Bulgarian Journal of Agricultural Science, 29 (No 2) 2023, 359–364

Effect of birth type on slaughter characteristics of Ile-de-France lambs

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Abstract

Achkakanova, E. & Penchev, I. G. (2023). Effect of birth type on slaughter characteristics of Ile-de-France lambs. *Bulg. J. Agric. Sci., 29 (2)*, 359–364

The subject of the scientific research are male lambs of the Ile de France breed, divided into 2 groups of 8 each, with different birth types – singletons and twins/triplets, fattened intensively for a period of 60 days. The lambs were slaughtered in a licensed slaughterhouse, according to Bulgarian State Standard (BSS), at 120 days of age. Four lambs from each group were slaughtered with an average live weight closest to the group average. The main slaughter parameters, cuts, offal and morphometric measurements of the carcasses were studied. The data were processed according to the methods of variation statistics with Data Analysis, EXCEL, 2016 of Microsoft.

The bodyweight at slaughter (BWS) of the lambs born as singles of the first group was 56.375 kg, and of the lambs of the second group was 52.725 kg. The weight of the cooled carcass of the lambs of the first group is 26.000 kg, and of the lambs of the second group – 24.675 kg. A significant difference was found in the net live weight, in the weight of the foremast and stomach, and the large length of the carcass. This, in turn, does not affect the obtained slaughter yield and compactness of the carcass, which are almost the same in both studied groups. From the conducted studies, we can conclude that the birth type factor does not have a significant impact on the slaughter performance of the slaughtered carcasses, but confirms the compensatory growth opportunities at a young age of the animals of the breed in case of multiple births. The manifestation of compensatory growth in lambs born as twins enables the realization of high growth at an early age and is an important indicator of the economic results of breeding the breed.

Keywords: carcass qualities; carcass dimensions; Ile de France breed

Introduction

The northern half of France, where the Ile-de-France breed originates, is home to over 10 meat breeds, all of which typically produce heavy, top-profitable market lambs. Whether raised as high-value purebreds or for terminal crossbreeding on hardy breeds, these breeds have met with success the world over, either in areas centered on cereal crop production or grassland areas offering good forage potential (France Génétique Elevage, 2011).

The French meat breed of Ile de France sheep possesses the valuable characteristics – high growth intensity at an early age, excellent carcass conformation, excellent slaughter characteristics, characteristic color and taste quality of the meat, polyestrility, high fertility and high milk yield of mothers in the first period of lactation. The mentioned qualities make it more and more preferred and widespread throughout the world and in Bulgaria. The phenotypic manifestation of the genetic potential of the breed in Bulgaria was studied in the period after the first importation of the breed in 1968

until the end of the 80s, mainly by Dimitrov (Dimitrov, 1978, 1988), who also made a comparison with the English meat breeds – Suffolk, Oxford and Hampshire, and also by Dimitrov et al. (Dimitrov et al., 1982, 1987). After this period until 2005, Bulgarian authors established the level of the selection characteristics of the breed and conducted experiments and comparative analyzes with other Bulgarian breeds (Tyankov et al., 2000; Slavov et al., 2004; Raicheva et al., 2005; etc.). Comparative studies with the Ile de France breed were carried out by scientists in Bulgaria on the live mass of lambs from other meat breeds, the Thracian thin fleece breed and its crosses, as well as on F1 crosses of the Ile de France breed (Laleva et al., 2006; Popova et al., 2019; Bianchi et al., 2003).

The intensity of growth of the obtained Ile de France offspring and their ability to achieve high growth at an early age are important for the economic results of breeding the breed. The main income in the meat sector is formed from the sale of lambs for meat and breeding animals with high genetic potential according to the main breeding traits. The selection limits for the Ile de France breed in Bulgaria are described by Dimitrov et al. (2016), and the fattening and slaughtering qualities of lambs of the breed in Bulgaria and abroad are studied by a number of authors (Raicheva et al., 2010; Moreno et al., 2010; Ivanova, 2021).

In recent years, a number of authors have studied the meat qualities of the breed and Factors Affecting it (Raicheva & Ivanova, 2005; Dimova, 2019; Achkakanova et al., 2020; Achkakanova & Staikova, 2021), as well as the efficiency of breeding purebred animals and crossbreeds (Slavov et al., 2005; Slavov, 2007; Ivanov, 2019). Studies on the influence of the type of birth on the slaughter characteristics of lambs of the Ile de France breed in our country are insufficient, especially in animals introduced in the last 10-15 years, they have not been conducted. Given the high levels of fertility achieved in recent years – in a number of farms in our country even over 200% and the introduction of a new modern selection from France, as well as the high economic significance of the signs of fertility and meat yield, the present study was necessary in order to update the results.

The aim of the present study was to investigate the slaughter characteristics 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 reared under real production conditions from the Ile de France breed, with different type of birth. The experiment was carried out in 2021 on a farm under the selection control of the breeding organization Association for the Breeding of the Ile de France Breed in Bulgaria (AILFB) in the area of the town of Dobrich. A total of 16 male lambs at the age of 2 months, during a 60-day period of intensive fattening, were included in the experiment. 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 animals were fed with a concentrate mixture containing 89.22% VE and KER 1.24 in 1 kg of dry matter, produced in a feed plant in the village of Krumovo, region Varna, with a BDS certificate, and alfalfa hay, containing 85% CB and KER 0.74 in 1kg of dry matter. The lambs were slaughtered at 120 days of age, with 4 lambs from each group slaughtered with a live weight closest to the group average.

At the end of the fattening period, lambs destined for slaughter were placed on a 12-hour fasting diet. After this period and before slaughter, the animals were weighed to determine the bodyweight at slaughter (BWS). Slaughter and primary processing were carried out in the following order: stunning, exsanguination, removal of the skin, removal of internal organs, halving of the carcass and subsequent cold storage – for 24 h at a temperature of 4°C. Before being chilled, the carcasses of singletons and twins were weighed to determine the hot carcass weight (HCW) (Figure 1 and Figure 3).

After the internal organs were removed, in parallel with the primary processing of the carcasses, they were separated and weighed individually. Forelimbs and hindlimbs were cut at the knee and hock, respectively, and weighed. The head was skinned and weighed without the skin. Body skin and scalp skin were collected and weighed together. The diges-

Fig. 1. Carcasses of lambs born as singletons

Fig. 2. Halved carcasses of lambs born as singletons

tive tract (foregastric, stomach, small and large intestines) was weighed full and empty to determine the empty bodyweight (EBW) of the animals (Cezar & Souza, 2007):

Empty bodyweight (EBW) (kg) = bodyweight at slaughter – the feed content.

After cold storage for 24 h, the carcasses were reweighed to determine the cold carcass weight (CCW). Cooling loss (CL) during storage were also determined in this way (Gonzaga Neto et al., 2006):

Cooling loss (%) = ((hot carcass weight – cold carcass weight)/hot carcass weight) × 100

Based on these weights, the slaughter yield of the cold carcass and the true yield were determined (Cezar & Souza, 2007):

Cold carcass yield (%) = (cold carcass weight/bodyweight at slaughter) × 100

True yield (%) = (cold carcass weight/Empty bodyweight) × 100

Carcass morphometric measurements were performed on the cold carcasses. The carcass compactness index (CCI) was calculated using the following formula (Cezar & Souza, 2007):

Carcass compactness index (kg/cm) = cold carcass weight/Large carcass length

Singleton and twin carcasses were divided into two halves along the spine and the two halves were weighed separately (Figure 2 and Figure 4). The carcass was then transected into the following cuts: neck, shoulder, thigh, cutlet, ribs, back, and belly. Each of the cuts was weighed individually, deboned, and the resulting meat and bone weights were weighed and reported for each cut, respectively.

Fig. 3. Carcasses of lambs born as twins

Fig. 4. Halved carcasses of lambs born as twins

The primary information was processed according to the methods of variational statistics using the software product Data Analysis, EXCEL, 2016 of Microsoft. Data are presented as means ($\bar{x}$) and standard error of the mean (SEM). The reliability of the differences between the studied groups was established by the Student's t-test.

Results and Discussion

Table 1 presents the data on the main slaughterhouse parameters of the two investigated groups of lambs. According to the pre-slaughter live weight indicator, an unreliable influence of the type of birth factor is found, which, in our opinion, is due to the wider ranges of variation according to the studied indicator in the lambs of the II group. In contrast to the first indicator, a significant difference was found between the two studied groups in terms of net live weight, respectively 49.150 kg in the I group and 45.665 kg in the II group ($p < 0.05$).

Table 1. Carcass characteristics depending on the type of birth in lambs of the Ile de France breed

Carcass characteristics	Type of birth	
	I group – Single	II group – Multiple
Bodyweight at slaughter, kg	56.375±0.937	52.725±1.767
Empty bodyweight, kg	49.150±1.002*	45.665±1.398*
Hot carcass weight, kg	26.725±0.711	25.463±1.047
Cold carcass weight, kg	26.000±0.769	24.675±0.994
Left half, kg	13.325±0.303	12.500±0.691
Right half, kg	12.650±0.569	12.175±0.360
Cooling loss, %	2.729±0.329	3.083±0.503
Cold carcass yield, %	46.098±0.593	46.785±0.688
True yield, %	52.883±0.674	54.015±1.038

n = 4 for both group; * – $p < 0.05$

For the weights of the carcasses – hot and cold, the influence of the type of birth factor was not established. The hot carcass weight for the 1st group is 26.725 kg and 25.463 kg for the II group, and after cooling for 24 h the weights are respectively 26.000 kg for the I group and 24.675 kg for the II group. Here again, the unreliable difference is established for the lower weights of the carcasses in the II group, which also reflects on the lighter halves of the carcasses in this group.

Regarding the cooling loss, no difference between the groups is found, as in the II they are higher, but statistically unreliable. It is interesting, however, that regardless of the differences in the bodyweights at slaughter between the two groups and the weights of the carcasses, almost the same slaughter yield was found in both groups – an average of about 46%. In the true yield, a higher percentage was observed in the II group, from which it can be concluded that the lower live weights of the lambs that were multiple in the lambing did not adversely affect the final slaughter yield. Slavov (2007) obtained results slightly higher in percentage terms than our results for purebred lambs slaughtered at 130 days of age for the slaughterhouse yield indicator. Cloete et al. (2007) found that the type of birth has a reliable influence on the slaughter yield, as it is higher in single lambs compared to lambs born in large lambs.

Table 2 presents the results for the cuts of the carcasses. It is clear from the data that the factor of type of birth does not produce reliable differences on the values for the cuts we obtained. In all of them, with the exception of the "chop" cut, higher values are found in the group of soles compared to the second group. This also affects the meat/bone ratio, such as the amount of meat in the cuts from the first group is implausibly greater compared to that of the II group.

Table 2. Main cuts of lamb carcasses of the Ile de France breed

Cuts, kg	Type of birth	
	I group – Single	II group – Multiple
Neck	1.063±0.055	1.038±0.140
meat	0.825±0.055	0.800±0.108
bone	0.238±0.014	0.238±0.060
Shoulder	2.450±0.100	2.250±0.137
meat	1.888±0.076	1.750±0.100
bone	0.563±0.028	0.500±0.047
Leg	3.950±0.111	3.725±0.242
meat	3.050±0.100	2.800±0.206
bone	0.900±0.047	0.925±0.055
Chop (cutlet)	0.888±0.134	0.950±0.058
meat	0.658±0.144	0.738±0.043
bone	0.230±0.021	0.213±0.049
Ribs	1.800±0.141	1.750±0.100
meat	1.225±0.152	1.225±0.087
bone	0.575±0.055	0.525±0.055
Back	2.000±0.194	1.750±0.153
meat	1.263±0.104	1.300±0.141
bone	0.738±0.109	0.450±0.100
Belly	1.075±0.073	0.900±0.082

n = 4 for both group;

Table 3 presents the data on the obtained by-products in the carcasses of the two studied groups. In the case of edible offal, no significant differences were found between the two studied groups. The weights of the offal head, lung, liver and large intestines are slightly higher in the first group, and of the heart, small intestines, kidneys and spleen in the second group. The only exceptions are the results for the forestomaches and the stomach which in the I group are significantly higher compared to the II group, respectively 1.175 and 0.995 ($p < 0.01$). This difference justifies the obtained reliable differences in Empty bodyweight indicator as well.

No significant differences between groups were also found for technical by-products. For offal tail, diaphragm,

Table. 3. By-products from Ile de France lambs

By-products, kg	Type of birth	
	I group – Single	II group – Multiple
Edible:		
Head (without skin)	1,645±0,039	1,585±0,044
Heart	0,285±0,036	0,295±0,011
Lungs (+trachea)	0,720±0,041	0,64±0,050
Liver	1,200±0,060	1,175±0,047
Forestomaches and stomach (clean)	1,175±0,050**	0,995±0,047**
Small intestine (clean)	1,155±0,071	1,225±0,099
Large intestine (clean)	0,720±0,069	0,715±0,059
Kidneys	0,184±0,011	0,190±0,012
Spleen	0,095±0,006	0,100±0,009
Technical		
Feet (with hooves)		
Front feet	0,685±0,011	0,635±0,037
Hind feet	0,715±0,330**	0,595±0,024**
Skin (head + body)	6,210±0,216	6,035±0,179
Tail	0,089±0,011	0,091±0,008
Kidney's fat	0,193±0,007	0,239±0,025
Diaphragm	0,229±0,038	0,224±0,029
Testicles	0,275±0,017	0,280±0,034
Bladder (clean)	0,035±0,006	0,030±0,007
Throaty	0,130±0,022	0,115±0,006

n = 4 for both group; ** – p < 0,01

Table. 4. Morphometric measurements of carcasses in lambs of the Ile de France breed

Morphometric measurements of carcass	**Type of birth**	
	I group – Single	**II group – Multiple**
Large carcass length, cm	113.250±0.553*	109.750±1.280*
Small carcass length (half carcass internal length), cm	70.750±2.075	66.275±2.702
Leg length (Pelvic limb length), cm	40.125±1.738	41.125±1.341
Leg girth, cm	48.375±1.516	48.000±0.817
Chest depth, cm	80.450±1.212	67.125±13.623
Carcass compactness index, kg/cm	0.230±0.006	0.225±0.009
Fat thickness at tail, cm	2.928±1.656	1.568±0.347
Fat thickness at last rib, cm	0.730±0.127	1.045±0.100
Fat thickness at sternum, cm	0.610±0.244	0.845±0.200
Length of small intestine, m	24.725±1.990	27.325±1.363
Length of large intestine, m	5.200±0.403	5.225±0.453

n = 4 for both group; * – p < 0.05

testicles, bladder the data are almost similar. A reliable difference exists only in the hind feet, as in the first group they are heavier compared to the second group, respectively 0.715 and 0.595 (p < 0.01).

Table 4 presents the morphometric measurements of the carcasses of the two investigated groups of lambs. From the analysis of the data, it is evident that the factor type of birth does not have a significant influence on the morphometric parameters of the carcass. A statistically significant difference between the groups is found only in the case of the large length of the carcass, and the results are higher for the first group, 113.250 cm, respectively, compared to the second group – 109.750 cm. This, in turn, does not adversely affect the carcass compactness index, which in both groups is 0.23 on average. Non-significant differences between groups were also observed in the remaining measurements. It was established that in the II group the fat thickness at last rib and at the sternum, although unreliable, is greater compared to that of the I group.

Conclusions

From the conducted studies, we can conclude that the type of birth factor does not have a significant impact on the slaughter performance of the slaughtered carcasses. The manifestation of compensatory growth in lambs born as twins enables the realization of high growth at an early age and is an important indicator of the economic results of breeding the breed. Significant differences were found in terms of empty bodyweight, forestomaches and stomach (clean) weight, and large carcass length. However, this, in turn, does not affect the values of the indicators of slaughter yield and compactness of the carcass, which in both studied groups are almost the same and confirm the compensatory growth opportunities at a young age of the animals of the breed in case of multiple births.

Acknowledgements

This work was supported by the project Strengthen Research And Innovation Capacity For Grazing Livestock Meat Production In Bulgaria Through Advanced Knowledge Transfer, „Greenanimo" (contract No Д01-287/07.10.2020 and Д 01-85/01.04.2021) part of the National Programme "European Scientific Networks" funded by the Bulgarian Ministry of Education and Science, Bulgaria.

References

Achkakanova, E. & Staykova, G. (2021). Evaluation of the effect of abiotic factors on the weight development of young male

breeding animals of the Ile de France breed in Bulgaria. *Zhivotnovadni Nauki, LVIII/2,* 20-27, (En).

Achkakanova, E.**, Minkova, T. & Nikolov, V.** (2020). Growth of Lambs of the Ile-de-France Breed from Birth to Weaning and Factors Affecting it. *Scientific Papers. Series D. Animal Science. LXIII (1),* 13-18, (En).

Bianchi, G., Garibotto, G. & Bentancur, O. (2003). Growth characteristics of light lambs from Corriedale ewes and Corriedale, Texel, Hampshire Down, Southdown, Ile de France, Milchschaf or Suffolk rams. Archives of Zootechnics, *52(199),* 339-345.

Cezar, M. F. & Sousa, W. H. (2007*)*. Sheep and goat carcasses: Obtaining, evaluating and classifying. 1st edition. *Agropecuária Tropical, Uberaba-MG*.

Cloete, J. J. E., Cloete, S. W. P., Olivier, J. J. & Hoffman, L. C. (2007). Terminal crossbreeding of Dorper ewes to Ile de France, Merino Landsheep and SA Mutton Merino sires: Ewe production and lamb performance. *Small Ruminant Research*, *69(1-3),* 28-35.

Dimitrov, I. (1988). Development of a specialized synthetic line and use of the Ile-de-France breed for improving the meat properties of lambs. *Doctoral Dissertation. Sofia,* (Bg).

Dimitrov, I., Slavov, R. & Achkakanova – Dimitrova, E. (2016). Selection programme for breeding the Ile-de-France. Stara Zagora, ISBN 978-619-90142-1-9.

Dimova, N. (2019). Opportunities for improving the productivity of sheep from different productive directions. *Dissertation,* Agricultural Institute, Stara Zagora*,* 156, (Bg).

France Génétique Elevage (2011). http://en.france-genetique-elevage.org/Diversity-of-meat-sheep-breeds.html

Gonzaga, N., Silva Sobrinho, A. G., Zeola, N. M. B. L., Marques, C. A. T., Silva, A. M. A., Pereira, F. J. M. & Ferreira, A. C. D. (2006). Quantitative characteristics of the Morada Nova slanted lamb carcass as a function of the bulky: concentrate ratio in the diet. *R. Bras. Zootec. 35,* 1487-1495.

Institut de l'Elevage (IDELE), INRAe & Races de France. Assessment of Performance Monitoring of Suckling Sheep. (Campagne 2020).

Ivanov, N. (2019). Increasing the lamb production efficiency. PhD Thesis, Agricultural Institute – Stara Zagora, Academy of Agriculture, 123, (Bg).

Ivanova, T. (2021). Assessment of the effect of the type of Birth on the Weight Development of Ile de France Lambs. *Journal of Mountain Agriculture on the Balkans, 24 (5),* 52-62, *ISSN1311-0489*.

Laleva, S., Slavova, P., Popova, Y., Boykovska, G. & Krastanov, **Zh. (**2006). Study of fertility and live weight in Mouton Charolais lambs, Ile de France, Thracian thin-wool breed and its crosses. Sb. *International Scientific Conference of SU-Stara Zagora, "Stara Zagora 2006",* 384-387.

Moreno, G. M. B., Silva Sobrinho, A. G. D., Rossi, R. C., Perez, H. L., Leão, A. G., Zeola, N. M. B. L., & Sousa Júnior, S. C. D. (2010) Carcass performance and yields of Ile de France lambs weaned at different ages. *Brazilian Magazine of Health and Animal Production, 11(4),* 1105-1116.

Popova, Y., Ivanov, N., Slavova, P., Laleva, St., Slavova, St., Kalaydzhiev, G. & Achkakanova, **E. (**2019). Efficiency of fattening lambs from Bulgarian dairy synthetic population and its F1 crosses with meat sheep breeds. *Bulg. J. Agric. Sci., 25 (Suppl. 1), 78-81.*

Raicheva, E. & Ivanova, T. (2005). Effect of lambing, type of birth and sex on the live weight and the gain of Ill de France lambs. *Journal of Animal Science, 5,* 222-226, (Bg).

Raicheva, E. & Ivanova, **T. (**2010). Live Weight and Gain at Sheep from Ile de France Breed According to Some Factors. *Journal of Animal Science, 5,* 10-15, (Bg).

Slavov, R., Slavova, P. & Laleva, S. (2004). Genetic structure of Ile de France sheep breed in Bulgaria according to the transferrin and haemoglobin polymorphous genetic system. *Trakia Journal of Sciences, 2(2),* 38-40.

Slavov, R. (2007). Possibilities for improvement of SIBT sheep – Dobrudzhan type. *Doctoral Dissertation,* DSN. St. Zagora, 322, (Bg).

Slavov, R., Dimitrov, I. & Ribarski, St. (2005). Study of fattening and slaughtering characteristics in lambs from SIBT and crosses with the participation of AM and ILF breeds. *Livestock Sciences, XLII (2),* 15-20.

Tyankov, S., Dimitrov, I., Stankov, I., Slavov, R. & Panayotov, D. (2000). Sheep Breeding and Goat Breeding. Abagar AD, V.Tarnovo, 588, (Bg).

Received: **February, 02, 2023**; *Approved*: **February, 22, 2023**; *Published:* **April, 2023**