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Physicochemical properties of meat of Lika Pramenka lambs raised under semi-extensive production system: effects of sex, slaughter weight and season

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ABSTRACT

The purpose of this study was to determine influence of sex, slaughter weight and slaughtering season on the physicochemical properties of meat of Lika Pramenka lambs raised in accordance with the traditional farming system in the Lika region. Male lambs had higher cooking loss ($P \leq 0.05$), higher proportions of linoleic and α-linolenic fatty acids ($P \leq 0.05$), and n-6 PUFA ($P \leq 0.05$) and n-6/n-3 ratio ($P \leq 0.01$) than female lambs. An increase in slaughter weight significantly affected carcass weight ($P \leq 0.01$), dressing percentage ($P \leq 0.01$) and the parameter a* ($P \leq 0.05$) of the meat colour. The season significantly affected slaughter weight ($P \leq 0.01$), carcass weight ($P \leq 0.01$), meat colour parameters ($P \leq 0.05$) and fatty acid composition ($P \leq 0.05$). Lambs slaughtered at a similar age and reared under similar conditions will have very similar expressions of meat quality traits, regardless of gender. Apart from yield and the redness of the meat, it is expected that slaughter weight will not notably affect any other trait that could be of interest for buyers. The season affected almost all the investigated traits, which was primarily due to the different availability of forage.

Key words: lambs, meat quality, sex, slaughter weight, season

Introduction

The final appearance of a carcass is primarily the result of a biological process affected by genetic, environmental and management factors (SARI et al., 2012), while purchase and consumption of meat is determined by consumer habits that are largely influenced by religion, tradition and customs (KEARNEY, 2010). In Croatia, lamb meat is mainly consumed roasted on a spit, and therefore the most common breeding aim is

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production of carcasses suitable for a spit. In the area of Lika and Gorski Kotar, where the Lika Pramenka breed is dominant, it is thought that the most favourable for a spit are lambs slaughtered at the age of approximately 5 months with live weight 25-30 kg, that is carcass weight between 12 and 15 kg. Traditionally, this meat is regarded as having high edible quality. It has been proven that meat quality is one of the most important factors in the selection and purchase of certain types of meat (FISHER et al., 2000). Although it is a polysemic and complex trait of meat, most authors believe that meat quality and its acceptance by consumers are primarily determined by its physicochemical properties (TEJEDA et al., 2008). The increasing demand for healthy, safe meat products is stimulating market interest in extensive production as an important part of a sustainable system (GIL et al., 2000). According to JOY et al. (2008) extensive production systems can produce a carcass of superior quality, in accordance with the demands of consumers.

Nevertheless, it must be considered that carcasses of Lika Prameka lambs have not been systematically investigated, so knowledge of their characteristics and the main factors affecting their quality is quite limited. Therefore, the purpose of this study was to determine the influence of sex, slaughter weight and slaughtering season on the physicochemical properties of meat of Lika Pramenka lambs, raised in a traditional farming system.

Materials and methods

The study was carried out on a total of 112 lambs (55 males and 57 females) of the Lika Pramenka breed raised on a single family farm located in the Lika region (Gospić) during the slaughtering season (i.e. the season) in 2009, 2010 and 2011. The lambs were raised in the southern part of the mountain region of Croatia, where the climate is typically mountainous. According to the available data from the Croatian Bureau of Statistics, the hydro meteorological conditions (the weather) in the Lika Pramenka breeding area in the present study significantly differed between the seasons. The average monthly air temperatures during the season in 2009 ranged from 1.2 to 17.1 °C, in 2010 from 0.7 to 17.9 °C and in 2011 from 0.2 to 18.4 °C. Average precipitation during the season in 2009 ranged from 91.1 to 144.5 mm, in 2010 from 98.4 to 158.6 mm and in 2011 from 18.0 to 57.6 mm. Lambs included in the research were born at the beginning of March and were kept with their dams until the end of July. All lambs were penned for the first three weeks. After that the lambs were raised with their dams throughout the day continuously on pasture land, and at night in a stable. The lambs suckled their dams and grazed until slaughter. No concentrate was available to ewes or lambs. At the age of five months, randomly selected lambs were transported to a local commercial abattoir. Transport and manipulation of the lambs was performed in accordance with the animal welfare rules prescribed by European Union regulations. After arrival at the abattoir, the lambs were placed in covered yards and they fasted for 12 h with free access to water. Additionally, lambs were weighed immediately prior to slaughter (slaughter weight; SW). Slaughter and dressing methods followed normal commercial procedures, as described by FISHER and DE BOER (1994). Once evisceration had been conducted, the carcasses were weighed (hot carcass weight; HCW) and then chilled at 4 °C for 24 h in a conventional chill cooler. Dressing percentage (DP) was defined as the ratio of hot carcass weight (HCW) to slaughter weight (SW).

The pH values of the longissimus thoracis et lumborum (LTL) muscle were measured at 45 min (pH_1) and 24 h (pH_{24}) post mortem between the 12th and 13th thoracic vertebrae, using a penetrating electrode (Schott BlueLine 21pH) attached to a portable pH meter (IQ 150, Scientific Instruments, USA). Meat colour parameters were successively measured on the cross-section of the longissimus thoracis (LT) muscle after 45 min blooming period, according to an L* a* b* system, using a Minolta colorimeter (Konica Minolta Chroma Meter CR 400, Osaka, Japan). Drip loss (DL), and cooking loss (CL) were determined on the longissimus lumborum (LL) muscle using the method described by HONIKEL (1998). DL was estimated separately after 24 h by the ratio of weight loss to initial sample weight, while CL was estimated by the ratio of the weight loss of the cooked sample to the initial sample weight. The chemical composition was determined on the LT muscle according to the AOAC official methods (AOAC, 2000). Nitrogen was determined by AOAC Official Method 928.08 (Nitrogen in meat, Kjeldahl method) and was used for calculation of nitrogen to protein content by the conversion factor (6.25). Total fat was determined by AOAC Official Method 991.36 (Fat (Crude) in meat and meat products). Ash was determined by AOAC Official Method 920.153 (Ash of meat), and moisture was determined by AOAC Official Method 950.46 (Moisture in meat). Fatty acid methyl esters of the LT muscle were determined according to the ISTE method (PARK and GOINS, 1994). Separation and quantification of the fatty acid methyl esters was carried out using a gas chromatograph (model 6890, Agilent Technologies, Palo Alto, CA), fitted with an automatic sampler (model 7683, Agilent Technologies) and a flame ionization detector. Fatty acid methyl esters were separated on a SP™-2560 fused-silica capillary column using a split/splitless injection (1 µL of FAMEs in hexane). Helium was used as carrier gas at a flow rate of 0.9 ml/min. Individual fatty acids were identified using their retention time. For identification and calibration, GLC 85, GLC 411 and GLC 68a external reference standards (Nu-Chek Prep, Inc., Elysian, USA) were used. Results were expressed as the weight percentage (wt %) of the total identified fatty acids. For each sample 27 fatty acids were evaluated altogether. They were used for the saturated (SFA), monounsaturated (MUFA), polyunsaturated (PUFA), n-3 PUFA, n-6 PUFA and n-6/n-3 PUFA ratio evaluation.

Statistical analysis was performed using the MIXED procedure of the SAS/STAT software package v 9.2. The following linear model was applied:

$Y_{ijk} = \mu + S_i + P_j + b\ (x_{ijk} - \bar{x}) + e_{ijk}$

where Y_{ijk} = dependent variable, μ = overall mean, S_i = fixed effect of sex ($_i$ = male, female), P_j = fixed effect of the season ($_j$ = 1, 2, 3), b = regression coefficient of the covariate slaughter weight (x_{ijk}), $\bar{x}$ = covariate mean and e_{ijk} = residual error.

The *t*-test was applied to assess the effect of sex and slaughter weight, whilst Scheffe's test was applied to assess the effect of the slaughtering season. Differences in the means determined at the level of $\alpha = 0.05$ were considered as statistically significant.

Results

The effects of sex, SW and season on the carcass traits, pH values, muscle colour, DL and CL of Lika Pramenka lambs are presented in Table 1. The differences determined for the carcass traits between male and female Lika Pramenka lambs were not statistically significant. An increase in SW from 23 to 31.7 kg was followed by an increase in HCW and DP ($P \le 0.01$). Season significantly affected SW, HCW and DP ($P \le 0.01$).

Sex, SW and season did not significantly affect the pH values of Lika Pramenka lambs. Values of the a* parameter significantly increased ($P \le 0.05$) with an increase in SW. Season significantly affected ($P \le 0.05$) all colour parameters of Lika Pramenka lambs. There was no statistically significant difference in DL between females and males, and the increase in SW did not significantly affect DL. In contrast to DL, it was found that males had significantly higher ($P \le 0.05$) CL than females.

Table 2 shows the effects of sex, SW and season on the chemical composition of Lika Pramenka lambs. It was found that sex, SW and season did not significantly affect the chemical composition of Lika Pramenka lambs.

The effects of sex, SW and season on the fatty acid composition of Lika Pramenka lambs are presented in Table 3. The differences determined for fatty acid composition between male and female lambs were only observed in the proportion of C18:2 n-6 ($P \le 0.05$) and C18:3 n-3 ($P \le 0.05$). Male lambs had a significantly higher proportion of n-6 PUFA ($P \le 0.05$) and n-6/n-3 PUFA ratio ($P \le 0.01$) than females. An increase in SW did not significantly affect the fatty acid composition of the lambs. In contrast, the season significantly affected ($P \le 0.05$) the fatty acid composition of Lika Pramenka lambs.

Table 1. Effects of sex (S), slaughter weight (SW) and season (SS) on the carcass traits, pH values, muscle colour, DL and CL of Lika Pramenka lambs

Trait	Sex (LSM ± SE)		S[1]	b[2]	SW[1]	Slaughtering season (LSM ± SE)			SS[1]
	Male	Female				2009	2010	2011	
SW, kg	27.59 ± 0.10	27.43 ± 0.16	NS	-	-	27.53 ± 0.10	27.53 ± 0.11	27.53 ± 0.15	**
HCW, kg	14.24 ± 0.10	14.32 ± 0.12	NS	0.56	**	14.58 ± 0.12	14.20 ± 0.13	13.98 ± 0.10	**
DP, %	51.61 ± 0.17	52.21 ± 0.16	NS	1.14	**	52.96 ± 0.16	51.58 ± 0.16	50.78 ± 0.11	**
pH_1	6.35 ± 0.03	6.41 ± 0.03	NS	0.01	NS	6.41 ± 0.03	6.34 ± 0.03	6.30 ± 0.05	NS
pH_{24}	5.56 ± 0.02	5.53 ± 0.02	NS	0.02	NS	5.53 ± 0.05	5.52 ± 0.01	5.55 ± 0.01	NS
L*	37.90 ± 0.17	37.17 ± 0.12	NS	-0.04	NS	35.72 ± 0.34	40.71 ± 0.63	37.68 ± 0.65	**
a*	17.85 ± 0.11	17.87 ± 0.13	NS	0.40	*	17.43 ± 0.91	18.08 ± 0.51	18.39 ± 0.53	*
b*	3.53 ± 0.29	3.73 ± 0.35	NS	0.07	NS	3.33 ± 0.80	3.68 ± 0.21	3.87 ± 0.22	*
DL, %	2.25 ± 0.18	2.26 ± 0.12	NS	-0.01	NS	2.39 ± 0.15	2.10 ± 0.13	2.18 ± 0.14	NS
CL, %	33.68 ± 0.02	31.29 ± 0.18	*	-1.11	NS	33.47 ± 0.96	32.91 ± 0.80	32.83 ± 0.82	NS

[1]Significance level: NS = not significant; *P≤0.05; **P≤0.01; [2]b: *regression coefficient* of slaughter weight

Table 2. Effects of sex (S), slaughter weight (SW) and season (SS) on the chemical composition of Lika Pramenka lambs

Trait	Sex (LSM ± SE)		S[1]	b[2]	SW[1]	Slaughtering season (LSM ± SE)			SS[1]
	Male	Female				2009	2010	2011	
Moisture, %	73.57 ± 0.18	73.31 ± 0.16	NS	0.27	NS	73.39 ± 0.31	73.54 ± 0.35	73.64 ± 0.33	NS
Fat, %	4.88 ± 0.19	5.13 ± 0.13	NS	0.07	NS	5.06 ± 0.53	4.77 ± 0.14	4.89 ± 0.13	NS
Protein, %	20.50 ± 0.19	20.51 ± 0.17	NS	-0.09	NS	20.60 ± 0.34	20.43 ± 0.36	20.54 ± 0.34	NS
Ash, %	1.05 ± 0.03	1.05 ± 0.03	NS	-0.01	NS	1.01 ± 0.08	1.08 ± 0.02	1.07 ± 0.02	NS

[1]Significance level: NS = not significant; [2]b: *regression coefficient* of slaughter weight

Table 3. Effects of sex (S), slaughter weight (SW) and season (SS) on the fatty acid composition of Lika Pramenka lambs

Trait	Sex (LSM ± SE)		S[1]	b[2]	SW[1]	Slaughtering season (LSM ± SE)			SS[1]
	Male	Female				2009	2010	2011	
C12:0	0.67 ± 0.03	0.52 ± 0.03	NS	-0.01	NS	0.78 ± 0.04	0.43 ± 0.03	0.57 ± 0.03	**
C14:0	6.01 ± 0.17	6.43 ± 0.17	NS	-0.02	NS	6.28 ± 0.25	5.37 ± 0.21	5.51 ± 0.21	*
C16:0	22.92 ± 0.12	23.06 ± 0.12	NS	-0.27	NS	21.79 ± 0.47	25.55 ± 0.38	21.63 ± 0.39	**
C17:0	1.10 ± 0.01	1.13 ± 0.01	NS	-0.03	NS	0.98 ± 0.02	1.29 ± 0.02	1.08 ± 0.02	**
C18:0	15.12 ± 0.15	15.69 ± 0.15	NS	-0.23	NS	13.22 ± 0.66	16.53 ± 0.54	14.47 ± 0.55	**
C20:0	0.17 ± 0.01	0.17 ± 0.01	NS	-0.01	NS	0.18 ± 0.01	0.16 ± 0.01	0.18 ± 0.01	*
C18:1n-9c	25.81 ± 1.14	26.04 ± 1.13	NS	0.07	NS	25.01 ± 1.01	27.66 ± 0.85	26.18 ± 1.06	*
C18:1n-9t	7.03 ± 0.17	6.49 ± 0.11	NS	0.03	NS	6.49 ± 0.19	6.23 ± 0.18	7.27 ± 0.65	*
C18:2 n-6	2.79 ± 0.13	2.39 ± 0.14	*	0.03	NS	3.01 ± 0.16	2.78 ± 0.08	2.35 ± 0.31	*
C18:2 c9 t11	1.52 ± 0.15	1.51 ± 0.18	NS	0.04	NS	1.92 ± 0.11	1.52 ± 0.17	1.52 ± 0.61	*
C18:3 n-3	1.69 ± 0.05	1.63 ± 0.05	*	0.06	NS	1.91 ± 0.08	1.34 ± 0.06	1.61 ± 0.06	**
C18:3 n-6	0.14 ± 0.01	0.13 ± 0.01	NS	0.02	NS	0.20 ± 0.01	0.12 ± 0.01	0.18 ± 0.01	**
∑SFA [3]	49.18 ± 0.13	48.96 ± 0.13	NS	-0.43	NS	49.51 ± 0.78	52.46 ± 0.64	47.25 ± 0.64	**
∑MUFA [4]	39.23 ± 0.11	39.47 ± 0.11	NS	0.07	NS	38.35 ± 0.74	40.03 ± 0.61	40.82 ± 0.61	**
∑PUFA [5]	11.59 ± 0.13	11.57 ± 0.10	NS	0.36	NS	12.14 ± 0.63	7.51 ± 0.52	11.93 ± 0.52	**
PUFA/SFA	0.24 ± 0.01	0.24 ± 0.01	NS	0.02	NS	0.25 ± 0.01	0.14 ± 0.01	0.25 ± 0.01	**
n-3 PUFA	3.40 ± 0.16	3.47 ± 0.16	NS	0.09	NS	3.74 ± 0.23	2.01 ± 0.19	3.57 ± 0.19	**
n-6 PUFA	6.55 ± 0.19	6.36 ± 0.19	*	0.16	NS	6.15 ± 0.43	5.64 ± 0.35	6.58 ± 0.35	**
n-6/n-3	1.91 ± 0.03	1.78 ± 0.03	**	0.03	NS	1.64 ± 0.14	2.80 ± 0.14	1.84 ± 0.16	**

[1]Significance level: NS = not significant; *P≤0.05; **P≤0.01; [2]b: *regression coefficient* of slaughter weight; [3]∑SFA: sum of saturated fatty acids = C12:0 + C13:0 + C14:0 + C15:0 + C16:0 + C17:0 + C18:0 + C20:0 + C22:0 + C23:0 + C24:0; [4]∑MUFA: sum of monounsaturated fatty acids = C14:1 + C16:1 + C17:1 + C18:1n-9c + C18:1n-9t

Discussion

The non-significant results found for the carcass traits between male and female lambs in the present study are in accordance with SANTOS et al. (2007) for Churra da Terra Quente lambs, where SW, HCW and DP were not influenced by sex. A small increase in lamb slaughter weight may result in higher productivity and give more flexibility to the production system (SANTOS et al., 2007). Therefore, one of the aims of this study was to investigate the influence of the slaughter weight of the Lika Pramenka breed at the age of 5 months in a traditional rearing system. An increase in SW was followed by an increase in HCW and DP. Similar results were reported by ABDULLAH and QUDSIEH (2008) for Awassi lambs, where HCW and DP increased with SW from 20.9 to 30.5 kg. The increase in DP determined in the present study was due to faster fattening and muscle growth compared to the slower growth of non-carcass components (data not shown). According to the available data from the Croatian Bureau of Statistics, the hydro meteorological conditions of the Lika Pramenka breeding area substantially differed between the seasons. The different climate conditions within the investigated period probably affected vegetation development and consequently the accumulation of the body weight of the lambs.

Sex did not significantly affect pH values, which is in accordance with the findings of RODRÍGUEZ et al. (2008) and ŽGUR et al. (2003), who also did not find any effect of sex on pH values. The obtained results suggest that both sexes respond to the same extent to stress at slaughter. SW did not significantly affect pH values, which is in accordance with SHIRIMA et al. (2012). The results are partially in accordance with those reported by BERIAIN et al. (2000) and TEIXEIRA et al. (2005). They found the same for pH measured 1 h post mortem, but also that heavier lambs had significantly higher pH values when pH was measured 24 h post mortem. DWYER and BORNETT (2004) reported that an insufficient amount of feed can lead to chronic stress and consequently to a significant increase in pH values. The availability of forage caused by different hydro meteorological conditions was obviously not so pronounced as to have an impact on pH values.

The non-significant differences of the determined L*, a* and b* colour parameters between males and females are in accordance with several previously reported findings (ŽGUR et al., 2003; SANTOS et al., 2007; RODRÍGUEZ et al., 2008). Lightness (L*) responded inversely to the value of the a* parameter, decreasing with greater SW, although the differences did not reach statistical significance. The effect of SW on colour parameters was also found by SANTOS-SILVA et al. (2002) for Merino Branco and crossbred Ile de France x Merino Branco lambs, and TEIXEIRA et al. (2005) for Mirandesa and Bragançana lambs. It was found that an increase in SW from 24 to 30 kg (SANTOS-SILVA et al., 2002) and from 19 to 24 kg (TEIXEIRA et al., 2005) significantly decreased the values of L* and b* parameters, while the value of the a* parameter increased only slightly. In the present study, the value of the b* parameter was not significantly influenced by SW. As already mentioned, the hydro meteorological conditions in the rearing area of the Lika Pramenka breed varied substantially during the research period, which was reflected in the development of vegetation. The daily activities of the animals in search for food and shelter also changed. Following the results of RIPOLL et al. (2008) who found that the meat of animals reared on pasture land was darker, due to intense physical activity, than meat from animals kept indoors, we can assume that this could be the main cause of changes in the meat colour in the investigated lambs.

The non-significant difference in DL between females and males found in the present study was consistent with that of ÇELÍK and YILMAZ (2010), and contrary to the results obtained by DÍAZ et al. (2003) and PELLATTIERO et al. (2011). Differences in DL reported by DÍAZ et al. (2003) were attributed primarily to differences in pH values. They determined that lower pH values in females reduced water holding capacity, i.e. increased drip loss. Since we did not find any significant difference in the pH values between genders, the absence of any difference in DL was somehow expected. The available information concerning the influence of SW on water holding capacity and drip loss is contradictory. Some authors report that this parameter was not affected by weight/age (DÍAZ et al., 2003), while others report that higher weight was accompanied by lower (AZIZ et al., 1993) or higher (VELASCO et al., 2000) drip loss.

Males had significantly higher CL than females, which is in agreement with the findings of PELLATTIERO et al. (2011). Slaughtering season and increase in SW did not significantly affect the CL of Lika Pramenka lambs.

Although gender did not significantly affect the chemical composition of the LT muscle, female lambs had slightly more fat and less water than male lambs. Similar results were found by SANTOS et al. (2007) in Churra da Terra Quente suckling lambs, and by RODRÍGUEZ et al. (2011) in Assaf and Merino x Assaf growing lambs. The greater fat content in females could be explained by the assertion that females mature more quickly and fatten earlier than males (IRSHAD et al., 2012). The increase in SW did not significantly affect the chemical composition of the LT muscle (Table 2). This result is not in agreement with that reported by BERIAIN et al. (2000) for Lacha and Rasa Aragonesa lambs slaughtered at 12.24 and 36 kg, or ABDULLAH and QUDSIEH (2008) for Awassi lambs slaughtered at 20 and 30 kg. These authors reported a decrease in moisture and an increase in fat percentage as SW increased, and confirmed the widely reported increase in fat deposition in lambs during periods of growth and feeding. It should be taken into account that the lambs in their studies had a wider range of SW than ours. It is possible that we would obtain the same results if our lambs were slaughtered in a wider range. Due to the hydro meteorological variations and the reports by MAHGOUB and LU (2004) and PERLO et al. (2008) that nutrition could significantly affect the chemical composition of lamb meat, it was expected that the chemical composition of Lika Pramenka lambs would be influenced by the season. However, in the present study the season did not significantly affect the chemical composition of Lika Pramenka lamb muscle.

Significant differences in fatty acid composition between male and female Lika Pramenka lambs were observed only in the proportion of C18:2 n-6 and C18:3 n-3, which were higher in males. CIVIDINI et al. (2008) also reported significantly higher proportions of C18:2 n-6 and C18:3 n-3 in male Jezersko-Solčava lambs. Furthermore, in the same study, CIVIDINI et al. (2008) found significantly higher proportions of C20:4 n-6 and C20:5 n-3 in male lambs, while female lambs had significantly higher proportions of C16:0 and C18:1 n-9. BORYS et al. (2012) also pointed out the differences in the proportions of fatty acids between male and female Suffolk x Merinofin crossbreds. The authors found a significantly higher proportion of C16:0 in the female lambs, and significantly higher proportions of C18:0 and C18:2 n-6 in the male lambs. However, ÇELÍK and YILMAZ (2010) did not find statistically significant differences in the proportions of individual fatty acids between male and female lambs.

The statistically significant differences in the main proportions of fatty acids and their ratios between male and female Lika Pramenka lambs may be attributed to the significantly higher proportions of C18:2 n-6 and C18:3 n-3 found in male lambs. These results are in accordance with the reports of KOSULWAT et al. (2003) for male Dorset Cross lambs, in which a significantly higher proportion of PUFA was also found, due to the greater proportions of C18:2 n-6 and C18:3. However, these authors also pointed out a significantly higher proportion of MUFA in female lambs, which was not the case in the present study. A significantly higher proportion of MUFA in female lambs was also found by DÍAZ et al. (2003), CIVIDINI et al. (2008) and BORYS et al. (2012). They attributed these differences primarily to the proportion of C18:1 n-9c, which was significantly higher in female lambs than in male lambs. In the present study, female lambs also had a slightly higher proportion of C18:1 n-9c, but the differences between the genders were not statistically significant. CIVIDINI et al. (2008) reported significantly higher proportions of PUFA in male lambs, while HORCADA-IBÁÑEZ et al. (2009) reported significantly higher proportions of PUFA in female lambs. In contrast to them, DÍAZ et al. (2003) did not find any significant difference in the proportions of PUFA between male and female lambs. In addition, DÍAZ et al. (2003) found a significantly higher proportion of SFA in male lambs, while CIVIDINI et al. (2008) and HORCADA-IBÁÑEZ et al. (2009) did not find any statistically significant effect of gender on the proportion of SFA.

The ratio of PUFA/SFA in male and female lambs was the same (0.24) and lower than the value (0.45) recommended by nutritional advisers (Department of Health 1994). Although it is well-known that PUFA/SFA ratios are lower in ruminants than non-ruminants, because of the biohydrogenation of dietary unsaturated fatty acids by ruminal microorganisms (WOOD et al., 2004), this low ratio could be due to the production system in which lambs naturally suckled and thus had higher levels of SFA, widely present in their dams' milk. The ratios of n-6/n-3 fatty acids in the present study for male (1.91) and female (1.78) lambs were within the recommended range (<4) for human health (World Health Organization, 2003). Similar n-6/n-3 ratios between male and female lambs were also reported by DÍAZ et al. (2003), CIVIDINI et al. (2008) and HORCADA-IBÁÑEZ et al. (2009). Many authors have reported that the fatty acid profile of lamb meat is affected by the slaughter weight (BERIAIN et al., 2000; OKEUDO and MOSS, 2007; JUÁREZ et al., 2009). However, in the present study increases in SW did not significantly affect the proportions of individual acids, and therefore neither their main proportions nor ratios. Despite that, the trend of unsaturated fatty acids (UFA) was positive, while that of SFA was negative (Table 3). It is assumed that the differences were not statistically significant primarily due to the narrow range of SW of Lika Pramenka lambs, but with a wider range the differences would be significant. The season significantly affected the fatty acid composition of Lika Pramenka lambs. This was more or less to be expected since diet is one of the main factors affecting the fatty acid composition of lamb meat (WOOD et al., 2004).

Conclusions

It may be concluded that lambs slaughtered at a similar age and reared under similar conditions will have a very similar expression of meat quality traits, regardless of gender. Apart from yield and the redness of the meat, it is expected that slaughter weight will not notably affect any other trait that could be of interest for buyers. Slaughtering season affected almost all the investigated traits, which was primarily due to the different availability of forage. In order to provide for the uniform placement of lambs on the market it is necessary to supplement rations with typical fodder in unfavourable seasons. Market interest is gaining popularity in typical and 'natural' meat products. Therefore, further research of the carcass composition and sensory quality of Lika Pramenka lambs and their acceptability by consumers is needed.

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KAIĆ, A., B. MIOČ, A. KASAP, A. LEVART: Fizikalno-kemijska svojstva mesa janjadi ličke pramenke uzgajane u poluintenzivnom proizvodnom sustavu: utjecaj spola, tjelesne mase pri klanju i sezone. Vet. arhiv 86, 229-241, 2016.

SAŽETAK

Cilj ovog istraživanja bio je utvrditi utjecaj spola, tjelesne mase pri klanju i sezone na fizikalno-kemijska svojstva mesa janjadi ličke pramenke uzgajane u skladu s tradicijskim načinom na području Like. U trupovima muške janjadi utvrđen je značajno veći kalo kuhanja ($P \leq 0,05$), značajno veći udio linolne i α-linolenske masne kiseline ($P \leq 0,05$), n-6 PUFA ($P \leq 0,05$) i kvocijent n-6/n-3($P \leq 0,01$) negoli u trupovima ženske janjadi. Povećanje tjelesne mase pri klanju značajno je utjecalo na klaoničku masu ($P \leq 0,01$), randman ($P \leq 0,01$) te a* pokazatelj boje mesa ($P \leq 0,05$). Sezona je značajno utjecala na tjelesnu masu pri klanju ($P \leq 0,01$), klaoničku masu ($P \leq 0,01$), sve pokazatelje boje ($P \leq 0,05$) i masnokiselinski sastav ($P \leq 0,05$) janjećeg mesa. Rezultatima predmetnog istraživanja je utvrđeno da janjad koju se uzgaja u podjednakim uvjetima i zakolje kod ujednačene dobi, neovisno o spolu, ima vrlo ujednačenu ekspresiju svojstava kakvoće mesa. Izuzev radmana i crvenila mesa, tjelesna masa pri klanju nije značajnije utjecala na ostala svojstva koja mogu biti od značajnijeg interesa za potrošače. Sezona je značajno utjecala na gotovo sva istraživana svojstva što se prvenstveno pripisuje različitoj dostupnosti krme.

Ključne riječi: janjad, kakvoća mesa, spol, tjelesna masa pri klanju, sezona