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Effect of birth type on meat quality in Ile-de-France lambs

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Abstract

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The aim of the present study was to investigate the influence of the factor "birth type" in lambs on the performance of the meat obtained from them. The studied lambs were of the Ile de France breed and were divided into two groups: the first group is **Single** and the second group – **Multiple**. The lambs were slaughtered at 120 days of age, with 4 lambs from each group slaughtered. Samples were taken at 24 hours post mortem from the following muscles: *m. longissimus thoracis et lumborum* (LTL), *m. iliopsoas* (IP) and *m. semimembranous* (SM). The research of the samples for the chemical composition and technological qualities of the meat was carried out 48 h post mortem, stored at 4°C. Regarding the total chemical composition of the meat, no significant difference was observed between the two study groups. There was also no significant difference between the groups in terms of technological qualities (pH value, color, roasting losses, brittleness). Only a significant difference ($p < 0.01$) was found in the indicator of water-holding capacity between the groups in the studied LTL and IP muscles.

Keywords: Ile de France; birth type; meat quality; Water holding capacity of meat (WHC); color; fatty acids

Introduction

Meat quality is a multifactorial parameter dependent on the perspective and objectives of the unit in the production chain (de Lima Júnior et al., 2016) that allows the product to satisfy the needs of the final consumer. The concept of meat quality can be described with the following more important characteristics – organoleptic, technological, nutritional, safety, commercial and image (Prache et al., 2022). But as we mentioned, the quality of meat is an indicator that is influenced by a number of factors affecting directly or indirectly. Often in the literature, these factors are divided into internal and external. External factors are related to human activity during animal husbandry – nutrition, husbandry systems, stress, pre-slaughter management of animals, etc. Internal factors are related to the animals themselves, therefore internal factors are less variable than external factors. These factors include breed, sex, age, birth type, genes and muscle fiber type. Some of these factors are not well studied, others have a variable influence or are controversial, and only a few are known and sometimes controlled (de Lima Júnior et al., 2016).

One of these less studied factors is the type of birth, most characteristic of small ruminants – sheep and goats. It is described as the number of lambs born (live or dead) from a lambed ewe (McHugh et al., 2017), most commonly described as singletons, twins, triplets or quadruplets. One of the main influences of this metric is on making genetic assessments of the individual, as the growth potential of the lamb before weaning is affected by whether it was born or reared as a single or twin (Safari et al., 2007; David et al., 2011; Notter and Brown, 2015), and birth type can account for up to 31% of the phenotypic variation in pre-weaning growth (Hagger, 1998). Nevertheless, lambs born twins or more are at greater risk of mortality (McHugh et al., 2016).

This, in turn, can affect the final quantitative slaughter performance of the lambs. At the same time, there are minimal studies on how this factor has or does not influence the quality of the harvested lamb meat.

On the other hand, the Ile de France breed has been one of the most common meat breeds in Bulgaria since its introduction in 1968 (Dimitrov, 1988). The breed is bred both in pure condition in the country and by crossing with meat breeds of sheep to improve their meat-producing qualities. Ile de France is characterized by excellent slaughtering indicators and meat quality, which is proven by a number of studies over the years (Raicheva & Ivanova, 2005; Slavov, 2007; Dimova, 2019; Ivanov, 2019). But despite this, the research related to the influence of the type of birth on the quality of the meat of this breed is too few. Therefore, the aim of our study was to investigate the influence of the factor „type of birth" on the quality of Ile-de-France lamb.

The aim of the present study was to investigate the meat quality of lambs at different birth types from the Ile de France breed.

Material and Methods

In fulfillment of the set objective, we studied two groups of lambs under real production conditions from the Ile de France breed, with different birth types. For this purpose, 2 groups were formed, each with 8 male lambs, equalized by type of birth (group I – Single, group II – Multiple), age and live weight. The complete and precise set-up of the experimental part is described in detail in our previous study related to the influence of birth type on the slaughter performance of Ile de France lambs (Achkakanova & Penchev, 2023). The lambs were slaughtered at 120 days of age and the selection from each group was based on live weight. Lambs with a live weight closest to the group average were designated for slaughter. Four lambs from each group were slaughtered according to birth type.

To establish the quality of the meat, samples were taken from the muscles *m. Longissimus thoracis et lumborum (LTL), m. Iliopsoas (IP)* and *m. Semimembranosus (SM)*, examining the chemical composition, technological qualities and fatty acid composition. The indicators of chemical composition of the meat, water-holding capacity, thermal losses during roasting, tenderness and fatty acid composition were examined at the 48th h *post mortem*, and the pH values and color characteristics of the meat – at the 24th and 48th h *post mortem.* Muscle samples were stored at 4°C.

The chemical composition of the meat (water, proteins, lipids and raw ash) was determined according to the Bulgarian State Standards (BDS) – BDS 5712:1974, BDS 8549:1992, BDS 9373:1980, BDS 9374:1982. The pH values were determined using a "Testo205" pH meter (Testo SE & Co. KgaA, Germany). Meat water-holding capacity (WHA) was determined by the method of Grau & Hamm (1953). Thermal losses during roasting were determined by the difference in the weights of a meat sample (15 g) baked at a temperature of 150°C for 20 min, expressed as a percentage. Brittleness was measured using a penetrometer "PA" (VEB Feinmess Dresden, Germany). Brittleness values were reported in penetrant degrees (°P). For brittleness, only LTL and SM were investigated, since the maximum score of 400°P was always reported for IP.

The color characteristics of the muscles were determined according to the CIE L*a*b system, using a „Minolta CR-400" colorimeter (Konica Minolta, Osaka, Japan). For L*, a* and b* values, the arithmetic mean of five measurements was taken, at illuminance D65 and viewing angle 2°. Hue angle (h°) was calculated by the formula $h° = tg^{-1}(b*/a*)$.Color saturation (C*) was calculated using the formula $C^* = \sqrt{a^{*2} + b^{*2}}$.

The fatty acid composition of total lipids was analyzed on a Clarus 500 Gas chromatograph (Perkin Elmer) equipped with a 60 m Thermo TG-WAXMS column, I.D. 0.25 mm and Film: 0.5 µm. Methyl esters were identified by comparison with retention times of standards. Fatty acids are presented as % of the total amount of methyl esters identified.

Significant differences between the two groups of lambs (Single and Multiple) for all examined parameters were calculated with One-Way ANOVA analysis at $p < 0.05$. The results in the tables are presented by Mean and Standard Deviation. The coefficient of determination R2 shows how differences in all examined parameters can be explained by differences in the variable Type of birth. Data analysis was performed using the SPSS Statistics V 26.0 package.

Results and Discussion

Chemical composition

Table 1 presents the data on the chemical composition of lamb from the Ile de France breed depending on the type of birth. From the analysis of the data, it is evident that the water content varies from 74.28% to 76.88% in the unit group (I group) for the three muscles studied, and in the multiple group (II group) from 74.56% to 75.71%. An impression is made that in both investigated groups the water content is the lowest in LTL and the highest in IP.

The protein content ranged from 20.61% to 21.86% in the singleton group and from 20.48% to 20.71% in the multiple group, respectively. The observed difference for lower protein content in meat in group II is statistically unreliable. Lipids in the three muscles studied varied from 2.45%

to 2.73% in group I and from 2.07% to 3.22% in group II. Crude ash (mineral matter) ranged from 1.09% to 1.22% in the I group and from 1.18% to 1.23% in the multiples group.

Summarizing the data on the chemical composition of lamb meat, we can conclude that the type of birth factor does not affect this meat indicator.

Technological qualities

Tables 2, 3 and 4 present the technological qualities of the three investigated muscles in lambs of the Ile de France breed, depending on the type of birth.

From the data analysis of the three processing quality tables, we can observe that the pH24 values of the meat in the

Table 1. Means±standard deviation of the meat chemical composition of lambs from Ile-de-France breed, depending on the type of birth

	Type of birth		P-value	R^2
	Single (n = 4)	Multiple (n = 4)		
LTL				
Water, %	74.28±0.67	74.56±0.36	0.497	0.08
Proteins, %	21.08±0.97	20.48±0.41	0.296	0.179
Lipids, %	2.73±0.35	2.56±0.68	0.676	0.031
Ash, %	1.22±0.25	1.23±0.23	0.955	0.001
IP				
Water, %	76.88±2.04	75.71±0.53	0.31	0.17
Proteins, %	20.61±0.79	20.50±0.80	0.851	0.006
Lipids, %	2.57±0.27	3.22±0.65	0.109	0.372
Ash, %	1.09±0.22	1.18±0.18	0.555	0.061
SM				
Water, %	75.60±0.32	75.21±0.44	0.196	0.261
Proteins, %	21.86±1.02	20.71±0.47	0.086	0.412
Lipids, %	2.45±1.17	2.07±0.37	0.567	0.058
Ash, %	1.11±1.17	1.22±0.18	0.299	0.177

Not significant differences (P > 0.05); R^2 – coefficients of determination, n – number of the lambs

Table 2. Means±standard deviation of the meat quality (LTL) of lambs from Ile-de-France breed, depending on the type of birth

	Type of birth		P-value	R^2
	Single (n = 4)	Multiple (n = 4)		
pH_{24}	5.65±0.03	5.67±0.05	0.367	0.037
pH_{48}	5.67±0.04	5.69±0.05	0.446	0.027
Meat colour – 24th h *post mortem*				
L*	42.38±2.43	41.39±1.76	0.268	0.055
a*	15.81±1.16	15.22±1.09	0.209	0.071
b*	7.08±1.45	6.63±0.93	0.373	0.036
h°	0.42±0.07	0.41±0.04	0.682	0.008
C*	17.36±1.48	16.61±1.29	0.199	0.074
Meat colour – 48th h *post mortem*				
L*	44.33±1.93	43.23±2.12	0.095	0.072
a*	14.74±1.55	14.93±1.21	0.676	0.005
b*	6.64±1.49	6.56±1.50	0.871	0.001
h°	0.42±0.08	0.41±0.07	0.682	0.004
C*	16.22±1.71	16.35±1.53	0.801	0.002
WHC, %	14.24±3.00^{a}	17.72±4.32^{a}	0.032	0.193
CL, %	29.73±3.00	28.83±3.06	0.476	0.023
Tenderness, °P	278.00±54.91	289.08±54.06	0.554	0.009

^{a,b} Different superscripts within the same row represent significant differences at the level of significance P < 0.05; ^{ns} – not significant differences (P > 0.05); R^2 – coefficients of determination; n – number of the lambs

Table 3. Means±standard deviation of the meat quality (IP) of lambs from Ile-de-France breed, depending on the type of birth

	Type of birth		P-value	R^2
	Single (n = 4)	Multiple (n = 4)		
pH_{24}	5.76±0.16	5.74±0.04	0.582	0.014
pH_{48}	5.80±0.12	5.74±0.05	0.126	0.103
Meat colour – 24th h *post mortem*				
L*	48.57±1.49	48.96±1.55	0.541	0.017
a*	19.58±2.38	19.80±1.60	0.788	0.003
b*	9.24±3.03	9.77±1.68	0.598	0.013
h°	0.44±0.12	0.46±0.06	0.604	0.012
C*	21.78±2.88	22.12±1.93	0.743	0.005
Meat colour – 48th h *post mortem*				
L*	48.06±2.49	48.77±2.10	0.339	0.024
a*	16.19±2.46	16.76±1.62	0.395	0.019
b*	8.45±2.75	9.29±2.08	0.285	0.03
h°	0.48±0.10	0.50±0.09	0.356	0.022
C*	18.36±3.19	19.23±2.04	0.309	0.027
WHC, %	17.78±3.02[a]	20.91±2.29[a]	0.009	0.272
CL, %	33.27±3.91	31.86±3.83	0.381	0.035

[a,b] Different superscripts within the same row represent significant differences at the level of significance $P < 0.05$; [ns] – not significant differences ($P > 0.05$); R^2 – coefficients of determination; n – number of the lambs

group of singles ranged from 5.65 (LTL) to 5.76 (IP) and in the group of multiples from 5.65 (SM) to 5.74 (IP). The differences between the two studied groups are minimal and unreliable. The same tendency for non-significant differences was also observed for pH48 values – from 5.67 (LTL) to 5.80 (IP) for group I and from 5.67 (SM) to 5.74 (IP) for group II, respectively. In both studied groups, IP pH values were highest at both 24 and 48 h post mortem.

In terms of color characteristics at 24 h post mortem, no significant differences were observed between the two groups of animals studied in all three muscles studied. The only exception is the values of L* SM (Table 4), where a significantly darker color is observed in group II (40.96) compared to group I (43.85). For the rest of the color indicators of all three muscles, we can note that a tendency is observed in which LTL has the lowest values of L*, a* and b* of the three muscles in both groups, which also reflects on the Hue angle and the color saturation of this muscle. The highest values of color characteristics are observed for IP in both studied groups.

In a study of the influence of rearing methods on the quality of lamb from Ile-de-France, Priolo et al. (2002) found comparatively higher values of L* and b* and low values of a* of LTL found at 24 h.

When examining the color characteristics at 48 hours, again, significant differences in SM color were observed between the two groups (Table 4). The values of a* for the group of singles (15.73) are significantly lower compared to the group of multiples (17.08). This, in turn, reflects on the saturation values (C*), reporting a significant difference between the two groups, 17.48 for group I and 18.75, respectively. Regarding the rest of the color characteristics of the studied muscles, no significant differences were reported and the values were relatively the same for the two studied groups.

The most differences between the two studied groups of lambs were observed with regard to the Water holding capacity of meat (WHC) indicator. In both LTL and IP muscles, a significantly worse meat water-holding capacity was observed in the multiple group compared to the single group. For LTL the values are respectively 14.24% (I group) and 17.72% (II group), and for IP – 17.78% (I group) and 20.91% (II group). In this way, the finished meat from these two muscles in the plurals will more easily lose its own water, reflecting negatively on the quality of the final meat product, in particular „fillet“ and „cutlet“ meat cuts. The values for the Water holding capacity of meat (WHC) of SM in the two studied are approximately the same and statistically unreliable.

From the analysis of the roasting thermal loss data, a non-credible trend was observed where the singles group had higher losses compared to the multiples group in all three muscles studied, LTL being 29.73% and 28.83% respectively , for IP are 33.27% and 31.86%, and SM – 29.29% and

Table 4. Means±standard deviation of the meat quality (IP) of lambs from Ile-de-France breed, depending on the type of birth

	Type of birth		P-value	R^2
	Single (n = 4)	Multiple (n = 4)		
pH_{24}	5.67±0.07	5.65±0.06	0.578	0.014
pH_{48}	5.70±0.05	5.67±0.03	0.097	0.12
Meat colour – 24th h *post mortem*				
L*	43.85±2.23[a]	40.96±1.55[a]	0.001	0.381
a*	19.66±2.41	18.31±1.17	0.094	0.122
b*	9.34±1.89	8.29±1.00	0.101	0.117
h°	0.44±0.04	0.43±0.03	0.339	0.042
C*	21.79±2.94	20.11±1.40	0.087	0.127
Meat colour – 48th h *post mortem*				
L*	43.43±2.92	42.96±1.90	0.545	0.010
a*	15.73±1.81[b]	17.08±1.27[b]	0.009	0.165
b*	7.36±2.31	7.58±1.60	0.727	0.003
h°	0.43±0.12	0.42±0.08	0.610	0.007
C*	17.48±2.12[c]	18.75±1.33[c]	0.029	0.120
WHC, %	11.75±3.63	11.56±3.66	0.900	0.001
CL, %	29.29±3.54	28.18±3.83	0.469	0.024
Tenderness, °P	319.28±85.56	306.23±87.15	0.635	0.006

[a,b] Different superscripts within the same row represent significant differences at the level of significance $P < 0.05$; [ns] – not significant differences ($P > 0.05$); R^2 – coefficients of determination; n – number of the lambs

28.18%. In general, the highest thermal losses, for both studied groups, were observed at IP.

Regarding the fragility of the two studied muscles LTL and SM, no significant differences between the two studied groups were observed. An implausible trend was observed for more tender meat from SM (Table 4) in both groups (319.28°P for Group I and 306.23°P for Group II) compared to LTL (Table 2) – 278.00°P for group I and 289.08°P for group II.

Fatty acid composition

Tables 5, 6 and 7 present the results for the fatty acid composition of the three studied muscles in lambs of the Ile de France breed, depending on the type of birth.

Regarding the content of saturated fatty acids (SFA), no significant difference was found between the two studied groups. Their total amount in group I averaged from 49.08% (LTL) to 49.638% (SM), and in group II from 48.66% (LTL) to 50.38% (IP), respectively. In the first group of SFA animals studied, palmitic fatty acid has the highest relative proportion (for the three muscles studied), and arachidic fatty acid has the lowest in LTL and IP, and lauric in SM. In the second experimental group, C16:0 again has the highest relative share, and C12:0 the lowest, in the three muscles examined.

The content of monounsaturated fatty acids (MUFA) in the three examined muscles in group I averaged from 45.748% (SM) to 46.450% (IP), in group II from 45.100% (IP) to 47.17% (LTL)). A reliable difference between the results of the two studied groups on this indicator was not found. The only significant difference ($P < 0.05$) between the two groups is reported in the content of margarinoleic (heptadecylene) fatty acid at IP (Table 6), respectively 0.572% for I group and 0.420% for II group.

In both studied groups, the largest proportion of MUFA in all three muscles was oleic fatty acid, and the smallest proportion was eicosaenic fatty acid. Also, oleic fatty acid has the largest share of the total amount of fatty acids in the three muscles studied. This shows that the Ile de France lamb we studied is rich in oleic fatty acid.

Regarding the content of polyunsaturated fatty acids (PUFA), no statistically significant difference was reported between the two groups of animals. In the group of singles, their content in all three muscles varied on average from 4.40% (IP) to 4.615% (SM) and from 4.16% (LTL) to 4.482% (IP) in the group of multiples. Linoleic fatty acid has the largest share for both studied groups for all three muscles, and C16:2 has the lowest (Table 7).

The ratio of polyunsaturated/saturated fatty acids (PUFA/SFA) in both studied groups was in the range from 0.088 (IP)

Table 5. Fatty acid composition of LTL in lambs of the Ile de France breed depending on the type of birth

Fatty acids, %	Type of birth		P-value	R^2
	Single (n = 4)	Multiple (n = 4)		
	Mean±SD	Mean±SD		
C12:0	0.423±0.154	0.438±0.041	0.857	0.006
C14:0	4.035±0.514	3.747±0.364	0.396	0.122
C16:0	28.080±1.139	28.485±1.204	0.642	0.038
C16:1	1.315±0.313	1.520±0.149	0.282	0.189
C16:2	0.073±0.145	0.320±0.244	0.132	0.337
C17:0	1.380±0.178	1.452±0.261	0.663	0.034
C17:1	0.298±0.254	0.323±0.076	0.856	0.006
C18:0	14.848±1.103	14.030±1.678	0.447	0.100
C18:1	44.568±1.917	45.022±1.632	0.730	0.021
C18:2	3.727±0.626	2.880±0.713	0.124	0.347
C18:3	0.802±0.118	0.965±0.160	0.154	0.307
C20:0	0.315±0.136	0.512±0.135	0.087	0.411
C20:1	0.137±0.096	0.305±0.216	0.207	0.250
SFA	49.08±2.069	48.66±1.988	0.782	0.014
MUFA	46.31±2.227	47.17±1.637	0.560	0.060
PUFA	4.60±0.704	4.16±0.907	0.475	0.088
UFA/SFA	1.042±0.088	1.057±0.079	0.808	0.011
PUFA/SFA	0.095±0.012	0.085±0.019	0.420	0.111
n-6/n-3	4.755±0.497[a]	3.303±0.386[a]	0.004	0.781

[a,b] Different superscripts within the same row represent significant differences at the level of significance $P < 0.05$; [ns] – not significant differences ($P > 0.05$); R^2 – coefficients of determination; n – number of the lambs

Table 6. Fatty acid composition of IP in lambs of the Ile de France breed depending on the type of birth

Fatty acids, %	Type of birth		P-value	R^2
	Single (n = 4)	Multiple (n = 4)		
	Mean±SD	Mean±SD		
C12:0	0.460±0.118	0.293±0.196	0.194	0.263
C14:0	4.185±0.284	4.330±0.429	0.593	0.050
C16:0	28.298±1.089	28.758±1.799	0.677	0.031
C16:1	1.465±0.241	1.228±0.107	0.122	0.351
C16:2	0.315±0.254	0.293±0.213	0.896	0.003
C17:0	1.528±0.329	1.368±0.273	0.483	0.085
C17:1	0.572±0.106[a]	0.420±0.053[a]	0.043	0.523
C18:0	14.345±1.648	15.14±1.336	0.482	0.086
C18:1	44.288±3.356	43.200±2.790	0.637	0.040
C18:2	3.400±0.412	3.400±0.974	0.996	0.000
C18:3	0.685±0.137	0.787±0.075	0.237	0.223
C20:0	0.335±0.107	0.490±0.150	0.133	0.335
C20:1	0.125±0.021	0.280±0.130	0.055	0.486
SFA	49.150±2.834	50.380±2.794	0.558	0.060
MUFA	46.450±3.256	45.100±2.680	0.556	0.061
PUFA	4.400±0.740	4.482±1.022	0.900	0.003
UFA/SFA	1.040±0.115	0.990±0.110	0.552	0.062
PUFA/SFA	0.088±0.013	0.090±0.024	0.862	0.005
n-6/n-3	5.485±0.881	4.660±0.924	0.244	0.218

[a,b] Different superscripts within the same row represent significant differences at the level of significance $P < 0.05$; [ns] – not significant differences ($P > 0.05$); R^2 – coefficients of determination; n – number of the lambs

Table 7. Fatty acid composition of SM in lambs of the Ile de France breed depending on the type of birth

	Type of birth		P-value	R^2
	Single (n = 4)	Multiple (n = 4)		
	Mean±SD	Mean±SD		
C12:0	0.398±0.153	0.403±0.139	0.963	0.000
C14:0	3.922±0.785	4.135±0.396	0.646	0.038
C16:0	28.958±1.351	28.428±1.183	0.577	0.055
C16:1	1.358±0.284	1.377±0.334	0.930	0.001
C16:2	0.445±0.113	0.363±0.185	0.475	0.088
C17:0	1.223±0.347	1.463±0.278	0.312	0.162
C17:1	0.308±0.213	0.338±0.071	0.798	0.012
C18:0	14.733±1.848	14.650±1.209	0.943	0.001
C18:1	43.898±1.734	43.930±2.114	0.982	0.000
C18:2	3.480±1.269	3.343±0.364	0.842	0.007
C18:3	0.690±0.112	0.763±0.144	0.456	0.096
C20:0	0.405±0.133	0.505±0.146	0.350	0.146
C20:1	0.185±0.033	0.305±0.094	0.053	0.491
SFA	49.638±1.532	49.583±1.591	0.962	0.000
MUFA	45.748±1.681	45.950±1.841	0.876	0.004
PUFA	4.615±1.353	4.468±0.421	0.842	0.007
UFA/SFA	1.015±0.065	1.018±0.067	0.959	0.000
PUFA/SFA	0.093±0.029	0.090±0.008	0.873	0.005
n-6/n-3	5.665±1.377	5.123±1.936	0.664	0.034

^{a,b} Different superscripts within the same row represent significant differences at the level of significance $P < 0.05$; ^{ns} – not significant differences ($P > 0.05$); R^2 – coefficients of determination; n – number of the lambs

to 0.095 (LTL) in the first group, and from 0.085 (LTL) to 0.090 (IP and SM) in the second group No significant differences were found between the results of the two groups. The PUFA/SFA ratio obtained by us for both groups of animals is relatively low, since its values in human nutrition should be above 0.4 (Popova, 2016) and even above 0.45 (Culyer, 1994), which makes the lamb meat we studied was unbalanced by this indicator.

Similar to our ratio results were obtained by Yarali et al. (2014) studied the influence of gender in Kıvırcık lambs – on average between 0.08 (female) and 0.11 (male), finding a significant difference. Relatively higher values for this ratio were obtained by Margetín et al. (2018) in the study of two types of rearing of Ile de France lambs – between 0.12 and 0.36.

Regarding the values for the n-6/n-3 ratio, a significant difference ($P < 0.05$) was found between the groups when examining LTL (Table 5), with the group of singletons having a relatively higher ratio (4.775) compared to the polynomial group (3.303). In the remaining two examined muscles (IP and SM), reliable differences between the two groups on this indicator were not established. In general, our results for the ratio of omega-6 to omega-3 fatty acids, except for LTL of the second group, are high. The ratio recommended by a number of authors (de Lorgeril et al., 1994; Scollan et al., 2006) for proper and healthy human nutrition is to be <4.0.

Conclusion

In conclusion, we can note that the type of birth in the Ile-de-France lambs studied by us affects only some of the meat quality indicators. Credible differences were found in the Water holding capacity (WHC) of the meat from *m. Longissimus thoracis et lumborum* and *m. Iliopsoas*, in which the finished meat of these two muscles in plurals will more easily lose its own water, reflecting negatively on the quality of the final meat product, in particular the meat cuts „fillet" and „chop".

Birth type affects some of the color characteristics of *m. Semimembranosus*, giving it a more saturated dark red color obtained from the group of multiples compared to the group of singles. In the fatty acid composition of the meat, a reliable difference was found in the n-6/n-3 ratio of *m.Longissimus thoracis et lumborum* between the two studied groups.

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