SENSORY CHARACTERISATION OF SHEEP PASTRAMI PRODUCED WITH DIFFERENT TECHNOLOGICAL PARAMETERS

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Abstract

Sensory attributes (appearance, aroma, smell, taste, and texture) are the most accessible tools that determine consumer acceptance and the decision to buy certain meat or meat products. When buying, the consumer's first impression is based on the appearance and color of the food and then the smell. Finally, during the chewing process, they check the texture, taste, and flavor, which together determine the final impression of the product. The aim of the study was to produce and sensory evaluate three batches of sheep pastrami in which the maturation process was carried out differentially (for 6, 12, and 19 days), with the tenderness being adjusted by adding a tenderizing agent. As regards the sensory acceptability test, the samples received average scores between 6.40 and 7.64 for the attributes evaluated, with Lexp 3 being the one with the highest scores. In terms of CATA analysis, the sample that was described as closest to the ideal was Lexp3, the 6-day matured sample, which contained the highest amount of tender, with Lexp2 being very close. In the case of Lexp1, some evaluators identified a slightly rancid aroma and a more pronounced hardness, as it was subjected to the longest maturation period (19 days).

Key words: sensory evaluation, CATA test, sheep pastrami

Global sheep meat production is approximately 9.8 million tonnes, although the sheep population is over 1.2 billion animals (FAO, 2020). The main sheep meat producer is Asia (5.2 million tonnes), with China (2.7 million tonnes) and Russia (1.9 million tonnes) in first places, followed in descending order by Africa (1.9 million tonnes), Oceania (1.14 million tonnes), Europe (1.1 million tonnes) and America (427 thousand tonnes) (FAO, 2020). Meat is an important component of the human diet, considered essential for its supply of high-value proteins, vitamins, and minerals (iron, zinc, selenium, vitamin B12) (de Lima Júnior D.M. *et a*l, 2016; Libera J. *et al*, 2021). The particularly complex and balanced chemical composition of sheep meat, especially protein substances, vitamins, and mineral salts, determines the nutritional and biological value of this type of meat. Due to the proportion of nutrients and their high digestibility, sheep meat has superior dietary properties and is highly appreciated by consumers (Chikwanha O.C. *et al*, 2018; Corazzin M. *et al*, 2019). Moreover, like other ruminants, sheep meat is a good source of ω-3 polyunsaturated fatty acids, branched-chain fatty acids (BCFA), and polyunsaturated fatty acid biohydrogenation intermediates (PUFA-BHI), in particular conjugated linolenic acids and trans-octadecenoic acids, which have potentially beneficial effects on human health (Dilzer A., Park Y., 2012; Chikwanha O.C. *et al*, 2018).

The food quality of sheep meat is most often assessed in terms of flavor, followed by tenderness, and then juiciness (Prache S. *et al*, 2022). As sheep meat has a unique flavour, different from other types of red meat, this may underpin the popularity of sheep meat, but may also impede consumer acceptance (Watkins P.J. *et al*, 2013).

Tenderness, juiciness, flavor, and the overall sensory quality of meat are positively related to intramuscular fat content (Pannier L. *et al*, 2018), as well as to the system of rearing and feeding the animals (Pethick D.W. *et al*, 2005). When animals age, the percentage of fat in the carcass increases, and consequently, the intramuscular fat content increases. The effect of age on leanness is muscle-dependent, as muscles with less collagen are less influenced by the age of the animal at the time of slaughter (Prache S. *et al*, 2022). Finally, regardless of the origin of the sheep meat, it is recommended to mature the meat for at least 5

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days to improve tenderness (Pannier L. *et al*, 2018).

All products that are naturally or artificially dehydrated, salted, dried, smoked, or not, will be considered dried and semi-dried products. Pastrami is a popular product, generally preserved by salting without heat treatment, made mainly from beef, and sometimes, in some geographical areas, from pork, mutton, lamb or turkey meat (Roşca D., Roşca A., 2015; Teixeira A. *et al*, 2020; Abd-Elghany S. M. *et al*, 2020).

Considering globalization as an important factor in terms of evolution in general, people's tendency nowadays is towards the new, innovative, and even unusual. Due to the wide range of food products, manufacturers are turning to sensory analysis, carried out by consumers themselves, to guide them in the concept of food production and improvement. Against the background of increasing consumer demand for quality, safe products that also meet the needs of the human body, the study aimed to produce sheep pastrami, in which enhanced ripening was attempted by correlating the ripening time with the addition of a tenderizing agent to reduce the time needed for proper ripening. The obtained products were sensory characterized in order to determine their acceptability for consumption and the differences in sensory attributes between the experimental batches.

MATERIAL AND METHOD

The experimental batches were obtained in the Meat Processing Workshop of the University of Life Sciences "Ion Ionescu de la Brad" Iasi. For all batches of pastrami, salting was done by immersion in a brine solution with the same concentration (%); the added spices were the same: garlic powder, pink pepper, and sweet paprika; however, the maturation periods, tender quantities, and heat treatment parameters were differentiated. The production scheme for the three experimental batches is shown in *table 1*.

Table 1

Technological scheme of experimental batches

Technological parameters	Lexp 1	Lexp 2	Lexp 3
Maturation time	19 days	12 days	6 days
Tenderizing agent (%)	1%	3%	5%
Drying	t = 30 min.; U = 25%; T = 72°C (60°C inside the product)	t = 45 min.; U = 25%; T = 82°C (62°C inside the product)	t = 30 min.; U = 25%; T = 90°C (62°C inside the product)
Smoking	t = 30 min.; U = 25%; T = 73°C (62°C în interiorul produsului)	t = 30 min.; U = 25%; T = 82°C (62°C inside the product)	t = 30 min.; U = 25%; T = 90°C (62°C inside the product)
Boiling	t = 2h; U = 99%; T = 73°C (69°C inside the product)	t = 1h; U = 99%; T = 83°C (69°C inside the product)	t = 30 min.; U = 99%; T = 90°C (69°C inside the product)
Air Drying/ Baking	t = 25 min.; U = 22%; T = 89°C (69°C inside the product)	t =25 min.; U = 25%; T = 89°C (69°C inside the product)	t = 25 min.; U = 25%; T = 93°C (69°C inside the product)

t – time; U – humidity; T – temperature

The manufacturing process involved specific production steps for compact products such as meat trimming, salting and seasoning, tying, drying, smoking, boiling, baking, cooling, packaging, labeling, and storage.

The sensory evaluation of the pastrami experimental batches was carried out in the Sensory Analysis Laboratory of USV Iasi, with the evaluators being students, aged between 22 and 26 years, recruited from members of a scientific circle within the Sensory Analysis discipline. The evaluators were trained in advance, receiving information regarding the organization of the tasting, how to interpret the questionnaire, and specific sensory terms.

Sample preparation consisted of slicing the pastrami pieces to approximately equal sizes, distributing them on plates, coding each experimental batch, and then distributing them to the evaluators. The sensory analysis session was held in a white-lit room with individual booths, and only one testing session was required.

The first stage of the sensory evaluation involved analysing the products and completing an acceptability questionnaire using a 9-point hedonic scale, with the extremes of the scale ranging from 1 (extremely unpleasant) to 9 (extremely pleasant) (Meilgaard M.C. *et al*, 2016). The acceptability test aimed to score the batches on the general attributes of appearance, texture, aroma, taste, overall quality (Tarancon P. *et al*, 2020).

In the second part of the questionnaire, the aim was to describe the specific sensory attributes of each experimental batch using the CATA ("check all that apply") test. In this stage, the evaluators were asked to check all the sensory terms considered appropriate for each of the three types of pastrami. The descriptive terms for the sensory attributes chosen to compose the CATA test were: color: uniform, red, degree of marbling, aroma: intensity, rancid, smoky, meaty, spicy, off-

flavour, taste: salty, sour, bitter, texture: hard, fibrous, juicy, tender, dry, chewiness.

The results obtained for the acceptability test (hedonic scale) were subjected to analysis of variance (ANOVA) to compare mean values using the Tukey test at a 5% level of significance ($p < 0.05$). CATA test results were expressed by frequency analysis of quotes for each sensory term of each sample using XLStat software (versiunea Addinsoft, 2022).

RESULTS AND DISCUSSIONS

The ANOVA analysis of variance, comparing the mean scores of all the attributes evaluated by the subjects, shows (*table 2*) that the samples showed differences in sensory acceptance for the attributes' appearance, texture, and overall acceptability ($p < 0.05$). For these attributes, the superior evaluated batch was Lexp 3, followed by Lexp 2 and Lexp 1, while for the attributes aroma and taste no significant differences ($p > 0.05$) were found in the assessment made by the evaluators. Based on the mean values, there was a marked tendency towards the lower acceptance with increasing ripening period, possibly due to higher moisture losses in the samples, with evaluators perceiving the texture as harder and with lower juiciness. Referring to the averages obtained, it can be observed that all processed products showed averages between 6 (slightly pleasant) and 7 (moderately pleasant), so that the products can be considered acceptable for consumption since, according to Meilgaard M.C. et al. (2016), acceptance scores when applying the 9-point hedonic scale should be above 6.3.

Table 2

Mean (± standard deviation) sensory acceptance scores (9-point hedonic scale) of sheep pastrami

Sensory attributes	Lexp 1	Lexp 2	Lexp 3	Statistical interpretation (ANOVA)
Appearance	7.04 ± 1.14	7.35 ± 0.90	7.64 ± 0.64	p = 0.010 < 0.05→*ds
Texture	6.40 ± 1.65	6.97 ± 1.30	7.42 ± 1.11	p = 0.003 < 0.05→*ds
Aroma	7.11 ± 1.19	7.24 ± 1.63	7.35 ± 0.98	p = 0.595 > 0.05→ns
Taste	6.86 ± 1.03	7.02 ± 1.63	7.46 ± 1.15	p = 0.08 > 0.05→ns
Overall acceptability	6.75 ± 1.31	6.95 ± 1.27	7.42 ± 1.17	p = 0.039 < 0.05→*ds

The significance level alpha = 0.05; ∗∗p < 0.001, ∗p < 0.05, ns p > 0.05

For sensory description and preference assessment, using the CATA test method, sheep pastrami samples were compared with an ideal. The ideal sample had the most pleasing overall appearance, the most uniform color, the most intense smell, the highest flavor, and the most intense taste. *Figure 1* shows the results of the multiple factor analysis (MFA), with factors 1 and 2 explaining the variation between samples and the similarity plot showing which sample was closest to a set ideal.

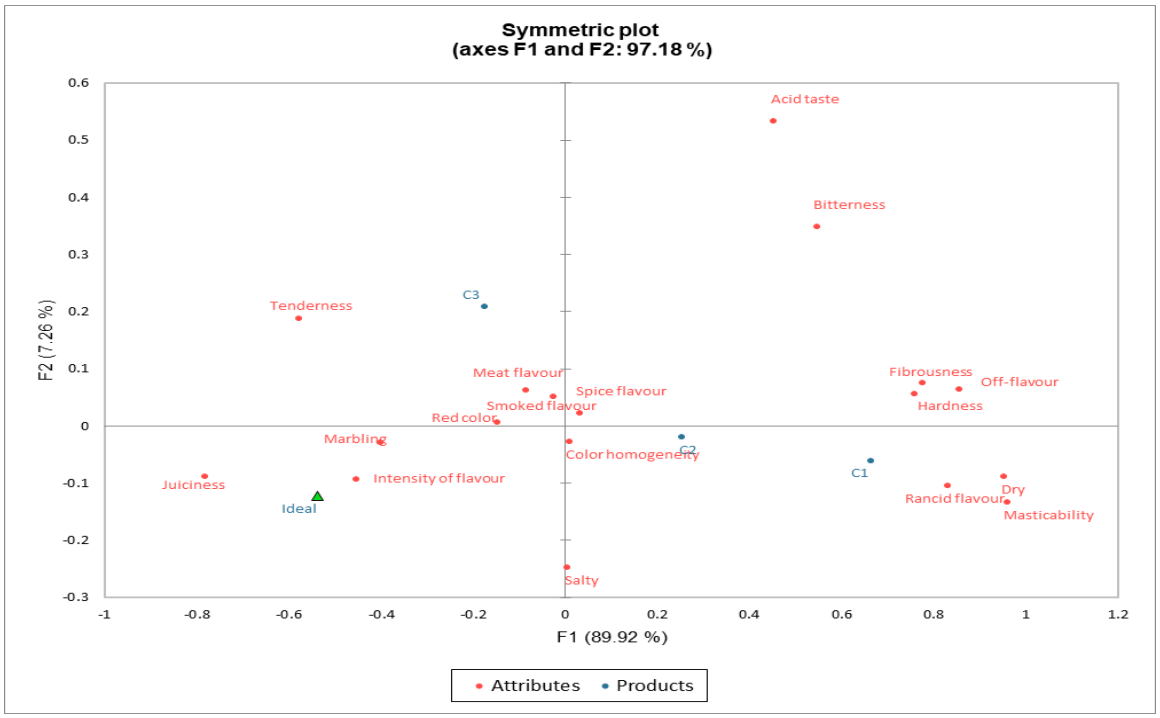

Figure 1 **Multiple factor analysis (MFA) of sheep pastrami assessed using the CATA test**

Thus, the left quadrant shows positive sensory characteristics describing the ideal, such as intense aroma, juiciness, marbling, meaty, smoky, and red color. It has been found that the experimental batch 3 (C3) is the closest to the ideal, and therefore it presents the sensory characteristics most desired by consumers. Experimental batches 2 and 3 (C2 and C3) were mainly characterized by the descriptive terms: uniform color, red, spicy, smoky, and meaty flavor, with Lexp 3 rated as more tender compared to Lexp 2.

CONCLUSIONS

The aim of this study was to highlight the importance of sensory analysis, which has recently become an essential component in the food industry. It supports producers, as food research can be used to create both nutritionally and sensory quality products that meet increasingly stringent consumer requirements. The sample from experimental batch 3 received the highest preference among the evaluators who participated in the tasting during the two stages of sensory evaluation, in which the goal was to highlight some important features related to the product's external appearance (texture, color, aroma, and taste), followed by the Lexp 2 sample and then the Lexp 1 sample. In terms of tenderness, the sample containing the highest amount of tenderizing agent was judged to be the most tender and juicy, with a more intense flavor and increased elasticity, characteristics that were shown by the correlation between physical ripeness and a higher amount of tenderizing agent than the other two samples.

REFERENCES

Abd-Elghany S. M., El-Makhzangy A. M., El-Shawaf A. G. M., El-Mougy R. M., & Sallam K. I., 2020 - *Improving safety and quality of Egyptian pastrami through alteration of its microbial community*. *LWT*, 118:108872.

Chikwanha O. C., Vahmani P., Muchenje V., Dugan M. E., & Mapiye C., 2018 - *Nutritional enhancement of sheep meat fatty acid profile for human health and wellbeing*. Food Research International, 104:25-38.

Corazzin M., Bianco S. D., Bovolenta S., & Piasentier E., 2019 - *Carcass characteristics and meat quality of sheep and goat*. In: Lorenzo J.M., Munekata P.E.S., Barba F.J., Toldrá F. (eds.), *More than beef, pork and chicken–the production, processing, and quality traits of other sources of meat for human diet,* Springer.

de Lima Júnior D. M., de Carvalho F. F., da Silva F. J., Rangel A. H. D. N., Novaes L. P., & Difante G. D. S., 2016 - *Intrinsic factors affecting sheep meat quality: a review.* Revista Colombiana de Ciencias Pecuarias, 29(1):03-15.

Dilzer A., & Park Y., 2012 - *Implication of conjugated linoleic acid (CLA) in human health*. Critical reviews in food science and nutrition, 52(6):488-513.

FAOSTAT, 2020 (available online at: https://www.fao.org/faostat/en/#data/QCL).

Libera J., Iłowiecka K., & Stasiak D., 2021 - *Consumption of processed red meat and its impact on human health: A review*. International Journal of Food Science & Technology, 56(12):6115-6123.

Meilgaard M.C., Civille G.V., Carr B.T., 2016 – *Sensory Evaluation Techniques*. Boca Raton: CRC Press.

Pannier L., Gardner G. E., O'Reilly R. A., & Pethick D. W., 2018 - *Factors affecting lamb eating quality and the potential for their integration into an MSA sheepmeat grading model*. Meat science, 144:43-52.

Pethick D. W., Davidson R., Hopkins D. L., Jacob R. H., D'Souza D. N., Thompson J. M., & Walker P. J., 2005 - *The effect of dietary treatment on meat quality and on consumer perception of sheep meat eating quality*. Australian Journal of Experimental Agriculture, 45(5):517-524.

Prache S., Schreurs N., & Guillier L., 2022 - *Review: Factors affecting sheep carcass and meat quality attributes.* Animal, 16:100330.

Roşca D., & Roşca A., 2015 - *The influence of cyclic vacuuming and pressuring process on tenderizing sheep pastrami*. Sci. Res. Educ. Air Force AFASES, 2:591-596.

Tarancón P., Tárrega A., Aleza P., Besada C., 2020 – *Consumer Description by Check-All-That-Apply Questions (CATA) of the Sensory Profiles of Commercial and New Mandarins. Identification of Preference Patterns and Drivers of Liking*. Foods, 9(4):468.

Teixeira A, Silva S, Guedes C, Rodrigues S., 2020 - *Sheep and Goat Meat Processed Products Quality: A Review*. Foods, 9(7):960. https://doi.org/10.3390/foods9070960

Watkins P. J., Frank D., Singh T. K., Young O. A., & Warner R. D., 2013 - *Sheepmeat flavor and the effect of different feeding systems: A review*. Journal of Agricultural and Food Chemistry, 61(15):3561-3579.