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Original Article/Özgün Araştırma

Goose meat: Salting/drying effect on nutritional value, physicochemical properties, and sensory properties

Kaz eti: Tuzlama/kurutmanın besin değeri, fizikokimyasal özellikler ve duyusal özellikler üzerindeki etkisi

Hürriyet Çimen[1], Pınar Kızılkaya[2], *Bilge Sayın[1], Duygu Alp Baltakesmez[1], Feyza Kırmacı[1]

[1]*Ardahan University, School of Tourism and Hotel Management, Department of Gastronomy and Culinary Arts, 75000, Ardahan/Türkiye*
[2]*Ardahan University, Vocational School of Technical Sciences, Department of Food Technology, 75000, Ardahan/Türkiye*
(Yazar sıralamasına göre)
***ORCID ID:** 0000-0001-6107-2444 Assoc. Prof.*
***ORCID ID:** 0000-0002-8420-7222 Dr.*
***ORCID ID:** 0000-0002-1898-0428 Asst. Prof.*
***ORCID ID:** 0000-0003-3268-9677 Asst. Prof.*
***ORCID ID:** 0009-0004-6285-2003*
**Sorumlu yazar/Corresponding author:* bilgesayin@ardahan.edu.tr

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Abstract

Objective: In Kars and Ardahan, where climatic conditions are suitable for goose farming, the consumption of goose meat has been an integral part of local cuisine for generations. In conventional production, salting and drying play pivotal roles in enhancing flavor and preserving goose meat. This study aimed to identify the nutritional, physicochemical, and sensory properties of goose meat subjected to different salting and drying levels.

Materials and methods: In this study, 16 naturally reared geese were collected from Hanak district of Ardahan province. Traditional cooking methods prevalent in the region, classical boiling and oven cooking, have been applied without the use of salt, spices, or food additives. Breast muscle samples were used for each treatment group. Subsequently, various analyses of physicochemical properties and nutritional parameters, including salt content, dry matter, pH, protein, fat, cooking loss, mineral content, and cholesterol level, were conducted for the raw and/or cooked samples. Sensory analysis was performed to assess the acceptability of the samples.

Discussion and results: According to the results obtained, the most abundant minerals in the goose meat samples were determined as sodium (Na), potassium (K), phosphorus (P), magnesium (Mg), and iron (Fe), respectively. The amount of salt and drying time significantly affected cooking loss ($P < 0.01$). Additionally, it was found that different salting and drying levels significantly affected the overall consumer acceptability of goose meat ($P < 0.01$). Finally, it was concluded that the optimization of traditional salting and drying techniques not only enhances the flavor and shelf life of meat, but also plays a crucial role in meeting consumer demands for quality and nutritional value.

Keywords: dry-cured; goose meat; nutrition; salting; sensory assessment; traditional meat product

Öz

Amaç: Kaz yetiştiriciliği için iklim koşullarının uygun olduğu Kars ve Ardahan'da kaz eti tüketimi nesillerdir yerel mutfağın ayrılmaz bir parçası olmuştur. Geleneksel üretimde tuzlama ve kurutma, kaz etinin lezzetini artırmada ve korunmasında önemli rol oynamaktadır. Bu çalışma, farklı tuzlama ve kurutma seviyelerine tabi tutulan kaz etinin besinsel, fizikokimyasal ve duyusal özelliklerini belirlemeyi amaçlamaktadır.

Materyal ve yöntem: Bu çalışmada, Ardahan ili Hanak ilçesinden doğal ortamda yetiştirilen 16 adet kaz toplanmıştır. Bölgede yaygın olan geleneksel pişirme yöntemleri, klasik kaynatma ve fırında pişirme, tuz, baharat veya gıda katkı maddeleri kullanılmadan uygulanmıştır. Her muamele grubu için göğüs kası örnekleri kullanılmıştır. Daha sonra, çiğ ve/veya pişmiş örnekler için tuz içeriği, kuru madde, pH, protein, yağ, pişirme kaybı, mineral içeriği ve kolesterol seviyesi dahil olmak üzere çeşitli fizikokimyasal özellikler ve besin parametrelerinin analizleri yapılmıştır. Örneklerin kabul edilebilirliğini değerlendirmek için duyusal analiz uygulanmıştır.

Tartışma ve sonuç: Elde edilen sonuçlara göre kaz eti örneklerinde en bol bulunan mineraller sırasıyla sodyum (Na), potasyum (K), fosfor (P), magnezyum (Mg) ve demir (Fe) olarak belirlenmiştir. Tuz miktarı ve kurutma süresi pişirme kaybını önemli ölçüde etkilemiştir (P < 0,01). Ayrıca farklı tuzlama ve kurutma seviyelerinin kaz etinin genel tüketici kabul edilebilirliğini önemli ölçüde etkilediği bulunmuştur (P < 0,01). Son olarak, geleneksel tuzlama ve kurutma tekniklerinin optimizasyonunun sadece etin lezzetini ve raf ömrünü artırmakla kalmayıp, aynı zamanda tüketicilerin kalite ve besin değeri taleplerini karşılamada da önemli bir rol oynadığı sonucuna varılmıştır.

Anahtar kelimeler: kuru-kürleme; kaz eti; beslenme; tuzlama; duyusal değerlendirme; geleneksel et ürünleri

1. Introduction

Food processing methods, including salting, drying, smoking, sugaring, pasteurizing, and fermenting, play a crucial role in ensuring food safety (Fardet and Rock, 2020). Sodium chloride (NaCl) is a vital food ingredient that enhances the flavor of meat products (Ying et al., 2016). At the same time, NaCl has been used as a food preservative for millennia to inhibit the growth of foodborne pathogenic bacteria and other spoilage organisms by reducing water activity in food. Additionally, salt plays various essential roles, such as masking bitter tastes and facilitating the binding of proteins and other components to achieve desired textures (Doyle and Glass, 2010). On the other hand, drying is one of the oldest preservation methods (Knorr and Augustin, 2023). The drying process aims to reduce the water activity of a product and control its microbiological, biochemical, and chemical activities (Aykın Dinçer and Erbas, 2019). The drying process is not applied alone; it is usually applied together with other processes such as fermentation, frying, salting, and curing (Ahmat et al., 2015).

Lamb, pork, beef, turkey, and chicken are the most frequently consumed meat types. Conversely, the consumption of waterfowl poultry meat, including goose, is less preferred (Wereńska et al., 2023). Poultry meat is an important source of polyunsaturated fatty acids that are important for human nutrition (Nowicka et al., 2019). Among them, goose meat is rich in proteins and contains all essential amino acids necessary for the human body (Fu et al., 2022). It also contains low cholesterol, various vitamins, and minerals (Orkusz et al., 2021).

Salted and dried meat products are popular in numerous countries owing to their highly favorable sensory attributes (Mediani et al., 2022). Goose breeding is widely conducted under free-range breeding conditions in Turkey (Kalaycı and Yılmaz, 2014), and geese are slaughtered by families at the beginning of winter. After cutting, the internal organs of the goose are removed, and the carcass is salted and dried (Kamber and Yaman, 2016). From the past to the present, many families in the Ardahan-Kars province have consumed goose meat in their diet during the winter months (Kaban et al., 2020). Processing goose meat by salting and drying provides a better aroma and consumers perceive certain sensory characteristics more dominantly. However, there is no standard salting rate or drying time in this region. In the current work, the primary aim was to investigate the effects of different salting rates and drying times on the sensory properties of goose meat. Additionally, various physicochemical properties and nutritional parameters (salt, dry matter, pH, protein, fat, cooking loss, mineral content, and cholesterol content) were evaluated.

2. Materials and methods

2.1. Materials

Sixteen naturally fed geese were purchased from the Hanak district of the Ardahan province in December 2022 and used in this study. In the district where the continental climate prevails, winters are very harsh and cold, whereas summers are warm and rainy. The average temperature of the coldest month is reported as -35°C, and the average temperature of the hottest month is +25°C (Hanak District Governorate, 2024). Animals were raised in the same field, fed the same diet, and subjected to a single slaughter procedure, then the internal organs were removed. After this process, the carcasses were salted with two different amounts of rock salt (150 and 300 g) and stored in safe containers. The salted carcasses were then hung to dry for different times (20 and 30 days) in open-air conditions and exposed to winter sun. A flowchart of the production of salted-dried goose samples is shown in Figure 1.

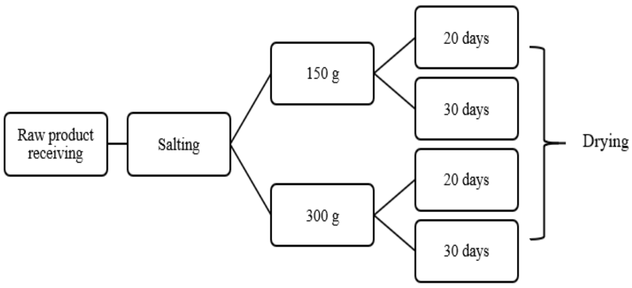

Figure 1. Flowchart of the production of salted-dried goose samples

2.2. Methods

2.2.1. Cooking methods of goose meat

In the present study, the most commonly used classical boiling and oven cooking methods in Ardahan, which do not contain salts, spices, or food additives, were preferred. Sixteen breast muscles were used for each heat treatment. Boiling was performed in an open cauldron for 3.5 hours. The decreasing amount of water was replenished continuously. Subsequently, oven cooking was performed in a domestic oven at 200°C for 15 min.

2.2.2. Determination of some nutritional and physicochemical properties of goose meat

For the detection of the mineral content of goose samples, AOAC Official Methods (2020) were used (AOAC 985.35 for Mg, K, and Na; AOAC 999.10 for Fe; AOAC 986.24 for P). Cholesterol analysis was performed according to the method described by Fenton and Sim (1991). Protein analysis was applied by the Kjeldahl method (AOAC 960.52, 2020). pH was measured by homogenizing 10 g of meat samples in 100 mL of distilled water using a pH meter (Mettler Toledo, Greifensee, Switzerland). Total dry matter (%) content was determined by drying the samples to a constant weight at 105 ± 2°C. The amount of NaCl diffused into the goose meat was determined by titrating the chloride anions in the sample solutions with silver nitrite using the Mohr method. The fat content (%) was analyzed using the Soxhlet method, employing petroleum ether extraction via a Soxhlet extractor.

2.2.3. Cooking loss of goose meat

Cooking loss was calculated using the following equation (1) after the samples were cooled to room temperature: Wb and Wp represent the weight of raw meat samples before cooking and the post-cooking weight of the samples, respectively.

$$Cooking\ loss\ \% = \frac{(Wb-Wp)}{(Wbx100)} \quad (1)$$

2.2.4. Sensory analysis of goose breast

Dry-cured goose samples were cut into slices (approximately 3 × 3 × 2 cm). The slices were then placed on numbered disposable plates and presented to the panel. Sensory analysis was performed by 15 panelists from the Food Engineering, Gastronomy, and Culinary Arts departments of Ardahan University. The sensory descriptions and score values of the sensory panel form used in the evaluation, and their corresponding expressions, are listed in Table 1.

Table 1. Descriptors used in the sensory assessment and definitions corresponding to the scores (Wereńska et al., 2023)

Score	Flavor and aroma	Tenderness	Juiciness	Cohesiveness	Springiness	Overall palatability
0-2	Absence	Extremely tough	Extremely dry	Extremely low	No elasticity	Unacceptable
3-4	Sufficiently	Moderately tough	Moderately dry	Low	Low elasticity	Sufficient
5-6	Pleasant-good	Moderately tender	Moderately juicy	Moderately low	Moderate elasticity	Good
7-8	Very pleasant	Tender	Juicy	High	Elasticity	Very good
9-10	Excellent	Extremely tender	Very juicy	Extremely high	Extreme elasticity	Excellent

2.2.5. Statistical analysis

One-way ANOVA was used for statistical analyses of the results. The statistical significance of the differences between the groups was estimated using Duncan’s multiple range test ($P < 0.05$). All statistical analyses were performed using SPSS version 24 software (SPSS Inc., Chicago, IL, USA). The results of the statistical analysis are presented as mean values with standard deviations in the figures. The experiments were performed in duplicate.

3. Results and discussion

3.1. Salt content of the samples analysis

As shown in Figure 2, the degree of intramuscular salt transfer was not regularly affected by the level of NaCl and drying time. As expected, the salt content of the samples that were salted with 300 g and dried for 30 days reached its maximum and was determined to be 1.73 ± 0.01. The differences in the salt content between the samples were statistically significant ($P < 0.01$).

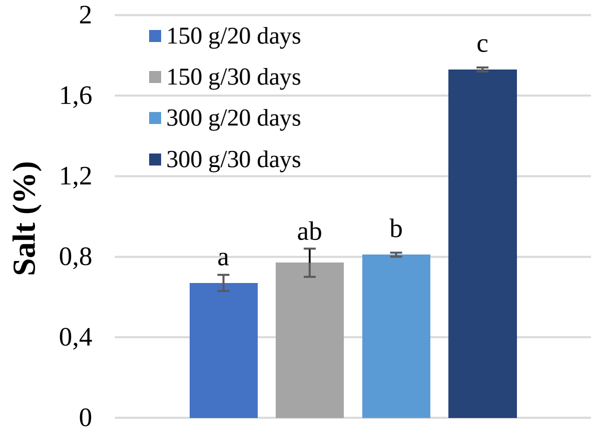

Figure 2. Salt amount results of goose samples

[a,b,c,d] Values within a column with different superscripts differ significantly at $P < 0.05$

3.2. Dry matter, pH, and cooking loss

The results of dry matter, protein, fat, and cooking loss of salted-dried goose meat samples are shown in Figure 3. As the drying time increased in samples that had been salted to the same amount, a corresponding decrease in moisture content was observed, accompanied by an increase in dry matter content (Fig. 3). As expected, the samples with the highest dry matter content were highly salted and dried (63.10 ± 0.56). The pH values of the raw samples ranged from 6.07 to 6.36, whereas those of the cooked samples varied from 6.31 to 6.76. The differences in the dry matter and pH between samples were statistically significant ($P < 0.01$).

The cooking loss increased with increasing salt content and drying time. The lowest and highest cooking losses were determined as 29.03 ± 0.01 and 42.01 ± 0.08, respectively, in the samples that were 150 g salted/20 days dried and 300 g salted/30 days dried, respectively. Moreover, the differences in cooking loss between samples were statistically significant ($P < 0.01$).

3.3. Protein and fat

The protein and fat content of the salted-dried goose meat samples are shown in Figure 3. The lowest protein content of the goose samples obtained after 150 g of salting and 20 days of drying was calculated as 37.64 ± 0.08. The highest protein content was determined as 46.21 ± 0.03, from the samples that were salted at 300 g and dried for 30 days. The differences between the protein content of the samples were statistically significant ($P < 0.01$). Considering the fat content of the goose samples, a statistically significant difference was observed between the 300 g salted and 30 days dried samples and the 150 g salted samples ($P < 0.05$).

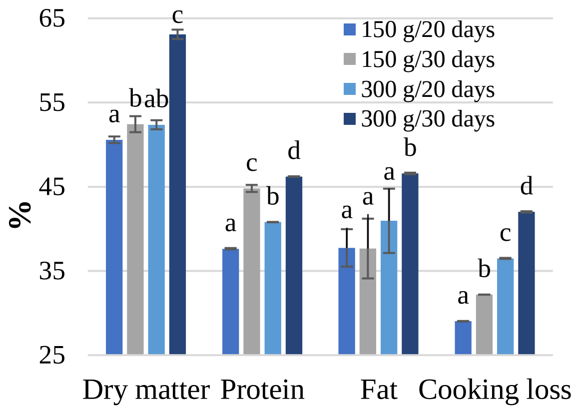

Figure 3. Dry matter, protein, fat, and cooking loss results of goose samples

[a,b,c,d] Values within a column with different superscripts differ significantly at $P < 0.05$

3.4. Mineral content of the samples

The mineral content of the samples is shown in Fig. 5. The results demonstrated that the Na mineral content of goose samples increased by the quantity of salt used during salting. The maximum concentration of Na detected was 19104.50 ± 770.04 mg/kg in the samples, salted with 300 g of salt and dried for 30 d. The K concentration was determined as 2510.50 ± 9.19 mg/kg in the samples that were salted at 150 g and dried for 20 days and 3322 ± 22.63 mg/kg with 30 days of drying. The K content in the 300 g salted samples were not significantly different ($P > 0.05$). A significant difference was detected between the P content of 150 g salted and 20 days dried and that of the other samples ($P < 0.05$). The highest Fe and P contents were determined as 59.97 ± 1.04 mg/kg and 1435 ± 100.41 mg/kg, respectively, in the samples salted with 300 g of salt and dried for 20 days. The highest Mg content was determined to be 544.35 ± 17.61 mg/kg in the samples that were salted with 150 g of salt and dried for 30 days. The differences between the minerals in the samples were statistically significant ($P < 0.01$) (Table 2).

Table 2. Results of the mineral content of goose breast samples

	150 g of salting		300 g of salting		
Mineral (mg/kg)	**20 days of drying**	**30 days of drying**	**20 days of drying**	**30 days of drying**	**Sig.**
Mg	386.95 ± 8.13[a]	544.35 ± 17.61[d]	448.45 ± 11.10[b]	489.40 ± 5.23[c]	**
K	2510.50 ± 9.19[a]	3322 ± 22.63[c]	2760.50 ± 17.68[b]	2761 ± 18.38[b]	**
Na	8441.50 ± 434.87[a]	10944.50 ± 919.95[b]	12866.50 ± 259.51[c]	19104.50 ± 770.04[d]	**
Fe	25.21 ± 0.46[a]	49.05 ± 0.44[c]	59.97 ± 1.04[d]	44.20± 0.49[b]	**
P	701 ± 117.38[a]	1168.50 ± 106.77[b]	1435 ± 100.41[b]	1211± 103.24[b]	**

[a,b,c,d] Values within a row with different superscripts differ significantly at $P < 0.05$

3.5. Cholesterol content of the samples

The cholesterol contents of the samples are shown in Figure 4. When the figure was examined, it was observed that the cholesterol values increased with increasing salting and drying rates. In addition, the highest cholesterol value was 255.18 ± 4.50, while the lowest value was 215.29 ± 0.83. Finally, the differences in cholesterol content between samples were statistically significant ($P < 0.01$).

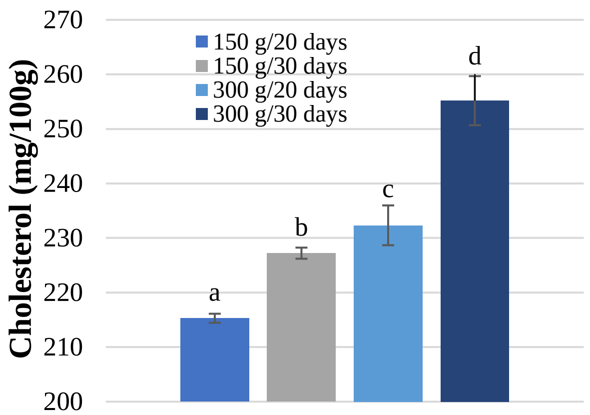

Figure 4. Cholesterol content of goose samples

[a,b,c,d] Values within a column with different superscripts differ significantly at $P < 0.05$

3.6. Sensory analysis

The results of the sensory analysis of the goose meat breast samples are shown in Figure 5. Cooking methods frequently used in this region were preferred for sensory evaluation. For this purpose, goose meat was boiled with skin and baked.

The salted-dried goose breast samples showed a statistically significant difference in the overall acceptability ($P < 0.01$). For overall acceptability, the most popular goose breast meat samples were 150 g salted and 30 days dried, and 300 g salted and 20 days dried, although the differences between these results were not statistically significant ($P > 0.05$). However, aroma and juiciness were significantly different between the samples ($P < 0.05$). The differences between other descriptors were not statistically significant ($P > 0.05$). Finally, it was noteworthy that 150 g of salt and 20 d of drying yielded the lowest results in terms of flavor and aroma.

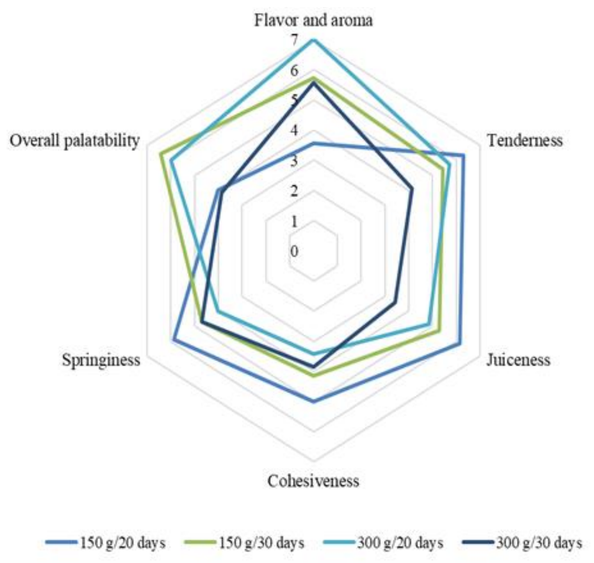

Figure 5. Sensory evaluation of goose breast samples

4. Discussion

Slaughter, carcass, and quality of geese can differ based on factors such as sex, age, nutrition, production method, and fattening period. Among these factors, the production system is a significant non-genetic factor that influences these traits (Boz et al., 2017). Microbial growth can be reduced by salting and drying meat products; however, these processes also affect the texture of the meat products (Yalçın and Şeker, 2016). There are limited studies on the effects of drying and salting on goose meat quality. In this study, it was aimed to determine the effects of different salting and drying times on the physicochemical, nutritional, and sensory properties of meat.

Sodium salt is a crucial bacteriostatic agent in the food industry that plays an important role in inhibiting the growth of spoilage and pathogenic bacteria. Its impact extends to reducing water activity (aw) and creating an inhospitable environment for microbial growth and reproduction in foods. Furthermore, NaCl can lower oxygen solubility and influence the enzyme activity in microbial cells. It can also compel microorganisms to expend a significant amount of energy to expel Na ions from their cells, thereby hindering their proliferation. The accumulation of harmful substances such as biogenic amines and bacterial toxins is favored in low-salt environments (Wang et al., 2023). In this study, the salt content of the samples that were salted at 300 g and 30 days dried reached its maximum and was determined to be 1.73 ± 0.01. The investigation revealed that as the amount of salt used and the duration of drying increased, there was an increase in the diffusion of salt into the muscles. Another preferred process in this region is to maintain the carcass in salt for a few days after salting. However, the samples used in this study dried immediately after salting. Therefore, the salt content may increase further with increasing salting time. Another option is to incorporate phosphates in low-salt meat products that reduce the salt content by up to 50%, boost the water and fat retention capacity, and enhance their sensory and physicochemical properties (Gómez et al., 2020). Such applications can be attempted if industrial-based goose production facilities are established in the region. Finally, in this way, the negative effects of excess salt on health could be reduced. Kokoszyński et al. (2022) reported that the salt content varied between 0.1-0.8% in goose breast samples.

As expected, the samples with the highest dry matter content were those that were the most salted and dried samples (%63.10 ± 0.56). Lower results have been reported in other studies (Oz and Celik, 2015; Damaziak et al., 2016; Oz et al., 2016; Gumułka and Połtowicz, 2020). Goluch et al. (2021) found that the moisture content in goose breast samples was influenced by both the muscle type (with or without skin) and heat processing methods. They also determined that skinless muscles have higher moisture content than muscles with skin.

The pH level of meat is an effective parameter for assessing traits such as water-holding capacity, texture, color, cooking loss, and shelf life. Hence, meat with higher pH level has a shorter shelf life, which is primarily attributable to microbial factors (Boz et al., 2019). In this study, the pH values of the raw samples range from 6.07 and 6.36. Similar results have been reported in other studies (Gumułka et al., 2020; Liu et al., 2011). In previous studies, lower values have been detected in goose breast meat samples (Kirmizibayrak et al., 2011; Yakan et al., 2012; Oz and Celik, 2015; Oz et al., 2016).

During the heat treatment process, the losses incurred during cooking, which are attributed to mass transfer, are contingent on various factors. These factors encompass not only the specifics of the cooking procedure, such as the method employed, cooking surface utilized, and duration and temperature of cooking, but also the main properties of the meat. The water, protein, and fat content, pH value of raw meat, and size of the meat all play integral roles in determining the extent of cooking loss (Oz and Celik, 2015). Other factors include the shape of the chopped meat, salt content, and inclusion of various additives (Choi et al., 2016). Previous research has suggested a positive correlation between the low pH level of poultry meat and diminished water-holding capacity, leading to increased drip and cooking losses (Damaziak et al., 2016). The primary components lost during the cooking of meat devoid of skin and subcutaneous fat include water, water-soluble components, and intramuscular fat. The goose exhibites a notable presence of subcutaneous fat. Consequently, when preparing meat with skin, subcutaneous fat is an additional component lost during heat treatment, contributing to higher cooking loss (Wołoszyn et al., 2020). In our study, it was found that as the salting and drying levels of goose increased, cooking loss also increased.

Goose meat is characterized by high-quality proteins with a minimal collagen content ranging from 0.39 to 0.91% (Buzała et al., 2014). Other studies conducted by different researchers have identified the protein content in fresh goose breast meat to be between 21 and 24% (Buzała et al., 2014; Boz et al., 2019; Biesek et al., 2020). On the other hand, considering the fat amount of the dry-cured goose samples, no statistically significant difference was observed between the fat amount of the samples salted with 150 g of salt ($P > 0.05$). In addition, the fat content of the 300 g salted samples was higher than that of the other samples.

Meat and its products constitute integral elements of our dietary patterns, encompassing nutrients such as fats, fatty acids, cholesterol, and vitamins, which can impact health (Pogorzelska-Nowicka et al., 2018). Cholesterol is an important molecule in the membrane structure and a precursor for the synthesis of vitamin D, steroid hormones, and bile acids (Nowicka et al., 2018). Some studies have reported a much lower cholesterol content in goose breast meat than in our study (Buzała et al., 2014;

Biesek et al., 2020; Haraf et al., 2021). In our study, the highest cholesterol value was 255.18 ± 4.50 mg/100 g, while the lowest value was 215.29 ± 0.83 mg/100 g (P < 0.01). In another study, the cholesterol value of salted and dried goose meat was determined to be 140.64 ± 9.28 mg/100 g (Şahin et al., 2022). These values were quite low compared to those in the present study, which could be due to differences in dry matter content. Boz et al. (2019) found that cholesterol levels did not differ between the sexes or varieties. In contrast, Buzała et al. (2014) pointed out variations in cholesterol content between genotypes and sexes. Cholesterol levels in meat and poultry can be affected by several factors, including animal species, muscle fiber type, and muscle fat content. The influence of fiber type appears to be linked to the size of muscle fibers and lipid accumulation in the muscles. Research indicates that muscles with high oxidative capacity with red muscle fibers, smaller fiber diameter, and higher fat content, tend to exhibit higher total cholesterol levels (Dinh et al., 2011). However, it cannot be forgotten that a daily intake of approximately 300 mg is recommended in human nutrition (USDA/HHS, 2010).

Genetic, physiological (sex), and environmental (diet) factors can affect the mineral composition of meat (Geldenhuys et al., 2015). On the other hand, Goluch et al. (2021) indicated that heat-processing methods for meat enhance food safety, sensory qualities, and digestibility, but they can also alter energy, nutrient content, and mineral retention. In our study, Na increased with an increase in the amount of salt used for salting and the drying time. Among the minerals whose amounts were investigated in goose breast meat samples, the most abundant minerals were Na, K, P, Mg, and Fe, respectively. Geldenhuys et al. (2015) reported that Egyptian goose meat contained a substantial abundance of P, K, Mg, and Na. Moreover, it was found that the meat had an Fe content of 5.3 mg/100 g. This level was attributed to the metabolic capacity and fiber composition of the breast muscle. Similar results were obtained with our study in terms of Na (13128.50 ± 1856.21 mg/kg), K (3004.44 ± 681.96 mg/kg), Fe (39.48 ± 3.85mg/kg), P (1443.03 ± 67.21 mg/kg) and Mg (269.62 ± 16.09) in goose leg meat (Şahin et al., 2022). Geldenhuys et al. (2013) highlighted that in addition to its high Fe content, Egyptian goose meat contains substantial levels of Zn and Cu. In addition, P was the most abundant mineral, followed by K and Mg. The authors also noted that elevated Fe content is a distinguishing characteristic, largely attributed to the higher level of physical activity in geese.

In this study, the highest overall palatability scores of meat samples were noted in 150 g salted and 30 days dried samples and 300 g salted and 20 days dried samples. Geldenhuys et al. (2014) observed that the aroma and flavor profiles of Egyptian goose meat exhibited characteristics distinct from those of Guinea fowl (breast), ostrich (fan fillet and moon steak), Pekin duck (breast), and broiler chicken (breast). It has also been stated that Egyptian goose meat has a very strong aroma and flavour, and leaves a metallic taste in the mouth due to the presence of high amounts of Fe. Nowicka et al. (2018) revealed that sensory quality varied depending on three different regions/producers due to the different smoking time used by each producer for a traditional Polish dry-cured product made from the meat of a White Koluda goose. In another study, the instrumental sensory value of male breast muscles was lower than that of females (Kokoszyński et al., 2022). Wołoszyn et al. (2020) reported that samples containing skin and subcutaneous fat exhibited a greater intensity of typical flavor and aroma, along with enhanced springiness, tenderness, and juiciness of goose meat. The samples also received a higher overall palatability score than their skinless counterparts.

5. Conclusion

This Salting and drying are age-old techniques that involve carefully applying salt to meat, effectively removing moisture, and inhibiting the growth of harmful microorganisms. Once adequately salted, meat is left to air-dry in a controlled environment, often characterized by low humidity and proper ventilation. This process imparts an intense flavor to meat while extending its shelf life. This product can be stored for extended periods, making it an essential food source in regions with harsh climates and limited access to fresh ingredients. Consumers attach importance to factors such as price, sensory quality, and nutritional content when deciding whether to buy meat and meat products. Finally, it is thought that the optimization of salting and drying processes may influence product sales dynamics and consumer preferences.

Availability of data and materials

The datasets used in this study are available from the corresponding author upon request.

Ethical statement

Ethical approval for animal experiments was not required for this study.

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Conflict of interest

The authors declare that they have no conflict of interest.

Author contributions

Academic Advisor of the Project- H.Ç.; Writing-Original Draft- B.S.; Conceptualization- B.S.; Formal Analysis; B.S., D.A.B., F.K., P.K.; Writing and Review B.S., P.K., D.A.B.; Project manager-F.K.; All the authors have read and agreed to the published version of the manuscript.

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