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# "UZICE BEEF PRSHUTA": INFLUENCE OF DIFFERENT SALTING PROCESSES ON SENSORY PROPERTIES

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**Key Words:** "Uzice Beef Prshuta"; salt penetration dynamics; dry-salting; vacuum tumbling; selected sensory characteristics.

## Introduction

Traditional dry-cured meat products constitute diverse group of food products. Originating from distinct geographic regions they bear characteristic sensorial properties gathered in superb quality meat products. Traditionally processed in a remote area of mountain Zlatibor (the south-western part of Serbia) "Uzice Beef Prshuta" remains the product that largely contributes to the local economy and gastronomic heritages. Being made of the most valuable parts of beef carcass (round muscles, loin muscles and tenderloin) originating from well feed, 3 – 5 years old cattle this product conforms fully with its PDO mark (Protected Designation of Origin). Detailed processing was reported earlier (Radovanovic et al., 1990-a, 1990-b, 1993).

## Objectives

Objective of meat salting process is salt diffusion into a muscle tissue, where salt, as a humectant, reduces water activity ($a_w$) providing preservation effect. Additionally salt contributes to appropriate salty taste, juiciness, softness, as well as to the development in a specific red colour. Salting process in production of dry-cured meat products is specific and differs from salting of other meat products. Generally, meat pieces are treated with dry salt and whole process is conducted under refrigeration temperatures (0-4 $^{o}$C). In these conditions the rate of salt diffusion from the product surface to the center is relatively slow. Application of mechanical treatments (tumbling and massaging) enhances salt penetration throughout the muscle by folding and crumpling them, which in return results in incoherent structure. In addition, vacuum applied along with massaging improves salt penetration through induced under-pressure.

The aim of this study was to determine salt penetration dynamics during the muscle salting process with and without vacuum tumbling, as well as to investigate influence of these two different salting treatments on sensory properties of "Uzice Beef Prshuta".

## Methodology

These investigations were conducted during the processing of "Uzice Beef Prshuta" according to the traditional technology described by Radovanovic et al., 1990-a. Twenty four samples of two different muscles obtained from beef carcasses were analyzed: 12 m. semitendinosus (MS) and 12 m. longissimus lumborum et thoracis (from cranial surface of 8. thoracic vertebra to caudal surface of 6. lumbal vertebra; ML). After deboning, cleaning of superficial fat and connective tissue, shaping of muscles, pieces were rubbed only with a 3.5% (w/w) NaCl. Six MS and six ML were immediately left in the salting chamber at the temperature 0-4 oC (traditional); other six MS and six ML were at first submitted to vacuum tumbling process for 20 hours (2 rpm with 70% of vacuum at 0-4 oC; 10 minutes tumbling and 50 minutes resting) and then left in the same salting room separately from the previous batch. In that way four experimental groups were obtained. After salting process was completed, muscles were washed and submerged into water for 12 hours. Later on, muscles were hanged on sticks in the chamber where smoking and drying processes were performed. Ripening was completed in 10 days.

Determination of chloride content was conducted according to Volhard method (ISO 1841-1:1996) in three layers (layer A: 1 cm in depth from external surface; layer B: 1 cm in depth from layer A; layer C: central part) of shaped muscles during whole salting process. Cross section cuts were taken up to 1 cm in thickness.

Sensory evaluation of ripened product "Uzice Beef Prshuta" was carried out by six experts. Five selected sensory characteristics were evaluated (appearance; cross section structure and appearance; colour; taste and smell; texture and juiciness) using the five level scale (from 1 – unacceptable to 5 excellent) – Radovanovic and Jovanka Popov-Raljic, 2001. Each of selected sensory characteristics were corrected by corresponding coefficient of importance (CI); sum of corrected scores gave the "percentage of total sensory quality" (Joksimovic, 1977).

Influence of different salting method on sensory quality of "Uzice Beef Prshuta" was statistically analyzed by analysis of variance.

## Results & Discussion

Results obtained (table 1. and figures 1., 2., 3. and 4.) show similar trend of salt penetration for each of formed combinations (muscle – salting process). During salting period, salt content in layer A has a decreasing, while in layers B and C increasing trend. Changes in salt content in all of three layers were more intensive in first 7 and 9 days of salting for vacuum tumbled meat and non-vacuum tumbled meat, respectively, than in the rest of the salting period. Necessary preservation effect by the salt content of about 2.5 % in layer C, was reached on 3rd day for vacuum tumbled ML, on 5th day for vacuum tumbled MS and non-vacuum tumbled ML, as well as on 7th day for non-vacuum tumbled MS. Critical concentration of NaCl in the muscle center are obtained in a faster rate by the vacuum-tumbling, which further induces shortening of a salting period. The effect of diameter difference between MS and ML expectedly led to faster salt diffusion into central part in ML than of MS. Salt content in muscle center (layer C) obtained at the of the salting process, in all four experimental groups, were approximately the same and ranged from 3.30% to 3.50 %. The end of salting process is traditionally determined by

cross section colour observation conducted by trained and experienced person. Salting period for vacuum tumbled muscles is 4 days shorter than for traditional one and had decreased from 16 to 12 days.

Table 1. Changes of salt content in different layers of muscles during the salting process for each experimental group

| Muscle type | Process | Dry salted and vacuum tumbled muscle | | | | | | Dry salted muscle | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Salting days | layer - A | | layer - B | | layer - C | | layer - A | | layer - B | | layer - C | |
| | | NaCl (%) | Sd | NaCl (%) | Sd | NaCl (%) | Sd | NaCl (%) | Sd | NaCl (%) | Sd | NaCl (%) | Sd |
| MS | 1. | 6.01 | 1.13 | 1.81 | 0.05 | 0.89 | 0.08 | 6.92 | 0.98 | 1.62 | 0.03 | 0.48 | 0.04 |
| | 2. | 4.13 | 0.07 | 2.13 | 0.06 | 1.54 | 0.09 | 4.50 | 0.87 | 1.92 | 0.38 | 0.63 | 0.07 |
| | 5. | 3.62 | 0.07 | 3.08 | 0.25 | 2.47 | 0.04 | 4.44 | 0.77 | 3.36 | 0.41 | 1.97 | 0.03 |
| | 7. | 4.19 | 0.05 | 3.60 | 0.00 | 3.04 | 0.29 | 4.54 | 0.79 | 3.84 | 0.38 | 2.51 | 0.06 |
| | 9. | 4.15 | 0.19 | 3.53 | 0.03 | 3.15 | 0.17 | 5.01 | 0.58 | 4.06 | 0.30 | 3.02 | 0.10 |
| | 12. | 4.27 | 0.23 | 3.89 | 0.08 | 3.30 | 0.11 | 4.93 | 0.10 | 4.07 | 0.19 | 3.30 | 0.22 |
| | 14. | - | - | - | - | - | - | 4.93 | 0.17 | 4.24 | 0.12 | 3.27 | 0.16 |
| | 16. | - | - | - | - | - | - | 4.82 | 0.50 | 4.33 | 0.10 | 3.38 | 0.06 |
| ML | 1. | 7.05 | 0.81 | 3.21 | 0.17 | 1.26 | 0.10 | 5.66 | 0.16 | 2.46 | 0.29 | 0.78 | 0.06 |
| | 2. | 5.55 | 1.10 | 3.41 | 0.01 | 2.24 | 0.02 | 5.79 | 0.48 | 3.00 | 0.28 | 1.96 | 0.05 |
| | 5. | 4.41 | 0.19 | 3.81 | 0.07 | 3.32 | 0.11 | 5.02 | 0.14 | 3.81 | 0.15 | 2.69 | 0.02 |
| | 7. | 4.24 | 0.30 | 3.88 | 0.30 | 3.44 | 0.19 | 4.80 | 0.23 | 3.78 | 0.09 | 3.15 | 0.10 |
| | 9. | 4.38 | 0.08 | 3.94 | 0.18 | 3.28 | 0.07 | 4.47 | 0.14 | 3.96 | 0.14 | 3.34 | 0.29 |
| | 12. | 4.09 | 0.08 | 3.79 | 0.16 | 3.41 | 0.25 | 4.38 | 0.12 | 4.00 | 0.23 | 3.45 | 0.14 |
| | 14. | - | - | - | - | - | - | 4.45 | 0.29 | 4.04 | 0.41 | 3.51 | 0.06 |
| | 16. | - | - | - | - | - | - | 4.36 | 0.21 | 4.09 | 0.19 | 3.49 | 0.19 |

**Figure 1. Changes of salt content in different layers of MS during salting process with vacuum tumbling**

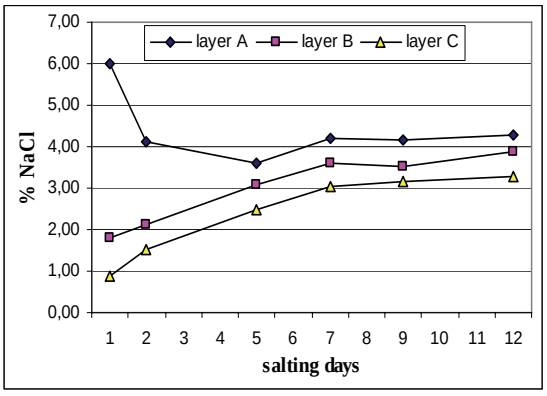



**Figure 2. Changes of salt content in different layers of MS during salting process without vacuum tumbling**

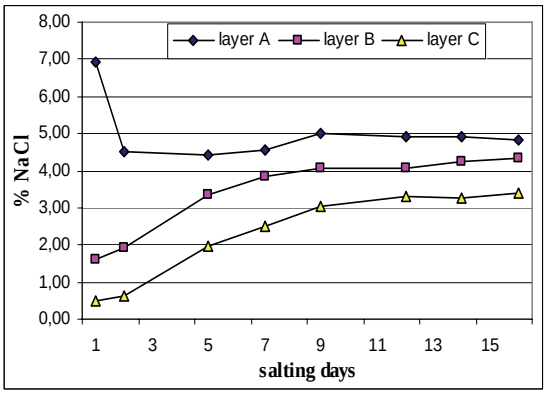


**Figure 3. Changes of salt content in different layers of ML during salting process with vacuum tumbling**

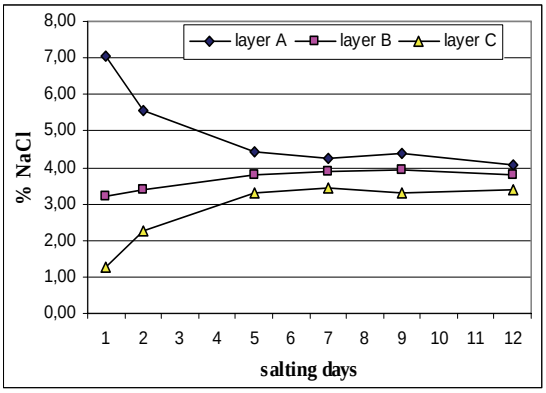
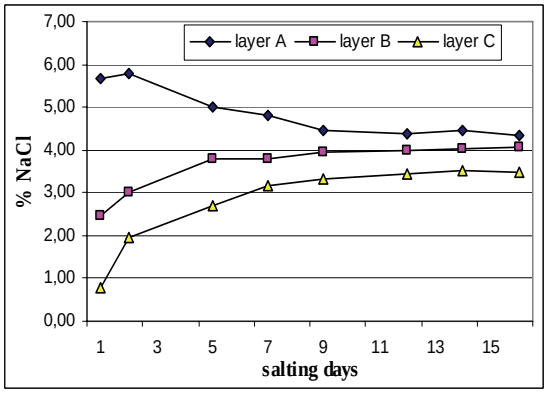



**Figure 4. Changes of salt content in different layers of ML during salting process without vacuum tumbling**




Furthermore, the influence of changes in the salting process on selected sensory properties of "Uzice Beef Prshuta" have been investigated. Sensory evaluation showed approximately uniform score values for corresponding sensory characteristics, as well as for total score value (table 2.). Analysis of variance has showed that there are no significant differences ($p<0.01$) in total sensory quality between examined four groups of samples, leading to conclusion that vacuum tumbling will have no impact on sensory quality of "Uzice Beef Prshuta", but will shorten salting process and the total production time.

Table 2. Sensory evaluation scores of the investigated samples of "Uzice Beef Prshuta"

| **Muscle type and selected sensory characteristics** | | **CI** | **Dry salted and vacuum tumbled muscle** | | **Dry salted muscle** | |
|---|---|---|---|---|---|---|
| | | | **"% of total sensory quality"** | Sd | **"% of total sensory quality"** | Sd |
| **MS** | appearance | 3 | 12.42 | 0.88 | 12.00 | 0.25 |
| | cross section structure and appearance | 3 | 12.58 | 0.52 | 12.25 | 0.87 |
| | colour | 3 | 12.42 | 0.29 | 12.25 | 0.43 |
| | taste and smell | 7 | 23.92 | 1.17 | 25.28 | 1.21 |
| | texture and juiciness | 4 | 14.11 | 0.69 | 14.67 | 1.33 |
| | total score value | 20 | 75.44 | 1.27 | 76.44 | 3.63 |
| **ML** | appearance | 3 | 11.58 | 0.29 | 9.67 | 1.01 |
| | cross section structure and appearance | 3 | 11.58 | 0.95 | 10.17 | 1.01 |
| | colour | 3 | 12.50 | 0.25 | 9.92 | 1.04 |
| | taste and smell | 7 | 27.03 | 1.68 | 27.03 | 2.05 |
| | texture and juiciness | 4 | 15.89 | 0.77 | 14.89 | 1.71 |
| | total score value | 20 | 78.58 | 2.05 | 71.67 | 4.84 |

CI – Coefficient of importance; Sd – Standard deviation

## Conclusions

According to the results presented following should be emphasized:

- Each of four experimental groups has a similar trend of salt penetration during the salting period. Salt content in layer A has a decreasing, while in layers B and C increasing trend.
- Salt content of about 2.5% in central part of muscle (layer C) is reached on day three for vacuum tumbled ML, on day five for vacuum tumbled MS and non-vacuum tumbled ML, as well as on day seven for non-vacuum tumbled MS.
- Salt content in muscle center (layer C) obtained at the end of the salting process, in all four experimental groups, were approximately the same and ranged from 3.30% to 3.50 %.
- A vacuum tumbling process shortens a period of salting in the production of "Uzice Beef Prshuta" for 4 days.
- Analysis of variance showed no significant differences ($p<0.01$) in total sensory quality between examined four groups of samples (dry-salted MS; dry-salted and tumbled MS; dry-salted ML; and dry-salted and tumbled ML).
- It is justified to include vacuum tumbling into traditional way of “Uzice Beef Prshuta” production.

## References

ISO 1841-1:1996. Meat and meat products – Determination of chloride content – Part 1: Volhard method.

Joksimovic, J. (1977): Osnovi kontrole i upravljanja kvalitetom. Privredni pregled, Beograd.

Radovanovic, R., Cavoski, D., Velickovic, D., Obradovic, D., Bojovic, P., Perunovic, M., Kerecki, Z. (1990-a): "Uzice Beef Prshuta". Project No. 1472/11. Faculty of Agriculture, Belgrade.

Radovanovic, R., Cavoski, D., Velickovic, D., Carapic, G. (1990-b): 36th ICoMST, Proceedings Vol.III, 905-912. Havana.

Radovanovic, R., Bojovic, P., Arbutina, Z., Vukajlovic, L. (1993): 39th ICoMST, Proceedings 10/S7P27.WP. Calgary.

Radovanovic, R., Jovanka Popov-Raljic (2001): Senzorna analiza prehrambenih proizvoda. Poljoprivredni fakultet - Beograd, Tehnoloski fakultet - Novi Sad.

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