

SLAUGHTER CHARACTERISTICS OF LAMB'S MEAT ACCORDING TO BREEDING SYSTEMS

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The aim of this research was to determine how breeding systems (organic and conventional) influence the growth intensity and carcass traits of lamb meat. The research was carried out on 120 lambs, of which 60 were reared in a conventional and 60 in an organic system, in a period of 75 days. The lambs from the organic system were bred according to the regulations on organic farming, while the lambs from the conventional system were bred in a traditional way. The results show differences in birth weight of lambs from organic (3.991–4.189 kg) and conventional breeding systems (4.226 – 4.338 kg). There are no significant differences ($p > 0.05$) in the body weight prior to slaughter and in the average daily gain between the groups. After the slaughter, measurements of each carcass were done. The differences in the dressing percentage of the lambs between the groups from organic and conventional production are not statistically significant ($p > 0.05$).

Key words: lambs; breeding systems; slaughter; quality; carcasses

КЛАНИЧНИ КАРАКТЕРИСТИКИ НА МЕСОТО ОД ЈАГНИЊА ВО ЗАВИСНОСТ ОД СИСТЕМОТ НА ОДГЛЕДУВАЊЕ

Цел на ова истражување беше да се утврди како влијае системот на одгледување (органски и конвенционален) врз прирастот и кланичните особини на месото од јагниња. Истражувањето беше спроведено на 120 јагниња, од кои 60 беа одгледувани во конвенционален и 60 во органски систем во период од 75 дена. Јагнињата од органскиот систем се одгледуваа во согласност со прописите за органско земјоделско производство, додека јагнињата од конвенционалниот систем се одгледуваа на традиционален начин. Резултатите покажуваат разлики во породната маса на јагнињата од органскиот (3,991 – 4,189 kg) и конвенционалниот систем на одгледување (4,226 – 4,338 kg). Не постои значајна разлика ($p > 0,05$) во телесната маса пред колење и просечниот прираст помеѓу двете групи. По колењето беа направени мерења на секој труп, со цел да се утврдат одредени кланични резултати. Рандманот на колење на јагнињата меѓу групите од органското и конвенционалното производство не е статистички значаен ($p > 0,05$).

Клучни зборови: јагниња; систем на одгледување; колење; квалитет; заклани трупови

INTRODUCTION

The lamb meat is a high-quality product, used by consumers from all over the world, from different cultures and religions. Due to the increase in the interest and the needs of the domestic and foreign markets for lamb, there are demands for increasing

its quality, covered by the new EU regulations concerning the quality of the animals for breeding (Zujović, 2004). According to Osamu et al. (2005), there is no general model for breeding, which could be applied in all farms and in all conditions. There are different breeding systems in the world that are conditioned by natural and economic factors, as

well as by the tradition of the countries or regions. In the conventional system, the traditional way of breeding is popular, with the technology of early weaning of the lambs 25 to 30 days after birth as well as intensive feeding with concentrated feed mixture and hay at will up to a certain slaughter weight or age.

The main goal of this kind of breeding is intensification of sheep breeding, by achieving good fattening performances in the early weaned lambs and obtaining a greater amount of milk per sheep (Paciovski et al., 2011). Compared to conventional, organic sheep production is based on the compliance with the standards and legal regulations in the control of each stage of the production cycle, and which contribute to the animals' welfare and the production of safe products of animal origin.

The breeding of lambs in an organic system is carried out in accordance with the organic production rules equivalent to the European Union Regulation 834/2007, according to which, in order to respect animals' welfare, the lambs should be weaned at the age of 45 days. Lambs grown in conventional and organic systems have similar production and slaughtering yields (Fisher et al., 2000).

The type of diet and the composition of the meal are the basic factors of the external environment that determine the success of lambs' fattening (Grubić et al., 1991). The lambs' diet must be tailored to the age of the heads, the planned intensity of fattening and the desired body weight at the time of their sale (Zeremski et al., 1989). The animals' nutrition in the organic system is one of the most important factors that influence the quality of the meat and constitutes the most important basis on which depends the success of organic meat production (Kerry et al., 2000).

MATERIAL AND METHODS

The research was carried out on 120 lambs, of which 60 were bred in a conventional and 60 in an organic system for a period of 75 days. In both systems of breeding, two groups of lambs were formed, each with 30 lambs: group I, made up of crossbreeds of domestic Merino breed refined with Virtemberg breed; and group II, made up of crossbreeds of domestic Merino breed refined with East-Friesian breed.

The lambs from the organic system were bred according to the regulations for organic farming, while the lambs from the conventional system were bred in a traditional way. The lambs from both systems were bred in separate, physically divided and

marked spaces on the farm, and in on-the-ground way with the use of deep layer of straw.

In the conventional system, the sucking ended at the 30th day, and thereafter they were fed with conventional commercial fodder (20% of corn, 20% of wheat, 30% of barley, 28% of peas, 1% of pre-mix, 0.6% of feed chalk and 0.4% of salt), alfalfa hay and *ad libitum* water.

In the organic system, the lambs were bred in compliance with the rules prescribed in EU Reg. 834/2007, according to which, in order to provide for the animals' welfare, the lambs were weaned at the 45th day after birth and further fed with concentrated fodder produced from organic and certified feed, in an own mill.

The chemical composition of the conventional and organic feed mixtures is presented in Table 1. The energy and protein values of the both feed mixtures are almost identical.

Table 1

Chemical composition of the feed mixture for lambs from the conventional and the organic system

Indicators (%)	Conventional system	Organic system
Moisture	15.44	14.98
Dry matter	84.56	85.02
Raw proteins	14.86	14.76
Raw fats	1.21	1.20
Raw fiber	3.63	3.96
Raw ash	4.92	3.81
* NFE	59.94	61.29
Calcium	2.20	1.20
Phosphorus	0.38	0.35

*Nitrogen –free extractive substances

The control of the body weight of the lambs from both systems has been performed every fifteen days, i.e. on day 1, 15, 30, 45, 60 and 75. During the research, the lambs' daily and total increment were determined, as well as the daily and total feed consumption per lamb and the feed conversion for 1 kg of growth. In determining the slaughter value, the following categories of lambs' carcass based on dressing percentage were defined: warm carcass with head and viscera (R I); cold carcass with head and viscera (R II); cold carcass with head but without viscera (R III); cold carcass without head and without viscera (R IV).

RESULTS AND DISCUSSION

The dynamics of the body weight of the lambs from the organic and conventional systems from the partus to the end of the breeding is presented in Table 2.

Table 2

Dynamics of body weight of lambs from the organic and the conventional system

Days	\bar{x}	Sd	cv	$S\bar{x}$	min	max
O(I)						
Birth weight	3.991	0.522	13.08	0.095	3.080	4.970
15 days	6.189	0.904	14.61	0.165	4.190	7.900
30 days	8.335	1.375	16.49	0.248	5.270	11.230
45 days	11.640	1.386	11.90	0.251	8.210	14.700
60 days	14.990	1.687	11.25	0.308	9.250	16.830
75 days	17.995	1.812	10.07	0.331	13.215	19.900
O(II)						
Birth weight	4.189	0.566	13.52	0.103	3.270	4.990
15 days	6.405	0.963	15.04	0.176	4.630	7.970
30 days	8.547	1.564	18.30	0.286	5.415	11.420
45 days	11.826	1.747	14.77	0.318	8.690	15.890
60 days	15.073	2.387	15.83	0.436	11.630	18.470
75 days	18.363	2.161	11.77	0.395	13.430	22.190
C(I)						
Birth weight	4.226	0.615	14.55	0.112	3.245	5.090
15 days	6.466	0.980	15.15	0.179	4.760	8.260
30 days	8.451	1.753	16.99	0.320	5.040	12.180
45 days	12.117	2.539	20.51	0.463	7.120	16.030
60 days	15.142	2.799	18.48	0.511	9.915	20.730
75 days	18.480	2.447	13.24	0.452	13.745	23.980
C(II)						
Birth weight	4.338	0.561	12.95	0.102	3.395	5.125
15 days	6.732	0.896	13.31	0.164	4.890	8.470
30 days	8.859	1.633	18.86	0.298	5.690	11.640
45 days	12.358	2.166	17.53	0.395	8.100	18.155
60 days	15.939	2.567	16.11	0.469	11.810	23.400
75 days	19.149	2.339	12.22	0.428	14.910	26.680

The birth weight is the basis for further growth and development of lambs (Petrović et al., 2009). The average birth weight of the lambs from group I in the organic system was 3.991 kg, and 4.189 kg from group II. Similar birth weights of 4.226 kg and 4.338 kg were found in the lambs from groups I and II, respectively, in the conventional system. Regarding birth weight, no statistically significant difference was found between the groups of lambs in the

organic system and between the groups in the conventional system. Also, the difference found in birth weight between the lambs from groups I in the organic and conventional systems, as well as the difference between the lambs from groups II in the organic and conventional systems, are statistically not significant ($p > 0.05$). Similar results were found by Pacinovski et al. (2011). At the end of the breeding on day 75, the highest body weight of 19.149 kg was reached by the lambs from group II in the conventional system, and the lowest body weight of 17.995 kg by the lambs from group I in the organic system. Our results regarding the body weight of the lambs in the organic system at the end of the breeding are similar with the results obtained by Morbidini et al. (2001). The differences in the body weight of the lambs found at the end of the breeding between the groups in the same system, as well as the differences between the respective groups in different systems (organic and conventional system) are statistically not significant ($p > 0.05$). The data on the growth of the lambs in the organic and the conventional system at certain periods of breeding are shown in Tables 3 and 4.

Table 3

Growth of lambs from groups I and II in the organic and the conventional system, at certain periods of breeding

	Days	\bar{x}	Sd	cv	$S\bar{x}$
O(I)	1-15	2.199	0.383	17.43	0.06
	15-30	2.146	0.448	20.88	0.08
	30-45	3.305	0.511	15.47	0.09
	45-60	3.350	0.371	11.09	0.06
	60-75	3.005	0.430	14.31	0.08
O(II)	1-15	2.225	0.399	17.96	0.07
	15-30	2.142	0.406	18.93	0.07
	30-45	3.279	0.534	16.29	0.09
	45-60	3.247	0.511	15.61	0.09
	60-75	3.290	0.474	14.42	0.09
C(I)	1-15	2.240	0.434	19.38	0.07
	15-30	1.985	0.347	17.48	0.06
	30-45	3.666	0.528	14.42	0.09
	45-60	3.026	0.588	19.40	0.10
	60-75	3.338	0.635	19.02	0.11
C(II)	1-15	2.394	0.522	21.80	0.09
	15-30	2.127	0.379	17.82	0.07
	30-45	3.499	0.596	17.04	0.11
	45-60	3.581	0.490	13.69	0.08
	60-75	3.210	0.568	17.69	0.10

Table 4
Total and daily lambs' growth from the organic and the conventional system

Day	Growth			
	Total kg	Daily g	Total kg	Daily g
	O (I)		O (II)	
1–15	2.199	148	2.225	148
15–30	2.146	143	2.142	143
30–45	3.305	220	3.279	219
45–60	3.350	223	3.247	216
60–75	3.005	200	3.290	219
Σ 1–75	14.005	186.8	14.183	189
	C (I)		C (II)	
1–15	2.240	149	2.394	160
15–30	1.985	132	2.127	142
30–45	3.666	244	3.499	233
45–60	3.026	202	3.581	239
60–75	3.338	222	3.210	214
Σ 1–75	14.255	189.8	14.811	197.6

The highest value of the total and the daily growth in the period from day 45 to day 60 was noted in the lambs from group I in the organic (3.350 kg and 223 g) and group II in the conventional system (3.581 kg and 239 g); in the period from day 60 to day 75 – in the lambs from group II in the organic system (3.290 kg and 219 g); and in the period from day 30 to day 45 in the lambs from group I in the conventional system (3.666 kg and 244 g). The lowest growth of the lambs in both systems was achieved in the period from day 15 to day 30 when the exterior temperatures were extremely low, thereby a conclusion can be drawn that the season has a certain influence on lambs' growth in some periods of their breeding. Our conclusion coincides with the conclusion drawn by Hahn et al. (1987), that the lower growth of lambs is due to extremely low temperatures which negatively affect the consumption of feed per head.

The total growth from day 1 to day 75, in the lambs from groups I and II in the organic system is 14.005 kg and 14.183 kg, respectively, while in the lambs from the groups I and II in the conventional system is 14.255 kg and 14.811 kg, respectively. In the period from weaning until the end of the breeding in the organic system (i.e. from day 45 to day 75), the daily growth of the lambs from groups I and

II is 211 grams and 217 grams, respectively, while in the conventional system during the period from the weaning to the end of the breeding (i.e. from day 30 to day 75) the daily growth is 222 g in the lambs from group I and 228 g in group II. The average daily growth (i.e. from day 1 to day 75) of the lambs from groups I and II in the organic system is 186.8 g and 189 g, respectively. The average daily growth of the lambs in the conventional system is 189.8 g in group I and 197.6 g in group II. The differences in the total and the daily growth between the groups in the same breeding system, i.e. between O (I) and C (I) as well as O (II) and C (II), are not statistically significant ($p > 0.05$). Results approximate to ours on the total and the daily growth were reported by Kozarovski (1988). Also, results similar to ours on the average daily growth were found by Danev (1984) in the lambs from the group A. Lower values for the growth compared to ours, which are due to the breed's characteristics, were registered by Hanoglu et al. (2013) in lambs of autochthonous Turkish breeds grown in both organic and conventional systems, while Cmiljanić et al. (2003) in their studies registered higher growth values than we did.

The total and daily consumption of feed by lamb in the organic and conventional systems are presented in Table 5.

Table 5
Total and daily consumption of food by lamb in the organic and the conventional system

	Total	Daily	Total	Daily
Organic system	Group I		Group II	
30–45 day	2.906	194.0	3.065	204.0
45–60 day	8.037	536.0	8.394	559.6
60–75 day	9.890	659.0	10.298	686.5
Σ \bar{x} 30–75 day	20.833	463.0	21.757	483.3
Conventional system	Group I		Group II	
30–45 day	5.992	399.0	6.389	425.9
45–60 day	7.911	527.4	8.285	552.0
60–75 day	10.480	692.0	10.670	711.0
Σ \bar{x} 30–75 day	24.383	539.4	25.344	562.9

During the entire research period (from day 30 to day 75), the total amount of consumed feed by the lambs from the organic system was 20.833 kg per lamb, or 24.383 kg in the conventional system. The

lowest consumption of feed mixture per lamb in the organic system was found in the period from day 30 to day 45 (2.906 kg), which was expected because in that period the lambs also received milk from their mothers in addition to the feed mixture. The highest consumption of food was in the period from day 60 to day 75 (9.890 kg), when the lambs were oldest (Gutić et al., 2006).

In the lambs from the conventional system, the lowest consumption was observed in the period from day 30 to day 45 (5.992 kg), and the highest in the period from day 60 to day 75 (10.480 kg). The established differences in the total consumption of feed between lambs from groups I in the organic and the conventional systems, as well as between lambs from groups II in both systems, are statistically significant ($p < 0.01$). These differences are due to the technology, namely – the system of breeding lambs practiced in the organic system, i.e. the weaning of the lambs on the 45th day, in contrast to the lambs in the conventional system that were weaned on the 30th day.

The differences in the daily consumption of feed between the lambs from groups I in the organic and conventional systems, as well as between groups II in both systems, are statistically significant ($p < 0.01$) and are also due to the different breeding technologies. Higher average values for total and daily consumption of feed for the entire experimental period were presented by Pacinovski et al. (2011), while higher values for the average daily consumption than those we have obtained, were presented by Hanoglu et al. (2013).

The profitability of the production of lamb is conditioned by the conversion of feed, i.e. by the average consumption of food for 1 kg of growth (Gutić et al., 2006). In the period from day 30 to day 75, the average consumption of feed for 1 kg of growth in the lambs from group I in the organic system is 2.189 kg, and 2.216 kg in group II.

The average consumption of feed for 1 kg of growth in the conventional system for lambs from group I is 2.472, and 2.488 kg in group II. In lambs of domestic merinized sheep (Pacinovski et al., 2011), the feed conversion was estimated to be 3.65 kg and 3.90 kg for the lambs from groups I and II, respectively, depending on the lambs' diet and the breeding technology.

The lamb's weight before slaughter affects the slaughtering weight of the lamb's carcass. The average slaughtering weight of lambs (Table 6) from group I in the organic system is 16.987 kg, and 17.267 kg for lambs from group II, while the lamb's

slaughtering weight in the conventional system is 17.368 kg for lambs from group I, and 17.792 kg from group II.

Table 6

Lamb slaughtering weight from the organic and the conventional system

Lamb slaughtering weight	\bar{x}	Sd	cv	S \bar{x}
O (I)	16.987	1.772	10.430	0.314
O (II)	17.267	2.125	12.308	0.388
C (I)	17.368	2.934	16.894	0.535
C (II)	17.792	3.133	17.611	0.572

The observed differences in the slaughtering weight of lambs from the groups in both systems are statistically not significant ($p > 0.05$), which is expected since the lambs' weight in both breeding systems before slaughter is nearly the same.

The dressing percentage of slaughtering is highly variable and depends on the influence of several factors such as breed, sex, age, diet, degree of fattening, etc.. During the research, between the lambs from groups I from the organic and the conventional system, a difference was found in the dressing percentage for the category R I of 0.89%, for R II of 0.84%, for R III of 0.65%, and for R IV of 0.59%; as well as differences in the dressing percentage between the lambs from groups II in the organic and the conventional system, for the category R I of 0.74%, for R II of 0.40%, for R III of 0.24%, and for R IV of 0.23%. The discrepancies in the average value of the dressing percentage for the lambs from groups I in the organic and the conventional system and groups II from both systems are statistically not significant in all cases ($p > 0.05$), which is understandable, because the live weight of lambs and slaughter weight of lamb carcasses from the organic and conventional systems are very close (Table 7). Morbidini et al. (2001) found similar results to ours regarding the dressing percentage of warm carcasses in lambs bred in the organic system of 51.66% and of 48.90% in lambs from the control group. The smaller dressing percentage values in lambs from the control group according to the authors are probably due to earlier weaning, changes in lambs' diet, and the stress they experience during transportation. Hanoglu et al. (2013) reported values for the dressing percentage of warm carcasses which deviate from the values we found, namely –

in the lambs from the conventional system of 49.27 ± 0.607 , and 49.36 ± 0.525 in the lambs from the organic system. In the research of the slaughtering indicators in Creska lambs, Mioč et al. (2009) registered values close to ours, namely – slaughtering weight of lambs of $19.04 \text{ kg} \pm 0.22$ and a dressing percentage of 50.50 ± 0.60 .

Table 7

Dressing percentage of lambs' slaughtering from the organic and the conventional system

Dressing percentage	\bar{x}	S _d	Cv	min	max
O(I) – R I	53.98	1.359	2.518	51.89	56.54
O(I) – R II	52.84	1.301	2.463	50.59	55.11
O(I) – R III	48.19	1.681	3.490	45.88	50.46
O(I) – R IV	43.90	1.642	3.740	41.59	46.17
O(II) – R I	54.95	1.249	2.274	52.41	56.65
O(II) – R II	53.67	1.210	2.256	51.13	55.37
O(II) – R III	48.77	1.330	2.272	46.23	50.47
O(II) – R IV	44.34	1.284	2.896	41.89	45.97
C(I) – R I	54.87	0.857	1.563	53.64	56.16
C(I) – R II	53.68	1.082	2.017	51.14	55.64
C(I) – R III	48.84	1.276	2.614	46.29	50.83
C(I) – R IV	44.49	1.488	3.346	42.21	48.16
C(II) – R I	55.69	1.052	1.889	53.62	57.68
C(II) – R II	54.07	1.029	1.904	52.02	55.72
C(II) – R III	49.01	1.087	2.218	47.02	51.38
C(II) – R IV	44.57	1.208	2.710	42.66	47.32

CONCLUSION

Based on the goals set and the results obtained, the following conclusions can be made:

The differences observed in the production results (birth weight, body mass and growth) of lambs throughout the entire breeding period were not statistically significant ($p > 0.05$) between any of the groups bred in an organic and a conventional system. As a result of the way of breeding and feeding the lambs in accordance with the EU Reg. 834/2007 in the organic system, a lower consumption of feed was found compared to the conventional system. During the entire breeding period of the lambs from both systems, there has been a constant increase in the consumption of feed, corresponding to the increase in the age of the lambs. The differences found

in the slaughter parameters (slaughtering weight, dressing percentage for R I, R II, R III and R IV) are not statistically significant between lambs bred in the organic and the conventional system ($p > 0.05$).

The results obtained in this research allow us to make the conclusion that lambs bred in an organic and a conventional system have similar production and slaughtering yields.

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