Microbiological properties and volatile compounds of salted-dried goose

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ABSTRACT Salted-dried goose is a traditional Turkish product with specific flavor that is produced by dry salting, post-salting, and subsequently air-drying of the goose carcass. In this study, the leg and breast parts of salted-dried goose carcasses were analyzed in terms of microbiological properties and volatile compounds. Lactic acid bacteria and *Micrococcus-Staphylococcus* bacteria constituted a significant part of microbiota in both leg and breast samples. The Enterobacteriaceae count was below the detectable level (<2 log cfu g^{-1}) in 60% of the leg samples and in 47% of the breast samples. The yeast–mold count was less than 5 log cfu g^{-1} in 80% of both leg and breast samples. Many volatile compounds belonging to different chemical groups, including aldehydes, aliphatic and aromatic hydrocarbons, esters, alcohols, terpenes, ketones, sulfur compounds, and furans, were identified from samples. The breast samples showed a higher mean amount of hexanal than the leg samples. No significant difference was found between the breast and leg samples in terms of ketones and sulfur compounds. It was also determined that a considerable part of volatile compounds is formed by lipid oxidation.

Key words: goose meat, hexanal, volatile compound, Enterobacteriaceae, lactic acid bacteria

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INTRODUCTION

The local products sector is stated to be one of the most dynamic sectors of food consumption. In the world, many products are known by the name of the region where they are produced, and they are recognized and marketed by the name of that region (Altuntaş and Gülçubuk, 2014). Salted-dried goose is one of many traditional products produced in Turkey. The product is commonly produced in Kars and Ardahan provinces (Kırmızıbayrak et al., 2011a,b; Tilki et al., 2011). It is homemade in accordance with old traditions. The production is usually carried out at the end of November (Buckland and Guy, 2002), especially after the fall of the first snow (Kamber and Yaman, 2016). Manufacturing of salted-dried goose consists of 6 stages: slaughtering, washing, salting, post-salting, drying, and ripening. After slaughtering, the internal organs are eviscerated. Carcasses are washed and dry-salted. Salting is a critical stage in manufacturing. Inappropriate salting may cause spoilage. Salted carcasses are subjected to post-salting process. In this stage, the ambient temperature and humidity have great effect on the quality of the product. After that, sun drying is applied to achieve appropriate dehydration. The storage, last stage, is also called post-ripening, and the product is stored under natural temperature conditions until consumption (Buckland and Guy, 2002; Kamber and Yaman, 2016). This product is sold in local markets from early winter to early spring (Güven et al., 2004).

Goose meat has high levels of unsaturated fatty acids, especially oleic acid, and is thus, potentially, also rich in fat-soluble nutrients (Nowicka et al., 2018). On the other hand, it is an important source of essential amino acids in human diet (Du et al., 2018a). There are studies on the use of goose meat in processed products such as fermented sausage (Gülbaz and Kamber, 2008; Li et al., 2011; Ying et al., 2011) and Bologna-type sausage (Güner et al., 2002). On the other hand, goose meat is also a good source of raw material in the production of traditional products in some countries. Dry-cured

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goose, which is a traditional Chinese meat product, is produced by dry curing, marinating, and air-drying maturation processes of fresh goose meat (Ying et al., 2016; Zhou et al., 2016). Polish goose meat called pólgęsek (Nowicka et al., 2018) and Mortara goose salami (Colombo et al., 2002) are other traditional products produced from goose meat. Another traditional processed poultry product is the Nanjing dry-cured duck, which is produced by dry-curing, marinating, piling, and drying–ripening (Du et al., 2018b).

There are quite a limited number of studies on dried goose meat, which is a traditional product and is commonly produced in family farms in Kars and Ardahan provinces (Güven et al., 2004; Kamber and Yaman, 2016). In both studies, microbiological properties of dried goose carcasses provided from Kars province were analyzed. No study on the volatile compound profile of this product was found in the literature. On the other hand, there are only 2 studies on the volatile profile of dry-cured goose, which is produced in China by conventional methods (Xu et al., 2007; Zhou et al., 2016). In this study, salted-dried goose carcasses were provided from 15 local markets, and their leg and breast parts were analyzed in terms of microbiological properties and volatile compound profile.

MATERIALS AND METHODS

Material

In this study, 15 salted-dried gooses were provided from different local markets in Ardahan (Eastern Anatolia/Turkey) province where goose production is commonly done. The leg (the whole leg, processed) and breast (skinless whole breast) parts of each salted-dried carcass were removed. Thus, 30 breasts and 30 legs were obtained from 15 carcasses. One of the 2 parts obtained from each dry-salted goose carcass was used for microbiological analysis, and the other was used for analyses of volatile compounds. Analyses were performed on 2 samples from each part. Microbiological analysis was carried out on the sampling day. For analysis of volatile compounds, the parts were separately vacuum packed (polyamide/polyethylene, 15 × 25 cm, Multivac A300/16, Wolfertschwenden, Germany) and stored at −18°C until analysis.

Microbiological Analysis

Twenty-five grams of each sample was placed into sterile stomacher bags, and 225 mL of sterile physiological saline (0.85% NaCl) was added. After homogenizing in a stomacher (Lab Stomacher Blender 400-BA 7021, Seward, West Sussex, UK), appropriate dilutions were spread on selective agar plates.

de Man–Rogosa–Sharpe agar (Oxoid, Basingstoke, England) was used for the enumeration of lactic acid bacteria, and the plates were incubated under anaerobic conditions (Anaerocult A, Merck, Darmstadt, Germany) for 48 h at 30°C. *Micrococcus/Staphylococcus* was enumerated on mannitol salt phenol-red agar (Oxoid, Basingstoke, England) for 48 h at 30°C; Enterobacteriaceae was enumerated on Violet Red Bile Dextrose agar (Merck, Darmstadt, Germany) for 48 h at 30°C under anaerobic conditions (Anaerocult A, Merck, Darmstadt, Germany); molds–yeasts were enumerated on Rose Bengal chloramphenicol agar (Merck, Darmstadt, Germany) for 5 D at 25°C.

Volatile Compound Analysis

For volatile compound analysis, samples of breast and leg parts were cooked in roasting bags in boiling water for 2 h. After cooking, the samples were cooled in a refrigerator. Thereafter, the cooled samples were homogenized using a food blender (Arçelik K1634, İstanbul, Turkey). For the analysis of volatile compounds, 5 g of each sample was weighed into a 40-mL vial and sealed using a polytetrafluoroethylene (**PTFE**)-coated silicone septum (Supelco, Bellefonte, PA). The samples were stored at −20°C until analysis. The extraction of headspace volatile compounds was carried out using a solid phase microextraction (**SPME**) device (Supelco, Bellefonte, PA), using 75-μm fibers of carboxen/polydimethylsiloxane. Before the analysis, the fibers were preconditioned in the injection port of the gas chromatography (**GC**) system as indicated by the manufacturer. The samples were placed in a water bath for 20 min at 60°C to obtain volatile compounds. A GC (Agilent 6890N, Santa Clara, CA)–mass spectrometry (Agilent 5973, Santa Clara, CA) system was used with the DB-624 capillary column (60 m × 0.22 mm i.d. × 1.4-μm film, Agilent, Santa Clara, CA). Helium was used as a carrier gas, and the sample was injected in the splitless mode. The temperature program was held at 40°C for 5 min and subsequently programmed from 40°C to 110°C at a rate of 3°C/min, at a rate of 4°C/min from 150°C, and then at a rate of 10°C/min from 210°C, the temperature at which the program was held for another 15 min. The GC–mass spectrometry interface was maintained at 280°C. Mass spectra were obtained by electron impact at 70 eV, and data were acquired across the range 30 to 400 m/z. The compounds were identified by comparing the results with mass spectra from a database developed by NIST and WILEY or standard molecules (for calculating Kovats indices, Supelco 44585-U, Bellefonte, PA) and by matching their retention indices with those in the literature. The results were given as arbitrary units of area ($AU \times 10^6$).

Statistical Analysis

In this study, 15 breast and 15 leg samples were subjected to microbiological analysis. The data of the microbiological results were arranged in frequency distribution tables and then presented in figures. In addition, for volatile compound analysis, the carcass part (the breast or leg) was subjected to treatment, and experiments were performed as per a randomized complete block design (15 replicates). All statistical analyses were performed using SPSS statistical software, version

Table 1. Volatile compounds of leg and breast parts of salted-dried goose carcasses.

Compounds	KI	R	Leg (n = 15)	Breast (n = 15)	Significance
			Mean ± SD	Mean ± SD	
Aldehydes					
Acetaldehyde	623	b	19.46 ± 2.16	19.43 ± 3.35	NS
Pentanal	742	b	8.24 ± 9.09	6.83 ± 2.28	NS
Hexanal	849	a	33.69 ± 57.18	118.48 ± 43.02	**
Heptanal	955	b	4.12 ± 5.09	5.85 ± 5.98	NS
Benzaldehyde	1022	a	0.42 ± 2.34	0.62 ± 1.25	NS
Octanal	1054	b	2.35 ± 2.98	1.69 ± 0.30	*
Nonanal	1162	b	1.66 ± 1.91	5.35 ± 2.87	**
2-Nonenal	1221	c	0.03 ± 0.11	0.30 ± 0.48	**
Decanal	1250	b	0.02 ± 0.10	0.18 ± 0.44	NS
Aromatic hydrocarbons					
Toluene	789	a	0.14 ± 0.44	0.83 ± 2.21	NS
p-Xylene	892	b	0.08 ± 0.19	0.36 ± 0.33	**
Styrene	933	b	0.10 ± 0.20	0.43 ± 0.47	**
Aliphatic hydrocarbons					
Heptane	700	a	2.26 ± 2.27	3.52 ± 1.90	*
Octane	800	a	8.72 ± 9.08	9.27 ± 3.70	NS
Nonane	900	a	0.09 ± 0.18	0.39 ± 0.16	**
Decane	1000	a	0.25 ± 0.98	0.60 ± 0.33	NS
Undecane	1100	a	0.00 ± 0.00	0.59 ± 0.68	**
Dodecane	1200	a	0.14 ± 0.38	1.73 ± 1.17	**
Tridecane	1300	a	0.01 ± 0.06	0.37 ± 0.81	*
Tetradecane	1400	a	0.11 ± 0.46	0.68 ± 0.67	**
Esters					
Ethyl acetate	648	a	0.89 ± 1.38	3.41 ± 2.70	**
Propyl hexanoate	1151	b	0.73 ± 1.86	1.83 ± 0.83	**
Hexyl butanoate	1215	b	0.30 ± 0.92	2.83 ± 8.47	NS
Alcohols					
Ethanol	539	a	14.21 ± 16.77	38.02 ± 15.90	**
1-Propen-2-ol	541	c	6.37 ± 15.18	11.42 ± 15.85	NS
2-Pentanol	748	c	0.02 ± 0.12	0.08 ± 0.22	NS
1-Pentanol	835	c	0.94 ± 3.31	0.04 ± 0.18	NS
1-Hexanol	931	b	0.53 ± 1.39	0.79 ± 0.41	NS
2-Ethyl-1-hexanol	1084	b	1.46 ± 3.24	2.97 ± 3.35	NS
Terpenes					
Limonene	1052	b	0.50 ± 0.99	1.39 ± 2.08	*
Ketones					
2-Pentanone	727	b	2.14 ± 5.57	4.16 ± 8.98	NS
2-Heptanone	938	b	3.36 ± 3.40	4.72 ± 7.10	NS
2,3-Octanedione	1024	c	7.08 ± 6.20	7.76 ± 3.70	NS
Cis-oct-5-en-2-one	1035	c	0.30 ± 0.64	0.51 ± 0.66	NS
2-Octanone	1038	c	0.36 ± 0.70	0.50 ± 0.54	NS
2-Nonanone	1140	c	1.53 ± 4.33	0.74 ± 1.67	NS
Furans					
2-Ethylfuran	717	b	0.68 ± 1.29	1.75 ± 1.39	**
2-Butylfuran	925	b	0.19 ± 0.42	0.57 ± 0.38	**
2-Pentylfuran	1021	b	6.07 ± 5.31	10.29 ± 6.08	**
Sulfur compounds					
2-Propanethiol	540	c	0.21 ± 0.60	0.12 ± 0.29	NS
Thiourea, tetramethyl	1343	c	1.10 ± 2.86	1.39 ± 1.14	NS

$*P < 0.05$; $**P < 0.01$.

The results are expressed as arbitrary unit of area ($AU \times 10^6$) as means of 3 replicates.

R, reliability of identification: a, mass spectrum and retention time identical with an authentic sample; b, mass spectrum and Kovats index from the respective literature; c, tentative identification by mass spectrum.

KI, Kovats index calculated for the DB-624 capillary column (60 m × 0.25 mm i.d. × 1.4-µm film, Agilent) installed on a gas chromatograph equipped with a mass selective detector.

Abbreviation: NS, not significant.

22 (IBM, New York, NY). Mean values ± standard deviations are shown in Table 1.

RESULTS

Microbiological Properties

The frequency distributions of the results of microbiological counts of the leg and breast samples are presented in Figures 1–4. As shown in Figure 1, lactic acid bacteria were the predominant microbiota in both leg and breast samples. The lactic acid bacteria count was found to be approximately 1×10^6 cfu/g or higher in 33% of the breast samples, whereas the count was found to be less than < 4 cfu/g in 20% of the leg samples (Figure 1). Another group of microorganisms in the microflora is *Micrococcus/Staphylococcus* bacteria. These microorganisms showed a count of 1×10^7 cfu/g or higher in 13% of the breast samples and 20% of the leg samples.

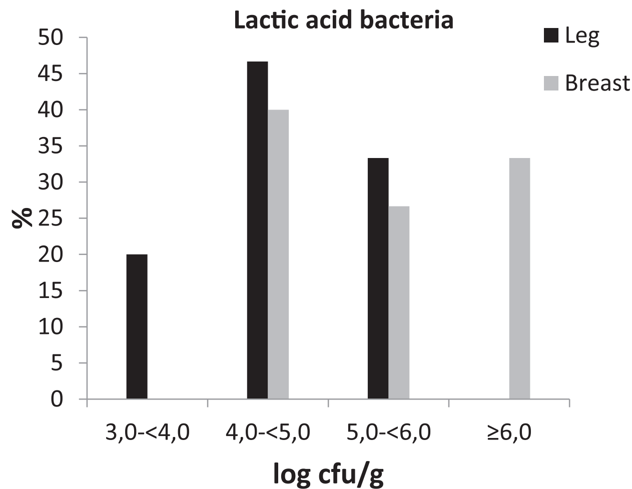

Figure 1. The frequency distributions of lactic acid bacteria count in salted-dried goose carcasses (n = 15).

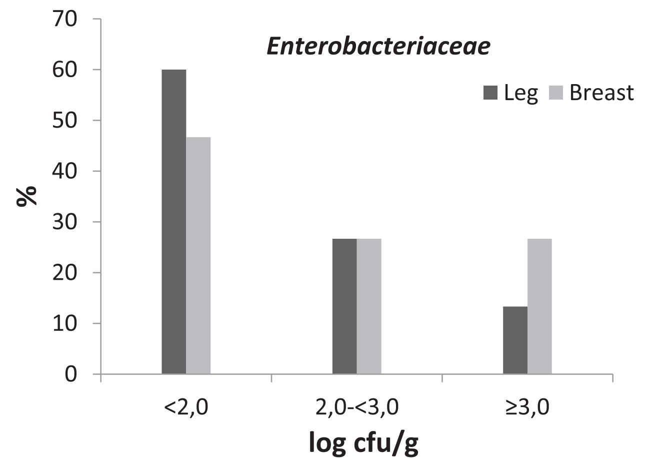

Figure 3. The frequency distributions of Enterobacteriaceae count in salted-dried goose carcasses (n = 15).

Furthermore, the *Micrococcus/Staphylococcus* count was not less than 1×10^4 cfu/g in any sample (Figure 2). The count of Enterobacteriaceae was detected at the level of < 2 log cfu/g in a significant part of the leg samples (60%). In the breast part, the number of samples giving the count of Enterobacteriaceae below the detectable limit was fewer. On the other hand, the Enterobacteriaceae count was found to be 1×10^3 cfu/g or more in 2 of the leg samples and 4 of the breast samples; however, this count did not reach 1×10^4 cfu/g in any sample (Figure 3). The yeast–mold count was less than 1×10^5 cfu/g in 80% of both leg and breast samples (Figure 4).

Volatile Compounds

Many volatile compounds belonging to 9 chemical groups such as aldehydes, aliphatic hydrocarbons, aromatic hydrocarbons, esters, alcohols, terpenes, ketones, furans, and sulfur compounds were identified in the samples of the salted-dried goose, which is a traditional product.

As can be seen from the results presented in Table 1, significant ($P < 0.05$) or very significant ($P < 0.01$) differences were determined in terms of hexanal, octanal, nonanal, and 2-nonenal between the leg and breast samples. The breast samples showed a higher mean hexanal amount than the leg samples. Higher mean values were also determined in terms of nonanal and 2- nonenal in the breast samples. However, a higher mean value was determined in terms of octanal in the leg samples (Table 1).

Three aromatic hydrocarbons were determined in the samples; p-xylene and styrene revealed high mean values in the breast samples (Table 1). A total of 8 aliphatic hydrocarbons in the breast samples and 7 aliphatic hydrocarbons in the leg samples were identified. All aliphatic hydrocarbons in the breast samples showed higher mean values than those in the leg samples. However, no significant difference was observed between the groups in terms of octane and decane. Three ester compounds were determined both in the breast and in the leg samples. Similar to aliphatic hydrocarbons, the

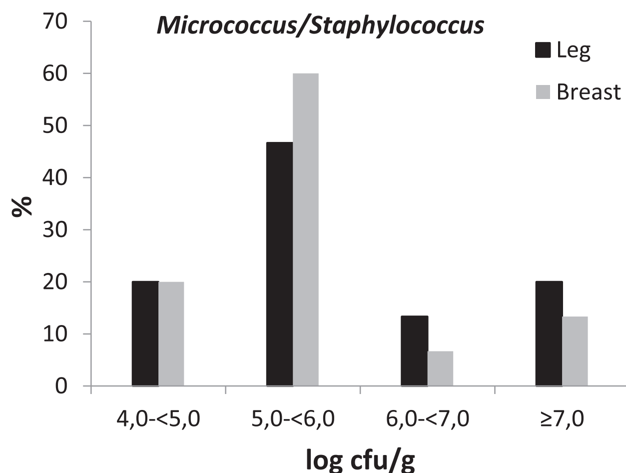

Figure 2. The frequency distributions of *Micrococcus/Staphylococcus* count in salted-dried goose carcasses (n = 15).

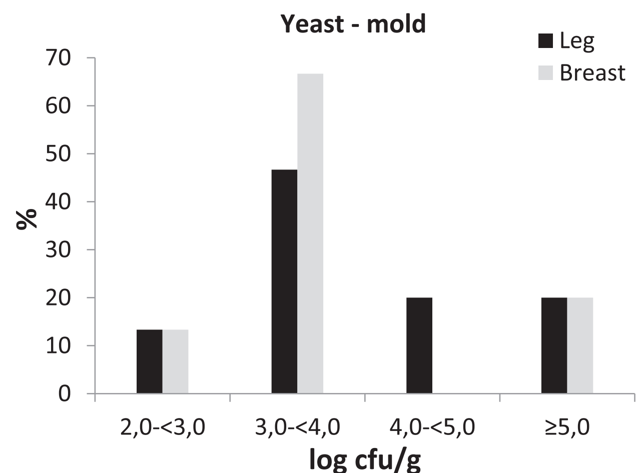

Figure 4. The frequency distributions of yeast–mold count in salted-dried goose carcasses (n = 15).

breast samples had high mean values of ester compounds. However, there was no statistical difference in terms of hexyl butanoate between the samples (Table 1).

Six alcohol compounds were detected in dried goose samples. In both breast and leg samples, the average values of ethanol and 1-propen-2-ol were higher than those of other alcohol compounds. On the other hand, the carcass parts had a significant effect only on ethanol ($P < 0.01$). The breast part had a higher mean value for ethanol than the leg part (Table 1).

Limonene was the only terpene compound detected in samples, and the highest mean value was found in the breast samples. No difference was observed between the 2 parts in terms of ketones and sulfur compounds detected in the samples. In terms of furans, the highest mean values were detected in the breast samples (Table 1).

DISCUSSION

Salting and drying are 2 important stages in the processing of goose meat. The amount of salt used in the salting of goose carcasses and drying conditions affect the microbiota of the product. As it is also understood from the results of microbiological counts of samples, lactic acid bacteria and *Micrococcus/Staphylococcus* bacteria are the dominant microorganisms in the microbiota in this product. Salting and drying are the common techniques for the conservation of meat. Salt favors the growth of lactic acid bacteria and Micrococcaceae (*Micrococcus/Staphylococcus*) (Kaya and Kaban, 2016). In dry-cured meat products, the typical microbiota consists of lactic acid bacteria, yeasts, and molds as well as Micrococcaceae (Garcia et al., 1995). El-Adab et al. (2015) reported that lactic acid bacteria and coagulase-negative staphylococci represent the 2 predominant microbiota in a traditional Tunisian dry fermented poultry meat sausage during ripening. In the present study, the lactic acid bacteria count was found to be 1×10^6 cfu/g or higher in 33% of the breast samples. However, the *Micrococcus/Staphylococcus* count was found to be of 1×10^7 cfu/g or higher in 13% of the breast samples and 20% of the leg samples. This result is probably due to the fact that *Micrococcus/Staphylococcus* is more tolerant to low a_w values than lactic acid bacteria. The initial a_w value of the product decreases depending on the amount of salt used in the production of salted and cured meat products, and lower a_w values are achieved with the effect of drying (Kaya and Kaban, 2016).

In this study, the count of Enterobacteriaceae was usually found to be below the detectable level in both leg and breast samples. This result shows that these microorganisms are sensitive to salt and therefore water activity is inhibited in sufficiently salted and dried products (Kaya and Kaban, 2016). The fact that the count of Enterobacteriaceae is especially higher than 10^3 cfu/g in some samples indicates that there is no sufficient salting and/or drying in these products. Therefore, the count of Enterobacteriaceae is estimated to reach higher levels if these products are not stored under cold conditions. Furthermore, a high count of Enterobacteriaceae also indicates that hygienic conditions cannot be ensured in obtaining the carcass and/or product production (Güven et al., 2004; Kamber and Yaman, 2016). Kamber and Yaman (2016) also reported that the count of Enterobacteriaceae varied between 2.30 and 7.00 log cfu/g in 92.8% of dried goose carcass samples collected from the local households in Kars. Furthermore, the mean coliform group bacteria count was determined to be 2.98 ± 0.31 log cfu/g (minimum: 2.30, maximum: 6.41 log cfu/g) in 67.8% of the samples. Güven et al. (2004) also reported that the count of Enterobacteriaceae was below the detectable level (< 2 log cfu/g) in 32.64% of the samples of processed goose carcasses obtained from different retail shops in Kars. On the other hand, Uçar et al. (2001) determined that the mean number of psychrophilic microorganisms was 5.9×10^2 cfu/cm^2 in goose carcasses.

Lipid oxidation plays a very important role in the formation of volatile compounds in dry-cured meat products. Furthermore, aldehydes are the most abundant volatiles derived from lipid oxidation in the dry-cured meat products (Yang et al., 2017). In salted-dried goose samples, hexanal constitutes the dominant compound in both leg and breast samples. The mean amount of hexanal was found to be higher in the breast samples (Table 1). Similarly, Lou et al. (2018) reported that hexanal made a significant contribution to the aroma derived from lipid oxidation of uncured duck, vinasse-dry-cured product, and vinasse-wet-cured product. In another study conducted on vinasse-cured duck products, it was found that thiobarbituric acid reactive substances (**TBARS**) values increased as the pressure increased from 0.1 to 150 MPa. In the same study, it was indicated that this treatment caused a significant increase in aldehydes including hexanal (Xia et al., 2020). In marinated pork in soy sauce, however, it was found that the high pressure treatment at 150 MPa had no significant effect on the amount of hexanal (Yang et al., 2018). Hexanal is formed by the oxidation of n-6 fatty acids such as linoleic and arachidonic acid (Ramirez and Cava, 2007; Kaban, 2009). High concentrations of this compound in meat products are a good sign of flavor deterioration, which results in rancid aroma (Kaban, 2009; Ying et al., 2016). Accordingly, the high level of this compound in breast meat indicates that lipid oxidation is higher in these parts. Indeed, Karwowska et al. (2014) reported that breast muscles revealed a higher TBARS value than thigh muscles. Ying et al. (2016) reported that the high level of salt (8%) increased the amount of hexanal in dry-cured goose compared with the low level of salt (4%). Geldenhuys et al. (2015) also reported that season and portion were effective on fatty acid composition, which plays an important role in the aroma and flavor profile, and that the breast part contained higher levels of polyunsaturated fatty acids than the thigh. In another study, Geldenhuys et al. (2016) indicated that the grain harvesting season had a major effect on the overall sensory

profile of the meat and the grain-based diet of summer is also responsible for higher levels of oleic and linoleic acid and lower polyunsaturated fatty acid (**PUFA**) content than that of winter.

Among aldehydes, acetaldehyde and pentanal were the other 2 important compounds. However, there was no statistically significant difference between the carcass parts in these compounds (Table 1) ($P > 0.05$). In a Chinese-type traditional dry-cured goose product, it was reported that aldehydes had a significant share in the volatile compound profile and that hexanal was the dominant compound, as in the present study (Xu et al., 2007; Ying et al., 2016).

Three aromatic hydrocarbons, including toluene, p-xylene, and styrene, were detected in salted-dried goose samples. Aromatic hydrocarbons, especially toluene (methylbenzene) and xylene (ethylbenzene), take an important place in the aroma of cured meat products (Ramirez and Cava, 2007). The sources of these compounds are different. For example, toluene may occur as a result of lipid degradation or amino acid catabolism (Akköse et al., 2017). Xu et al. (2007) also determined that toluene was the dominant compound among aromatic hydrocarbons in dry-cured goose samples, as in the present study.

Among aliphatic hydrocarbons, heptane and octane were determined to be at higher levels in salted-dried goose samples. However, no statistically significant difference was found between the octane amounts of the leg and breast samples (Table 1). Aliphatic hydrocarbons have no significant contribution to aroma because they have high threshold values (Ramirez and Cava, 2007). Many aliphatic hydrocarbons were also detected in Chinese-type dry-cured goose meat samples (Xu et al., 2007; Ying et al., 2016).

Higher levels of ethyl acetate and propyl hexanoate were detected in the breast samples than in the leg samples. Esters usually occur as a result of esterification of carboxylic acids and alcohols in meat products. Ethyl acetate was determined only in the curing stage in a study on dry-cured goose meat (Xu et al., 2007). In the present study, ethanol had a significant share among the alcohols identified in the leg and breast samples. This compound showed a higher mean value in the breast samples. There are different ways in the biosynthesis of alcohols such as methyl ketone reduction, amino acid metabolism, and lipid oxidation (Sidira et al., 2015).

Spice, which is an important source of terpenes, is not used in the production of salted-dried goose meat. Therefore, only D-limonene was detected in the samples. Feedstuff is also among the sources of this compound (Çakır et al., 2013). Ketones are the compounds that are formed as a result of lipid oxidation, the Maillard reaction, and microbial esterification (Pugliese et al., 2015). Six ketone compounds identified in the samples were not affected by the carcass part (Table 1). 2-Heptanone and 2-octanone, resulting from lipid oxidation detected in the present study, were also detected in dry-cured Chinese goose by Ying et al. (2016). Xu et al. (2007) also detected many ketones including 2-pentanone and 2-heptanone in dry-cured goose samples. Higher amounts of 2-ethylfuran, 2-butylfuran, and 2-pentylfuran were detected in the breast meat samples than in the leg samples (Table 1). These 3 compounds were also detected by Ying et al. (2016), and these compounds were reported to result from lipid oxidation. 2-Pentylfuran, revealing the highest value in the present study, was also detected at a higher level in Chinese-type dry-cured goose (Ying et al., 2016).

Two sulfur compounds were detected in this study. There was no significant effect of the carcass part on these compounds. It is also stated that sulfur compounds are usually originate from sulfur-containing amino acids (Kaban, 2009). Nevertheless, in a study on the volatile profile of goose meat, it was reported that carbon disulfide was usually a predominant compound and that the odor of this compound was similar to that of cabbage. Furthermore, it was stated that carbon disulfide might also originate from ethylene bis-dithiocarbamate fungicides used in agriculture (Soncin et al., 2007).

CONCLUSIONS

Lactic acid bacteria and *Micrococcus/Staphylococcus* have a significant share in the microbiota of salted-dried goose meat, which is a traditional product. The count of members of the Enterobacteriaceae family is usually below the detectable limit in this product. However, counts of Enterobacteriaceae ranging from 10^2 to 10^3 cfu/g were also encountered. Therefore, the amount of salt used in salting and the adequate drying time are important for product safety. Low-salt and semi-dry products should be necessarily stored under refrigerator conditions. When the pro-oxidant effect of salt is considered, the storage of the product under cold conditions becomes even more important. The compounds originating from lipid oxidation, especially hexanal, come to the forefront in the aroma of this traditionally produced product. The breast part contains higher levels of volatile compounds than the leg part.

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