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Strengthening the Sustainability of Sjenica Sheep

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Abstract

The Sjenica–Pešter Plateau (43.27306 N, 19.99944 E), due to its natural characteristics, holds significant potential for sheep production. Breeding the Sjenica sheep in this region represents a key mechanism for securing livelihood for the local population, reducing unemployment, and preventing depopulation. However, uncontrolled crossbreeding with highly productive breeds (such as Württemberg and Île-de-France) has led to a loss of authenticity and reduced genetic diversity of this autochthonous strain, thereby threatening biodiversity, agroecosystems, and the cultural heritage of Serbia and the surrounding region. As a response to these challenges, the most reliable conservation strategy involves promoting sustainable low-input breeding systems within traditional habitats. This study focuses on the characterization of lamb stelja - a cured meat product - as a value-added traditional resource obtained through extensive production relying exclusively on local plant-based forage. Fatty acid analysis of the stelja revealed a highly balanced nutritional profile. The proportion of monounsaturated fatty acids (MUFA) was 48.82 ± 2.00, saturated fatty acids (SFA) accounted for 46.05 ± 1.30, while polyunsaturated fatty acids (PUFA) comprised 3.08 ± 0.52. The dominant fatty acid was oleic acid (C18:1 cis-9) at 46.90 ± 1.75, followed by palmitic acid (C16:0) at 23.12 ± 0.48 and stearic acid (C18:0) at 19.30 ± 1.33. Omega-3 fatty acids contributed 0.95 ± 0.07 of the total content, with an omega-3 to omega-6 ratio of 0.46 indicating a favourable lipid

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composition in terms of human nutrition. These findings confirm that stelja derived from the Sjenica sheep represents a valuable regional product that offers not only nutritional benefits but also ecological and cultural significance. As an authentic, well-adapted, and traditionally bred animal, the Sjenica sheep deserves systematic protection and affirmation through the integration of its genetic traits, local production practices, and sustainability - serving the purpose of rural development and preserving the cultural identity of the Pešter Plateau and the region.

Keywords: Sjenica sheep, lamb stelja, fatty acids, autochthonous genetic resource, rural development

Introduction

The Pešter Plateau represents a unique area where, across approximately 1000 km², there are no industrial facilities that could harm the environment—namely, pollute water, soil, or air in any way (DANGIĆ, 1998; DRAGOVIĆ, 2004). The climate is significantly harsher and, in some aspects, more extreme than in other regions of Serbia with similar altitudes. Winters are typically long and severe, with deep snow cover, although occurrences of black frost with extremely low temperatures can also negatively affect cultivated plants, including grasses—especially young sown pastures—in terms of overwintering and productivity. The Sjenica–Pešter Plateau is well recognized in the domestic market for its traditional products. All products originating from this region bear specific characteristics shaped by local climate, soil, vegetation, and traditional production methods (e.g., Sjenica cheese, Sjenica lamb, kaymak, prosciutto, sudzuk, dried sheep meat—*stelja*, pastrma, *jardum*, etc.). Livestock production in the Pešter region is based on the traditional *katun*-style pastoralism involving cattle, sheep, and goats, characterized by extensive and semi-extensive farming systems. The Pešter Plateau is also marked by rich plant biodiversity (LAZAREVIĆ, 2014). The long-standing tradition of dried sheep meat (*stelja*) production in this area is a result of skills, knowledge, and experience passed down through generations. This product is traditionally made during the winter months, taking full advantage of the local climatic conditions. Dried sheep meat (*stelja*) is a salted and smoked meat product obtained from the deboned carcass of sheep, including associated fat and connective tissue, but excluding the shoulder and most bones (except for the shank). The traditional production of *stelja* involves the use of the autochthonous Sjenica Pramenka breed, which is raised in the Sjenica–Pešter Plateau at an altitude of 1150–1250 meters, in southwestern Serbia (43.27306 N, 19.99944 E). The animals are mainly fed on vast open pastures (Savić et al., 2014). Toward the end of summer and the beginning of winter, mostly female animals are selectively culled from the flock for various reasons—age, infertility, or

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udder damage due to mastitis—and removed from the production herd. Animals intended for slaughter must be between 1.5 and 5 years of age. During this period, selected animals are additionally fed with grains (barley, wheat, corn) to improve body condition. Only sheep meat and salt are used in the production of *stelja*. The product is obtained from the whole deboned carcass of mature sheep, with kitchen salt added as a preservative. The salting, drying, and smoking process is carried out in traditional smokehouses, where conditions (temperature, humidity, and ventilation) are influenced by the local climate. The traditional production of ovčija stelja (dried sheep meat) is closely linked to climatic conditions, as the entire process is carried out during the winter period when low temperatures play a crucial role in achieving the desired product quality. The aim of this study was to determine the fatty acid composition as one of the quality parameters of ovčija stelja produced in traditional rural households.

Material and methods

Production of Dried Sheep Meat (*Ovčija Stelja*)

Traditional **dried sheep meat** was produced from deboned meat with the addition of coarse salt. The raw material was obtained from Sjenica Pramenka sheep, with an average age of approximately 4 years. All animals were born and grazed on the Pešter Plateau. The smoking and drying process was carried out in a small traditional smokehouse, where conditions (temperature, humidity, and ventilation) were influenced by the local climate.

Sampling

After the smoking and drying process was completed, six finished products from six different producers were selected. From each product, three subsamples were taken from three different anatomical locations (shoulder, *m. longissimus dorsi*, and hind leg), which were then pooled into a single composite sample to obtain average values for better assessment of the composition and quality of **dried sheep meat**. The dimensions of the individual subsamples were 10 × 10 cm. The samples were wrapped in aluminum foil, stored at +4°C, and transported to the laboratory. Fatty acid composition was determined according to ISO standards (ISO 5509, 2000).

Statistical Analysis

Statistical analyses were performed using GraphPad Prism version 6 (GRAPHPAD, SAN DIEGO, CA, USA). Descriptive statistics included arithmetic mean, standard deviation, and coefficient of variation.

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Results and discussion

The fatty acid composition of the traditional product dried sheep meat (Table 1) shows a notable presence of monounsaturated fatty acids (MUFA), which on average account for 48.82 ± 2.00% of total fatty acids.

Table 1: Fatty acid composition of traditional dried sheep meat (ovčija stelja)

Fatty acids	Dried sheep meat
C14:0	1.44±0.06
C15:0	0.52±0.08
C16:0	23.12±0.48
C16:1	0.86±0.13
C17:0	1.54±0.30
C18:0	19.30±1.33
C18:1trans-11	1,96±0.60
C18:1cis	46.90±1.75
C18:2cis	2.09±0.44
C20:0	0.13±0.05
C18:3n-6	-
C18:3n-3	0.69±0.34
C20:1	0.72±0.07
C20:2	0.14±0.27
C20:3n-6	0.01±0.02
C22:1+C20:4	0.10±0.03
C20:5n-3	0.02±0.02
C22:5n-3	0.10±0.03
c9,t11CLA	0.01±0.02
t10c12CLA	0.01±0.02
SFA	46.05±1.30
MUFA	48.82±2.00
PUFA	3.08±0.52
n-6	2.13±0.46
n-3	0.95±0.07
n-3/n-6	0.46±0.06
n-6/n-3	2.23±0.31

The most abundant fatty acid among them is oleic acid (C18:1cis, 46.90 ± 1.75%), which aligns with previous findings for sheep meat products (ENSER et al., 1998). A high content of MUFA is desirable as it contributes to a more favourable lipoprotein profile in consumers and plays a role in the prevention of cardiovascular diseases (WOOD et al., 2008). Saturated fatty acids (SFA) are present at 46.05 ± 1.30%, dominated by palmitic acid (C16:0, 23.12 ± 0.48%) and stearic acid (C18:0, 19.30 ± 1.33%). Stearic acid is considered metabolically neutral as it does not significantly affect serum cholesterol levels (HUNTER et al., 2010).

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Polyunsaturated fatty acids (PUFA) constitute a smaller portion of the total fatty acid profile (3.08 ± 0.52%), which is typical for ruminant adipose tissue due to the active biohydrogenation process in the rumen (JENKINS et al., 2008). The most abundant PUFA is linoleic acid (C18:2cis, 2.09 ± 0.44%). Although present in low concentrations (0.01 ± 0.02%), conjugated linoleic acids (CLA) indicate a certain functional potential of the product, given their anti-inflammatory and anticancer properties (BENJAMIN & SPENER, 2009). The n-6/n-3 fatty acid ratio (2.23 ± 0.31) is particularly important, as it falls within the recommended limits (4:1), thus achieving a nutritional balance crucial for reducing the risk of inflammatory processes and cardiovascular diseases (SIMOPOULOS, 2002). The favourable value of this ratio may result from the traditional grazing system of sheep, which contributes to a higher proportion of n-3 fatty acids (SCOLLAN et al., 2006). Overall, the results indicate that dried sheep meat has a balanced and functionally valuable fatty acid profile. The high MUFA content and favourable n-6/n-3 ratio represent important nutritional qualities that contribute to the quality and potential health benefits of this traditional product.

Conclusion and recommendation

Based on the conducted research aimed at characterizing *dried sheep meat*, it can be concluded that this product belongs to the category of traditional dry-cured meat products originating from the autochthonous Sjenica Pramenka breed from the Pešter Plateau. The preparation technique is specific to this region, which distinguishes the product from other dry-cured meats. Additionally, the production is characteristic of the artisanal sector and is primarily carried out in rural households for personal use.

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