples. However, the average final value of sırt pastırma (14.0%) and kuşgömü pastırma (14.37%) was higher than those observed by Akköse et al. (2018) and Kaban (2009). These differences may arise from process conditions and raw material.

Free fatty acid content

Free fatty acids are those that are not bound to the triglyceride structure and are in the free form. An increase in the acidity of free fats or a high presence of them in this fat means that the stability to oxidation decreases. The development of sensory and chemical properties of dry-cured meat products, intramuscular fats play an important role. During the processing of meat products of this type, intramuscular fats are degraded as a result of lipolysis and oxidation. Thus, an increase in the amount of free fatty acids may occur (Jin et al., 2010).

Table 2. Average salt, pH and aw values of pastırma taken from different factories

Factory	pH		a _w		NPN (%)		FFA (%)		TBARS (mg malonaldehit /kg)	
	Sırt	Kuşgözü	Sırt	Kuşgözü	Sırt	Kuşgözü	Sırt	Kuşgözü	Sırt	Kuşgözü
A	6.27±0.07 ^b	5.83±0.02 ^c	0.923±0.002 ^c	0.924±0.006 ^a	15.69±2.00 ^{ab}	12.35±0.60 ^d	6.91±2.17 ^a	7.10±2.32 ^a	1.12±0.91 ^d	2.06±0.23 ^{cd}
B	6.21±0.03 ^{bc}	6.52±0.04 ^a	0.909±0.003 ^d	0.913±0.001 ^b	8.81±0.40 ^c	11.69±0.50 ^d	6.03±1.83 ^{ab}	4.20±0.28 ^b	7.03±0.73 ^b	8.00±0.80 ^b
C	6.11±0.00 ^{bc}	5.85±0.03 ^c	0.895±0.004 ^e	0.909±0.009 ^b	14.49±0.71 ^{ab}	15.90±0.08 ^b	5.75±1.63 ^{ab}	5.27±1.25 ^{ab}	10.80±0.55 ^a	13.49±2.57 ^a
D	6.51±0.14 ^a	6.14±0.06 ^b	0.937±0.004 ^a	0.916±0.005 ^{ab}	13.86±0.18 ^b	13.99±0.00 ^c	3.94±0.41 ^b	5.52±1.28 ^{ab}	1.68±0.11 ^{cd}	2.05±0.60 ^{cd}
E	5.99±0.19 ^c	5.89±0.00 ^c	0.940±0.002 ^a	0.919±0.004 ^{ab}	14.90±0.28 ^{ab}	14.77±0.30 ^c	6.18±1.19 ^{ab}	3.87±0.70 ^b	1.85±0.37 ^c	1.37±0.14 ^d
F	5.75±0.24 ^d	5.74±0.01 ^d	0.930±0.002 ^b	0.912±0.008 ^b	16.25±0.41 ^a	17.51±0.01 ^a	4.65±0.98 ^{ab}	4.98±0.85 ^b	2.13±0.31 ^c	3.46±0.19 ^c
Mean	6.14±0.27	5.99±0.27	0.922±0.016	0.915±0.007	14.00±2.64	14.37±2.10	5.58±1.66	5.16±1.56	4.10±3.68	5.07±4.56

Presented values are means ±SD; ^{a-d} Different letters indicate significant difference ($p < 0.05$) in each column, SD: standard deviation

In terms of % oleic acid, the average free fatty acidity was found to be 5.58% in sirt pastırma and 5.16% in kuşgömü pastırma ($p<0.05$) (Table 2). FFA values were close to each other in pastırma varieties. However, there are differences between the varieties themselves. During the production of dry cured horse meat by Lorenzo and Carballo (2015), changes in textural and physicochemical properties and volatile components were investigated. In the study, it was found that the total amount of free fatty acids increased during the production stages. In a study conducted by Xu, Xu, Zhou, Wang, and Li (2008), changes in the amount of intramuscular phospholipids and free fatty acids during the production of dry-cured duck meat were investigated. As a result of the analyzes, it was found that the total amount of phospholipids decreased during production, and the amount of free fatty acids increased.

Thiobarbituric acid reactive substances value

Thiobarbutyric acid reactive substances (TBARS) are considered a good indicator of lipid oxidation in meat and meat products, and they are emerging as secondary products of lipid oxidation. The mean value of TBARS was determined in sirt pastırma and kuşgömü pastırma 4.10 and 5.07 mg malonaldehyde/kg respectively ($p<0.05$). There were great differences in TBARS values between pastırma varieties and different samples of the same type of pastırma. According to the results of the research; It was determined that the highest TBARS average among the varieties was 10.80 mg malonaldehyde/kg in sirt pastırma and 13.49 mg malonaldehyde/kg in kuşgömü pastırma. The properties of the raw material are considered to be effective on the obtained TBARS value. In another study (Gök, Obuz, & Akkaya, 2008), the TBARS of pastırma in different packaging methods were founded between 1.54-2.80 mg malonaldehyde/kg.

Colour values

One of the most important quality characteristics for the consumer is color, which is also effective in accepting food. The formation of color in pastırma occurs as a result of a number of

reactions. In this formation; the curing agent, the raw material pH and the myoglobin content are effective. In addition to these, factors such as the production process also affect the formation of color (Öztan, Vural, & Helvacı, 1991). The colour of first class pastırma changes from pink to red (Çakıcı et al., 2015).

The L^* , a^* and b^* values of the color characteristics were significantly affected by the type of pastırma ($p<0.05$). In the study, the L^* value, which is the measure of lightness, was found to be higher in kuşgömü pastırma samples compared to type of sirt pastırma samples (Table 3). The average L^* value was determined as 40.85 in the sirt pastırma variety and 42.62 in the kuşgömü pastırma variety. It has been that there are no very significant differences between the pastırma varieties of the same enterprises in terms of L^* values (except for factory A). Akköse et al. (2018) reported the L^* value as 37.73 in sirt pastırma and 35.28 in kuşgömü pastırma. Çakıcı et al. (2015) determined L^* values between 27.50–46.85 in sirt pastırma and 25.28–43.34 in kuşgömü pastırma.

It is known that the value of a^* is important, especially in terms of consumer preferences. a^* value was determined between 7.31-18.52 in sirt pastırma samples. a^* value was determined in the ranging from 8.81 to 12.96 in kuşgömü pastırma samples. It was found that pastırma varieties affected significant ($p<0.05$) on the a^* value. The mean a^* value determined as 11.05 ± 2.05 in kuşgömü pastırma increased to 12.13 ± 3.84 in sirt pastırma. Aksu, Dogan, and Sirkecioglu (2017) determined the a^* value between 38.57-40.06 in pastırma. In other studies, in pastırma samples, a^* value between 13.66-36.63 (Aksu & Kaya, 2001) and between 21.45-30.22 (Çakıcı et al., 2015) have been identified. The quality of raw meat, production conditions and methods, curing methods and time, curing compounds may affect the color values of pastırma varieties, especially a^* value (Aksu et al., 2017; Çakıcı et al., 2015). However, since curing agents were not used in the production of bacon samples in the current study, there is no effect on the color values of substances such as nitrite, nitrate, or ascorbic acid.

Table 3. Average color (L*, a* and b*) values of pastırma taken from different factories

Factory	CIE L*		CIE a*		CIE b*	
	Sirt	Kuşgömü	Sirt	Kuşgömü	Sirt	Kuşgömü
A	45.20±3.44 ^a	53.71±5.44 ^a	18.52±1.24 ^a	12.96±2.06 ^a	20.84±3.07 ^a	27.16±1.76 ^a
B	35.23±4.93 ^b	36.07±1.16 ^d	9.11±1.19 ^c	8.81±1.30 ^c	11.95±2.52 ^b	12.15±1.23 ^d
C	41.36±2.89 ^a	42.05±1.55 ^{bc}	13.06±2.10 ^b	10.25±1.89 ^{bc}	18.80±4.32 ^a	14.80±1.13 ^c
D	40.09±2.47 ^{ab}	38.28±1.57 ^{cd}	12.01±1.00 ^b	10.28±1.60 ^{bc}	17.95±2.09 ^a	15.36±0.76 ^c
E	39.79±4.29 ^{ab}	40.27±1.71 ^c	7.31±1.07 ^c	12.74±1.25 ^{ab}	10.44±1.21 ^b	17.74±2.16 ^b
F	43.43±2.74 ^a	45.32±1.44 ^b	12.78±2.02 ^b	11.27±1.29 ^{abc}	18.01±2.75 ^a	19.12±1.20 ^b
Mean	40.85±4.50	42.62±6.30	12.13±3.84	11.05±2.05	16.33±4.60	17.72±5.03

Presented values are means ±SD; ^{a-d} Different letters indicate significant difference ($p < 0.05$) in each column, SD: standard deviation

While b* value changed between 10.44-20.84 in sirt pastırma, it was determined between 12.15-27.16 in kuşgömü pastırma. The average b* value was found to be 16.33 in sirt pastırma and 17.72 in kuşgömü pastırma ($p < 0.05$). Accordingly, it has been observed that the average values of b* in pastırma varieties are very close to each other. In one study, it was reported that the b* value was found to be 3.54 in sirt pastırma and 2.85 in kuşgömü pastırma (Akköse *et al.*, 2018). M. I. Aksu *et al.* (2017) determined the b* values of pastırma samples between 17.50-23.71. These results are consistent with those in the current study.

Conclusion

Significant differences were determined among the pastırma types in all analysis ($p < 0.05$). Pastırma type significantly affected moisture amount ($p < 0.05$). The average moisture content in the kuşgömü pastırma was determined higher than the sirt pastırma. The total protein amount of all samples was determined over 30% and it is very valuable in terms of nutrition. However, the salt amount (10% / dry matter) and pH (max. 6.0) in 50% of samples was above the maximum acceptable limit. Also, the water activity values of all samples were above 0.90. TBARS and FFA values of some samples were found to be higher than the values previously determined.

In terms of the parameters examined, the differences between the samples belonging to the same pastırma variety show that there is no

standard production method among the enterprises in the production of pastırma and production is made with the production methods specific to the enterprises. In addition, that the amounts of moisture and salt largely comply with the Turkish Food Codex Meat, Prepared Meat Mixtures and Meat Products Communique is a sign that the enterprises are adequately inspected and high-quality products are produced under the standards. Although there are differences in some values in terms of quality characteristics in the sirt and kuşgömü varieties examined in this study, it has been understood that there is a similarity between the same kind of products.

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Author contributions: Conceptualization, literature review, organization, analysis was done by BI. Review and editing was done by HG. HG had supervised the entire research works. Literature review, critical analysis of data, manuscript review and editing was written by MOY. All authors of this research have read the manuscript and agreed to publish it.

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