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### RESEARCH ARTICLE

#### DETERMINATION OF SOME MICROBIOLOGICAL, CHEMICAL AND HISTOLOGICAL PROPERTIES OF SALAMI AND SAUSAGES SOLD IN MARKETS

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#### Abstract

Salami and Sausage are ready to eat meat products that can pose a risk for human health. This study was aimed to determine the some microbiological, chemical and histological properties of 31 salami and 23 sausages from different companies offered for sale in markets, Turkey. The total aerobic mesophilic bacteria (TAMB), yeast and mould enumeration, lactic acid bacteria and psychrophilic bacteria count were evaluated. The water activity, pH, moisture content, and ash content were analysed. The mean TAMB value of salami and sausage samples were 2.30 log CFU/g and 2.80 log CFU/g, respectively ( $P > 0.05$ ). The water activity was found as 0.97 for both samples. The pH value of salami and sausage samples were 5.94 and 5.87, respectively ( $P > 0.05$ ). Moisture content was higher in salami samples (63.80%) than sausage samples (62.00%) ( $P > 0.05$ ). The average ash content in salami samples was 2.15%, while it was 2.80% in sausage samples ( $P > 0.05$ ). In conclusion, the microbiological and chemical analysis of sausage and salami products were within the range of Turkish standards. However, histological analysis revealed that some packed sausage and salami products sold in market are manufactured from lower-value trimmed food.

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#### Introduction:-

According to Turkish Standards, salami is a meat product made by filling the meat paste prepared with the addition of necessary auxiliary substances, after being separated from the bones, fat, tendon, scapula, nerve and cartilage of the bovine and ovine body meats or their mixtures, and then being smoked and cooked in water in accordance with their type [1]. Sausage, on the other hand, is obtained by filling the dough prepared from butchery bovine body meats into suitable cases, knuckling at regular intervals into a string shape, then smoking or boiling according to the method [2].

The people's eating habits is tendency to change the packaged ready-to-eat foods such as salami and sausage is increasing [3, 4]. Emulsified products such as salami and sausage pose a risk to human health if they are not made in accordance with the process. Although the heat treatment causes less bacterial load, high water activity (aw) of salami and sausage may cause the shelf life shortened, which results with easy deterioration of products [5].

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The microbiological and chemical properties that cause undesirable taste and appearance in ready-to-eat salami and sausages are important in determining whether they are suitable for the production process and the shelf life [6, 7]. In addition, due to the nature of the raw materials used in the production of salami and sausages, they are highly susceptible to fraud, and the histological properties of the products determine whether the unwanted textures and structures have been used in the production [4].

This study was carried out to determine some microbiological, chemical and histological properties of salami and sausages from different companies offered for sale in markets, Turkey.

### Materials and Methods:-

The present study was carried out with 31 salami and 23 sausages belonging to different companies, which were offered for sale in the markets of Erzurum, Turkey. Packaged salami and sausage samples transported to the laboratory in the cold chain, and stored at +4°C until analysis.

#### Microbiological analysis

For microbiological analysis, 25 g of sample was weighed into a sterile stomacher bag and 225 ml of sterile Ringer's solution was added. It was prepared in appropriate dilutions by homogenizing in a Stomacher device (Ultra Turrax IKA, Germany). The total aerobic mesophilic bacteria (TAMB), yeast and mould enumeration [8], lactic acid bacteria and psychrophilic bacteria count [9] were evaluated after the incubation of samples.

#### Chemical analysis

The water activity of samples was determined by using a water activity device (Aqua LAB 4TE, Meter Group, USA). The pH value of samples was measured with a pH meter (Orion 3 Star pH Benchtop, Thermo Scientific, USA). The moisture content of each sample was calculated by gravimetric method. The ash was burned in porcelain crucibles in the muffle furnace until it turned gray-white, and the percentage was calculated.

#### Histological analysis

2x5 µm thick slices of salami and sausage samples were obtained and placed in tissue follow-up cassettes. Samples were kept in 10% buffered formaldehyde solution for 24 hours. After the fixation process, the samples were washed with water for 6-8 hours, passed through graded alcohol and xylene series and embedded in paraffin blocks. The Crossman's triple staining was applied to the sections [10]. The samples were photographed by using a Nikon Eclipse 50i light microscope.

#### Statistical analysis

T-test was performed to compare the difference between salami and sausage products. The significance level was accepted as  $P < 0.05$ . Data were presented as mean  $\pm$  standard deviation. All data were analysed using the SPSS20 (IBM Company, Version 20.0, SPSS Inc, USA, 2018) statistical package.

### Results:-

The mean TAMB value of 31 salami and 23 sausage samples were 2.30 log CFU/g and 2.80 log CFU/g, respectively ( $P > 0.05$ ). The mean lactic acid bacteria values of salami and sausages were determined as 3.06 log CFU/g and 2.64 log CFU/g, respectively ( $P > 0.05$ ). The average value of yeast-moulds of the samples was 3.30 log CFU/g for salami, while it was 3.04 log CFU/g for sausage samples ( $P > 0.05$ ).

The mean value of psychrophilic bacteria count of salami and sausage samples were 4.00 log CFU/g and 3.60 log CFU/g, respectively ( $P > 0.05$ ). The water activity was found as 0.97 for both samples. The pH value of salami and sausage samples were 5.94 and 5.87, respectively ( $P > 0.05$ ). Moisture content was higher in salami samples (63.80%) than sausage samples (62.00%) ( $P > 0.05$ ). The average ash content in salami samples was 2.15%, while it was 2.80% in sausage samples ( $P > 0.05$ ). The most common tissues except muscle and adipose tissue in histological examination was the cartilage tissue (48%), followed by skin tissue (43%), hair follicle (41%), bone tissue (39%) and connective tissue (37%) (Table 1; Figure 1).

**Table 1:-** Histological contents of salami and sausage samples.

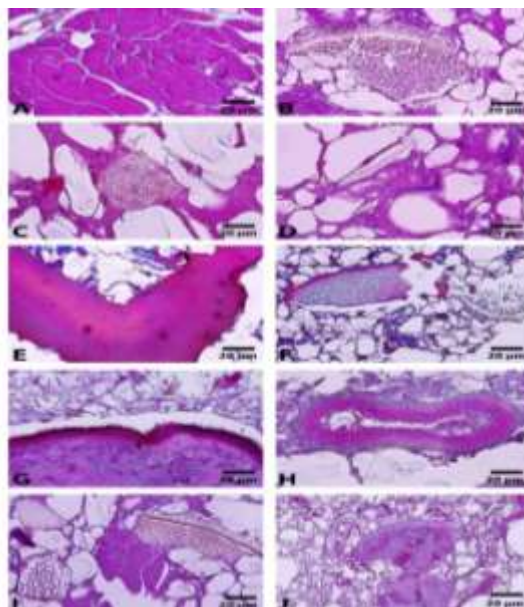
Muscle tissue	Adipose tissue	Cartilage tissue	Bone tissue	Skin and keratin tissue	Hair follicle	Connective tissue
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+++ (n=31)	+++ (n=28)	+++ (n=15)	+++ (n=13)	+++ (n=14)	+++ (n=10)	+++ (n=20)
++ (n=14)	++ (n=12)	++ (n=6)	++ (n=6)	++ (n=5)	++ (n=7)	++ (n=12)
+	+	+	+	+	+	+
+/ (n=0)	+/ (n=4)	+/ (n=0)	+/ (n=0)	+/ (n=2)	+/ (n=0)	+/ (n=13)
- (n=0)	- (n=0)	- (n=28)	- (n=33)	- (n=1)	- (n=32)	- (n=0)
- : absent, +/-: very low, +: low, ++: medium, +++: high. Every column contains 54 samples.						

### Discussion:-

The TAMB value of the salami samples of this study was 2.30 log CFU/g, whereas sausage samples found as 2.80 log CFU/g. This finding was consistent with previous studies that reported this rate as 1.80 CFU/g [7] and 4.8x10<sup>1</sup> CFU/g [11]. Lactic acid bacteria are listed as a major component of the microbial population found on vacuum-packaged emulsion-type products [12]. Previous research has reported lactic acid bacteria count between 2.00 and 8.15 log CFU/g, similar findings was found in the current study. The average value of yeast-moulds of the samples was 3.30 log CFU/g for salami, while it was 3.04 log CFU/g for sausage samples (P>0.05). Previous researchers have found similar yeast-mould ratio in packaged sausage samples [6, 13].

The water activity is correlated with the length of storage, which may cause water binding activity of sample. It has been stated that water activity of sausage is ranging between 0.97-0.98 [14]. Similar finding was obtained both salami and sausage samples in this study. In this study, the pH value of salami and sausage samples were found as 5.94 and 5.87. This finding was compatible with previous reports [7, 15, 16]. It has been stated that fermentation process of sausage causes a decrease in pH values, which is linked to the bacteria [17]. Even though the moisture content of sausage sample was higher than previous study [18], it was within the range of fermented sausage [19]. It has been stated that sausage samples are influenced by the content, handling of meat and the ripening conditions [20]. The average ash content in sausage samples was 2.80%, whereas 2.15% for salami samples, this was consistent with previous study [21]. In this study, the most common tissues except muscle and adipose tissue in histological examination of salami and sausage samples were the cartilage, skin, hair follicle, bone and connective tissues. Various studies have reported the unauthorized tissues in meat products such as adipose tissue, blood vessels, peripheral nerves, bone, and cartilage [22, 23].



**Figure 1:-** A: Histological appearance of normal salami and sausage samples, B: Skin (Epithelial tissue) C: Nerve tissue, D: Hair follicle, E: Bone tissue, F: Cartilage tissue, G: Epithelial, keratin layer and dermis, H: Muscular artery, I: Epithelial and keratin layer, J: Skin glands.

### Conclusion:-

In conclusion, there are few investigations regarding microbiological, chemical, and histological analysis of the packed sausage and salami products in Turkey. The microbiological and chemical analysis of sausage and salami products were within the range of Turkish standards. However, histological analysis revealed that some packed sausage and salami products sold in market are manufactured from lower-value trimmed food.

### References:-

- [1] Anonim: Salam, TS 979, TürkStandartlarıEnstitüsü. Ankara, 2002.
- [2] Anonim: Sosis, TS 980, TürkStandartlarıEnstitüsü. Ankara, 2002.
- [3] Elmalı, M., Ulukanlı, Z., &Yaman, H. (2005). Kars' da satışsunulanemülsifiye tipi et ürünlerininmikrobiyolojikkalitesi. ErciyesÜniversitesiVeterinerFakültesiDergisi, 2(1), 15-21.
- [4] Sezer, Ç., Ögün, M., &Güven, A. (2013). Salam vesosislerinbazıkımyasalözelliklerinininceleme. KafkasÜniversitesiVeterinerFakültesiDergisi, 19(1), 69-72.
- [5] Tandler, K. (1985). Frankfurter-type sausages-shelf-life and packaging of the fresh product. Fleischwirtschaft, 65(5), 561.
- [6] Apaydin, G., Ceylan, Z. G., Atasever, M., & Kaya, M. (2008). A Survey on microbiological and chemical quality of vacuum-packaged frankfurters. Atatürk ÜniversitesiZiraatFakültesiDergisi, 39(1), 109-113.
- [7] Aras, İ. S., &Çetin, Ö. Piyasadasatışsunulansosislerinmikrobiyolojikkalitesininbelirlenmesi. SağlıkBilimlerindelleriAraştırmalarDergisi, 2(1), 10-17.
- [8] Halkman A. K. Mikroorganizmaanalizyöntemleri. A.K. Halkman (Ed.), Merck Gıda MikrobiyolojisiUygulamaları, Vol. 358s, BaşakMatbaacılık, Ankara (2005), pp. 89-124
- [9] Swanson, K.M.J.; Petran, R.L.; Hanlin, J.H. Culture methods for enumeration of microorganisms. (2001) In: Downes, F.P.; Ito, K. (ed.) Compendium of methods for the microbiological examination of foods. 4 ed., American Public Health Association, Washington, p. 53-62.
- [10] Crossmon, G. (1937). A modification of Mallory's connective tissue stain with a discussion of the principles involved. The Anatomical Record, 69(1), 33-38.
- [11] Blickstad, E., &Molin, G. (1983). The microbial flora of smoked pork loin and frankfurter sausage stored in different gas atmospheres at 4 C. Journal of Applied Bacteriology, 54(1), 45-56.
- [12] Schmidt, U., & Kaya, M. (1990). Behaviour of L. monocytogenes in vacuum-packed sliced frankfurter-type sausage. Fleischwirtschaft, 70(11), 1294-1295.
- [13] Coşkun, F., Yılmaz, İ., &Demirci, A. Ş. (2015). The microbiological quality of frankfurters sold in Tekirdag. Journal of Tekirdag Agricultural Faculty, 12(1), 105-109.
- [14] Gnanasambandam, R., &Zayas, J. F. (1994). Chemical and bacteriological stability of frankfurters extended with wheat germ, corn germ and soy proteins 1. Journal of food Processing and Preservation, 18(2), 159-171.
- [15] Uşan, E., Kılıç, G. B., &Kılıç, B. (2021). Effects of Aloe vera utilization on physicochemical and microbiological properties of Turkish dry fermented sausage. Journal of Food Science and Technology, 1-12.
- [16] Samelis, J., Maurogenakis, F., &Metaxopoulos, J. (1994). Characterisation of lactic acid bacteria isolated from naturally fermented Greek dry salami. International Journal of Food Microbiology, 23(2), 179-196.
- [17] Ju, M. G., Kim, J. H., Jang, H. J., Yeon, S. J., Hong, G. E., Park, W., Seo, H. G., & Lee, C. H. (2016). Changes of physicochemical and sensory properties of fermented sausage from sulfur-fed pork. Korean Journal for Food Science of Animal Resources, 36(6), 729.
- [18] Samelis, J., Metaxopoulos, J., Vlassi, M., &Pappa, A. (1998). Stability and safety of traditional Greek salami—a microbiological ecology study. International Journal of Food Microbiology, 44(1-2), 69-82.
- [19] Lücke F.K. Fermented sausages. B.J.B. Wood (Ed.), Microbiology of Fermented Foods, Elsevier Applied Science, New York, USA (1985).
- [20] Stiebing, A., &Rödel, W. (1988). Influence of relative humidity on the ripening of dry sausage. Fleischwirt., 68, 1287-129.
- [21] Pal, U. K., &Agnihotri, M. K. (1996). Effect of vegetable oil on the quality of fresh chevon sausages. Journal of Applied Animal Research, 9(2), 187-191.
- [22] Latorre, R., Sadeghinezhad, J., Hajimohammadi, B., Izadi, F., &Sheibani, M. T. (2015). Application of morphological method for detection of unauthorized tissues in processed meat products. Journal of Food Quality and Hazards Control, 2(2), 71-74.
- [23] Rokni N., JahedKhaniki G.R., Pousty I. (1999). Detection of unauthorized tissue in heated sausages by using histology. Pajouhesh and Sazandegi. 13, 76-82.