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Growth Intensity of Lambs during Artificial Milk Rearing Depending on Chosen Non Genetic Factors

Research Article

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ABSTRACT

The aim of the research was to evaluate the influence of sex, breeding group, litter size and age of lambs when placed in lambing pens for their growth rate during rearing. The average daily gain of lambs was evaluated based on their weighing data each week after their placement into lambing pens. Lambs of Improved Valachian, Tsigai and Lacaune breed (n=26) had been gradually integrated to the experiment. Artificial rearing was carried out using a feed slot machine. All lambs were weighted on a digital scale with an accuracy of 0.1 kg at birth, when placed in the lambing pens and then every week until weaning. The breeding group factor had no statistically significant effect on the average daily gain during milk rearing. The average daily gains of lambs at the end of milk rearing were the same for all experimental grups. The ewe lambs at the end of milk rearing reached a higher average daily gain than ram lambs; but we did not detect statistically significant influence of sex on the average daily gain. The litter size factor had a highly significant effect ($P<0.01$) only on the growth rate of lambs during the first week after beieng placed in the lambing pens. At the end of milk rearing, the average daily gain was the same for single-litter-lambs and twin-litter-lambs too. The difference of the age of their placement into lambing pens had no statistically significant effect on the weight of the lambs at the end of milk rearing. Statistically significant effect ($P<0.05$) was found in lambs of different age at their placement in the lambing pens on the average daily gain from placing in to the end of milk rearing. The lambs involved in rearing had a lower weight gains when placed into the lambing pens at an older age.

KEY WORDS age, average daily gain, breeding group, improved Valachian, Lacaune, lambs, litter size, sex, Tsigai.

INTRODUCTION

Nowadays dairy ewes produce a high amount of milk which exceeds the requirement for normal lamb growth (Bocquier *et al.* 1999; Pollott and Gootwine, 2004). During the first 30 days of lactation a dairy ewe produces quite an important amount of total lactation milk yield (Folman *et al.* 1966); it is the period when lambs are typically allowed to suckle their dams. The peak daily milk production typically occurs during the first month of lactation (Akçapinar, 2000) when in a traditional rearing system it is not possible to get this milk because of suckling. Therefore, a dairy sheep producer has to wait until weaning for the milking of ewes, which significantly reduces the income from a dairy sheep herd because of lower milk production (Gargouri *et al.* 1993; McKusick *et al.* 2001). Total

marketable milk yield is increased; however mastitis is reduced milk yiled. The benefits of this mixed system have been reported for several dairy sheep breeds and used extensively throughout the world for dairy ewes and goats (Caja and Such, 1991; Sheath *et al.* 1995; Garcia *et al.* 1998).

The purpose of the present study was to evaluate the influence of sex, breeding group, litter size and age of lambs when placed in lambing pens for their growth rate during rearing. The average daily gain of lambs was evaluated based on their weighing data each week after their placement in to lambing pens.

MATERIALS AND METHODS

The study was carried out at the Slovak Center for Agricultural Research, in Sheep Breeding Institute, Trenčianská Teplá, Slovakia. In the experiment, we have gradually included 26 heads improved Valachian (IV), Tsigai (T) and Lacaune (L) breed lambs. All lamb groups that were taken into the experiment were subjected to similar conditions of management and nutrition during the experiment. The lambs of three breeds were placed in the lambing pens (nursery) where they were housed in group, lambs were fed by commercially milk replacer using a feed slot machine, with an *ad libitum* access to the milk fodder mixture. In the first days after being placed in the lambing pens it was necessary for lambs to get accustomed to the soother of the feed slot. If the lamb couldn't learn to use the feed slot on it's own within one week, it was excluded from the experiment. For lambs had on disposition quality hay from manger and a bucket of clean water from the beginning of the rearing. Since the 10th day, lambs have also started to be fed with high-quality nuclear fodder (ČOJ 1) from plastic plates.

All lambs were weighted on a digital scale with an accuracy of 0.1 kg at birth, when placed in the lambing pens and then every week until weaning. Based on weightings, we determined the weight of lambs at birth, when placed in the lambing pens, at the age of 8, 15, 22, 30, 36, 44, 51 and 58 days.

For the purposes of assessing age impact on weight when rearing and average daily gains, lambs were divided into 3 groups, namely:

1st group: rearing until the 3rd day after birth
2nd group: rearing on the 4th and 5th day after birth
3rd group: rearing after the 5th day after birth

In this division of lambs into 3 groups, depending on their age when placed in the lambing pens, we did not take into account their belonging to any breed, their sex and litter size.

Multifactorial analysis of variance using a linear model with fixed effects was used for evaluation of primary data, where we took into account the genotype of lambs (3 genotypes - improved Valachian, Tsigai and Lacaune), the litter size (single litters and multiple litters), sex of lambs (female and male), and the age of lambs when placed in the lambing pens (3 groups of lambs, see above). For data analysis the mathematical and statistical software package SAS/STAT 1999-2001 ver. 8.2 (SAS, 2001) and general linear method (GLM) procedure was used.

For determining the shape of growth curves of lambs in various stages of rearing the graph editor of microsoft excel-MS office software package was used. By analysing data with the help of line graphs, we found out, what influence the genotype, sex and litter size has on the growth curve of lambs.

RESULTS AND DISCUSSION

Table 1 shows the average daily gain of lambs during milk rearing depending on the breeding group, sex and litter size. In the first week after placing lambs in the lambing pens, we found the highest weight gain in lambs of improved Valachian (0.07±0.04 kg) and Lacaune (0.07±0.05 kg).

In the first week after placing in the lambing pens, the Tsigai lambs reached lower average daily gain (0.02±0.04 kg) compared to the other breeds. Until the 6th week after rearing, Lacaune lambs had the highest average daily gain.

Whereas, improved Valachian lambs had the lowest average daily gain in this age. In the 7th week after rearing, we recorded the highest average daily gain of Tsigai lambs (0.33±0.05 kg), and the lowest of Lacaune lambs (0.20±0.05 kg). The lambs of improved Valachian breed had the highest average daily gain at the end of lactation (0.51±0.08 kg).

In this period the Tsigai breed had an average daily gain of 0.46 ± 0.08 kg and the lowest average daily gain was found in Lacaune breed (0.45±0.10 kg).

For the entire rearing period, lambs of all three breeds had an average daily gain of 0.24 ± 0.02 kg. Differences between breeds were not statistically significant (Table 2), while Čapistrák *et al.* (2004) found a higher average daily gain (0.26 kg) at a very early weaning. Bimczok *et al.* (2005) when using artificial milk rearing with *ad libitum* access reported higher average daily gain (0.262±0.032 kg) during the rearing period. However, after the weaning, the authors reported a lower average daily gain of lambs with *ad libitum* access to the feed automat (0.137±0.057 kg). The lowest weight and average daily gain, as reported by Bimczok *et al.* (2005) were subsequently observed in case of sudden weaning.

Figure 1 shows the intensity of the growth of lambs in each stage of lactation depending on sex.

Table 1 Average daily gains of lambs during milk rearing least square means ± standard error (LSM±SE) depending on breeding group, sex and litter size

Week after placing in lambing pens	Breeding group			Sex		Litter size		Total averages
	IV	Tsigai	Lacaune	Ewe lambs	Ram lambs	Single litter	Multiple litter	
1	0.07±0.04	0.02±0.04	0.07±0.05	0.09±0.03	0.02±0.04	-0.02±0.04	0.14±0.03	0.078±0.118
2	0.23±0.04	0.26±0.04	0.27±0.05	0.25±0.03	0.26±0.04	0.28±0.04	0.23±0.03	0.246±0.117
3	0.17±0.05	0.22±0.04	0.23±0.05	0.22±0.03	0.19±0.04	0.20±0.04	0.21±0.03	0.206±0.132
4	0.12±0.05	0.12±0.05	0.13±0.06	0.16±0.04	0.18±0.05	0.10±0.05	0.14±0.04	0.131±0.149
5	0.09±0.05	0.19±0.05	0.26±0.05	0.23±0.04	0.13±0.04	0.22±0.04	0.14±0.03	0.177±0.134
6	0.22±0.04	0.24±0.04	0.25±0.04	0.24±0.03	0.24±0.04	0.23±0.03	0.24±0.03	0.235±0.103
7	0.27±0.05	0.33±0.05	0.20±0.05	0.23±0.03	0.30±0.05	0.29±0.04	0.24±0.04	0.258±0.127
8	0.51±0.08	0.46±0.08	0.45±0.10	0.45±0.06	0.50±0.08	0.52±0.07	0.43±0.07	0.468±0.213
For the whole period of rearing	0.24±0.02	0.24±0.02	0.24±0.02	0.25±0.01	0.23±0.02	0.24±0.01	0.24±0.01	0.242±0.042

IV: improved Valachian.

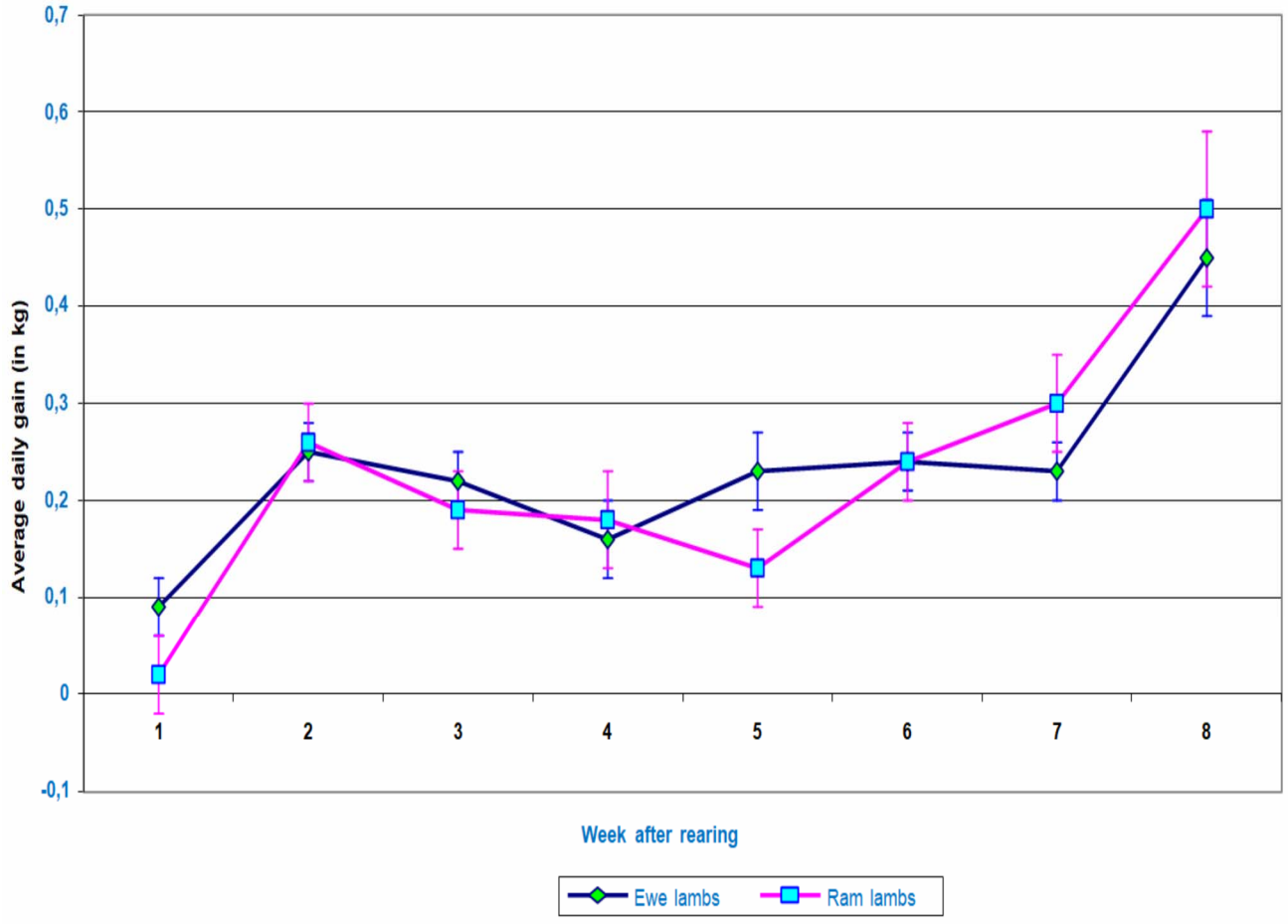

Figure 1 Growth intensity of lambs in various stages of milk rearing based on sex

The ewe lambs reached a higher average daily gain (0.09±0.03 kg) in the first week after being placed in the lambing pens, compared to the ram lambs (0.02±0.04 kg). In the 2nd week after rearing, ram lambs reached a higher average daily gain (0.26±0.04 kg) than ewe lambs (0.25±0.03 kg), but the differences were minimal.

In the 3rd week after rearing, ewe lambs had a higher average daily gain (0.22±0.03 kg) than ram lambs, and they had a slightly higher gain in the 4th week after rearing (0.18±0.05 kg).

Table 2 Significance of influence (F-value) of the breeding group, sex and litter size on the intensity of the growth of lambs (average daily gain) in the individual stages of milk rearing

Week after placing in rearing grounds	Breeding group	Sex	Litter size
1	0.51^{ns}	2.10^{ns}	10.78*
2	0.30^{ns}	0.10^{ns}	1.38^{ns}
3	0.50^{ns}	0.24^{ns}	0.05^{ns}
4	0.01^{ns}	1.49^{ns}	0.32^{ns}
5	3.06^{ns}	2.84^{ns}	1.88^{ns}
6	0.16^{ns}	0.00^{ns}	0.05^{ns}
7	1.76^{ns}	1.43^{ns}	0.79^{ns}
8	0.16^{ns}	0.17^{ns}	0.87^{ns}

* ($P<0.05$).
NS: non significant.

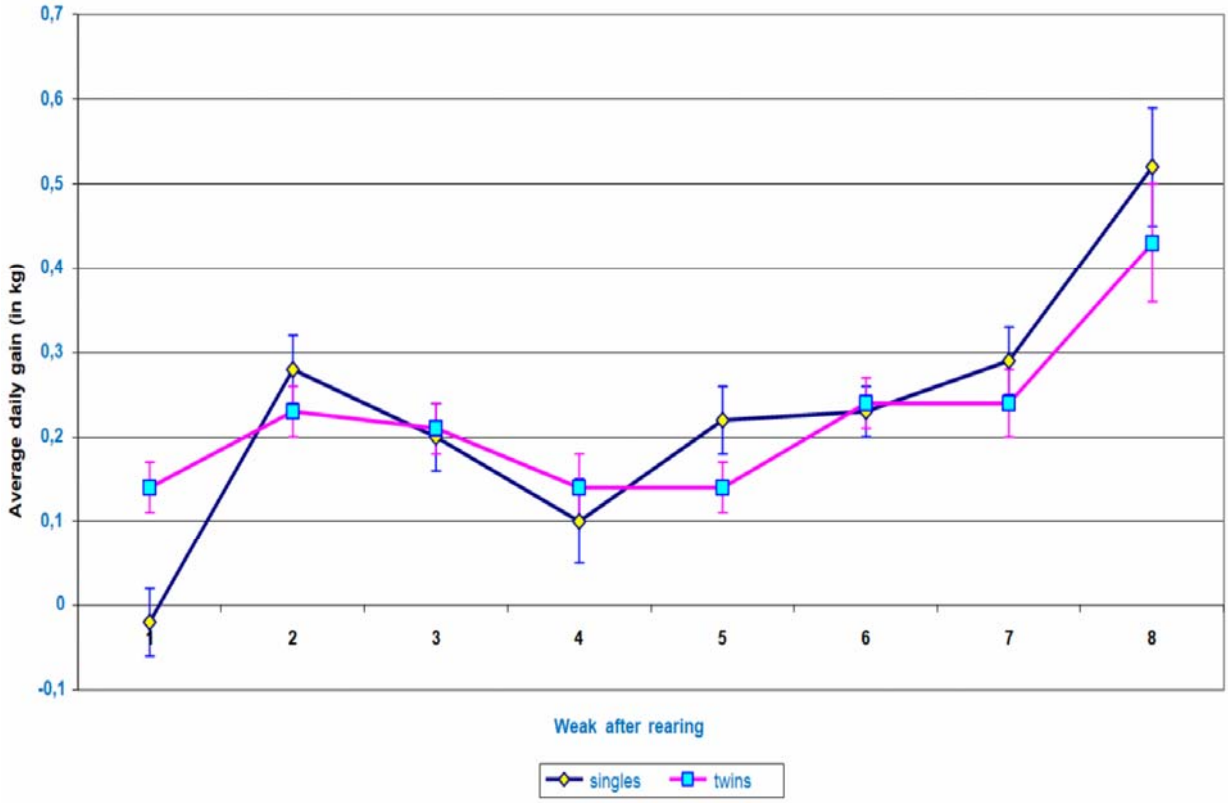

Figure 2 Growth intensity of lambs in the various stages of lactation depending on litter size

It can be seen from the chart that in the 5th week after being placed in the lambing pens, the daily gain of ram lambs decreased (0.13±0.04 kg); while the average daily gain of ewe lambs increased (0.23±0.04 kg).

Ewe lambs and ram lambs had the same average daily gain at the 6th week, deviations were minimal (ewe lambs 0.24±0.03 kg, ram lambs 0.24±0.04 kg). The average daily gain of ewe lambs was 0.23 ± 0.03 kg in the 7th week after rearing, of ram lambs up to 0.30 ± 0.05 kg. At the end of milk rearing, the average daily gain was higher for ram lambs (0.50±0.08 kg), for ewe lambs an average daily gain of 0.45 ± 0.06 kg was recorded.

As shown in Table 1, for the entire lactation period, a higher average daily gain of ewe lambs (0.25±0.01 kg) was achieved during the milk rearing period, and ram lambs gained 0.23 ± 0.02 kg weight in this period.

Similarly, Bimczok *et al.* (2005) did not find any difference between the average daily gains of ewe lambs and ram lambs.

During the observed period, the average daily gain of ewe lambs was 0.236 ± 0.039 kg – less than in our experiment. The authors reported an average daily gain of 0.234 ± 0.036 kg for ram lambs, which correspons to our results as well.

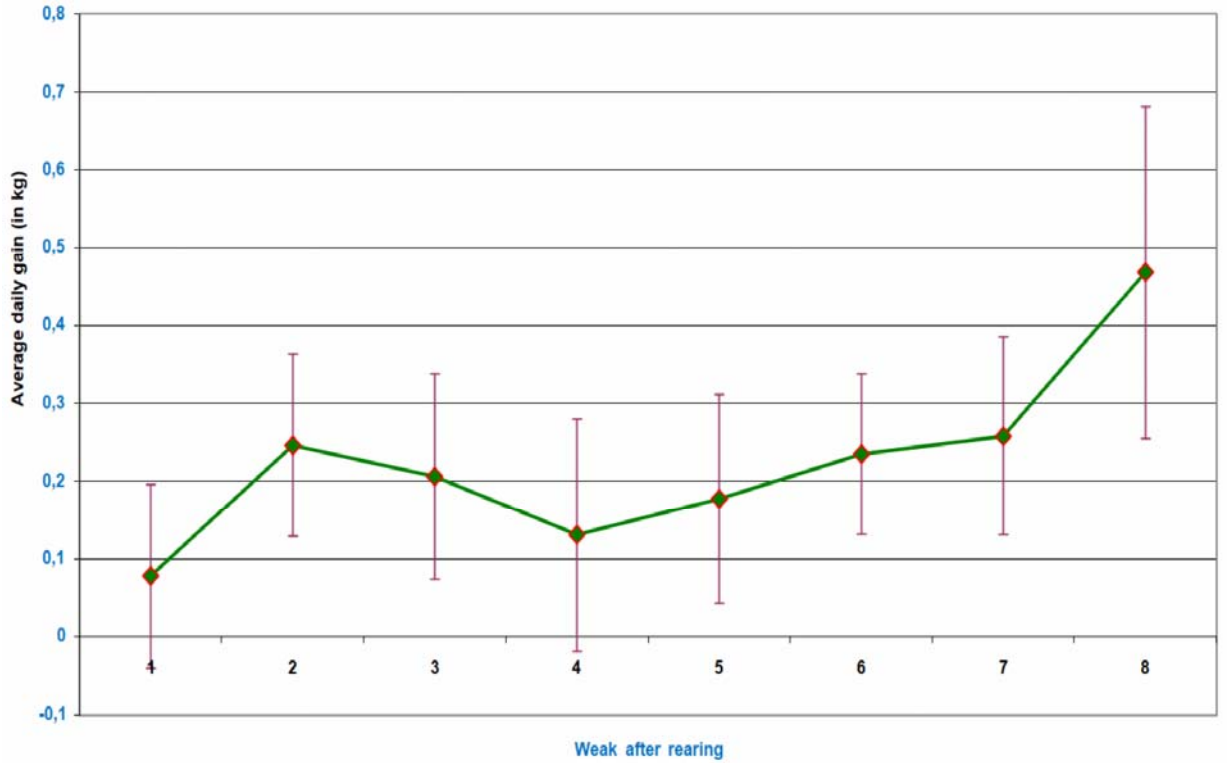

Figure 3 Average daily gains of lambs (LSM±SE) in various stages of milk rearing

Table 3 Results of the analysis of the intensity of the lamb's growth during milk rearing, depending on the age of the lambs when placed in the lambing pens

Group[1]	Lamb weight (in kg) at the end of the rearing			Average daily gains (LSM) (in kg) of lambs during milk rearing from placing in the lambing pens to at the end of lactation		
	N	LSM	SE	n	LSM	SE
1*	15	18.79	0.659	15	0.249	0.010
2**	8	18.87	0.931	8	0.253	0.015
3***	3	15.70	1.317	3	0.197	0.021
F-value	-	2.40^{ns}			2.88^{ns}	
Significant differences	-	-			1:3+; 2:3+	

* The first group of lambs (n=15) reached the weight of 18.79 ± 0.659 kg at the end of milk rearing.
** The second group of lambs reached the weight of 18.87 ± 0.931 kg at the end of milk rearing. These lambs were placed in the lambing pens 4-5 days after birth (n=8).
*** The third group of lambs (n=3) was placed in the lambing pens on the 5th day after birth, their weight at the end of milk rearing was 15.70 ± 1.317 kg.
LSM: least square means; SE: standard error and NS: non significant.

The average daily gains of lambs during milk rearing, depending on litter size, are shown in Table 1 and are graphically processed in Figure 2.

In the first week after being placed in the lambing pens, there were marked differences in the average daily gains between singles and twins. It is clear from the Figure that the average daily gain of singles was -0.02 ± 0.04 kg (singles lost weight) while the twins gained 0.14 ± 0.03 kg. In the next period we see an increase in the average daily gain of singles: in the 2nd week we saw an increase of 0.28 ± 0.04 kg, and a slightly lower gain of twins; 0.23 ± 0.03 kg. On the 3rd and 4th week after milk rearing, average daily gains were higher for twins than for singles.

The chart shows that the average daily gain of singles at 5th weeks increased dramatically from 0.10 ± 0.05 kg to 0.22 ± 0.04 kg, the twins had at the same time in average daily gain of 0.14 ± 0.03 kg, ie the same as in the 4th week. In the next week, the average daily gain of twins increased, and in the 8th week after rearing it was 0.43 ± 0.07 kg. For singles the average daily gain at the end of rearing also increased to 0.52 ± 0.07 kg, to a higher value than for twins at the end of rearing.

For the whole rearing period, from placing to the lambing pens to weaning, the average daily gain of singles and twins was 0.24 ± 0.01 kg. This result is consistent with the known data on the average daily gains of lambs from single litter

and lambs from multiple litter. Bimczok *et al*. (2005) found during artificial rearing an average daily gain of 0.219 ± 0.029 kg by twins, which is a lower value than we have recorded in our experiment.

The authors also reported an average daily gain of 0.246 ± 0.040 kg of singles, and this value corresponds to our results. We found a statistically significant impact of the litter size on the intensity of the lamb's growth during the first week after the lambs were placed into the lambing pens. This is shown in Table 2.

Figure 3 shows average daily gains of lambs in all stages of milk rearing for a whole group of artificially reared lambs. In the first week after placing lamb into the lambing pens, the average daily gain was relatively low (0.078±0.118 kg), but it increased to 0.246 ± 0.117 kg already in the 2nd week.

This low gain in the 1st week after placing lambs in the lambing pens could be due to the sudden weaning of lambs from the mother and then getting used the feed slot on their own. In the following two weeks a decrease in average daily gains was found, falling to 0.131 ± 0.149 kg in the 4th week after rearing. In the next period, average daily gains increased, and at the end of milk rearing the average daily gains were 0.468 ± 0.213 kg, which was extremely high.

Figure 3 shows a high variability in average daily gains during the whole milk rearing. For the entire rearing period, the average daily gain of monitored lambs was 0.242 ± 0.042 kg (Table 1).

The results of the analysis of variance of the intensity of growth of lambs, depending on their age at placing in the lambing pens, are given in Table 3. The first group of lambs reached the weight of 18.79 ± 0.659 kg at the end of milk rearing. The largest number of lambs was in this group (n=15), these lambs were placed in the lambing pens on the 3rd day after birth. The second group of lambs reached the weight of 18.87 ± 0.931 kg at the end of milk rearing. These lambs were placed in the lambing pens 4-5 days after birth (n=8). The third group of lambs (n=3) was placed in the lambing pens on the 5th day after birth, their weight at the end of milk rearing was 15.70 ± 1.317 kg.

It is clear from the table that the lambs placed is lambing pens at their younger age had a significantly higher weight at the end of their milk rearing compared to lambs that were placed in later. However, this fact is largely influenced by the low number of animals placed in after the 5th day after birth. We did not detect a statistically significant effect of lambs' age when placed in the lambing pens on the weight of lambs at the end of milk rearing.

The first group of lambs reached an average daily gain from placing in the lambing pens to the end of the rearing of 0.249 ± 0.010 kg. The second group of lambs reached the highest weight gain that is 0.253 ± 0.015 kg. On the other hand, the 3rd group of lambs reached the lowest average daily gain from placing in the lambing pens to the end of the rearing (0.197±0.021 kg). This fact is largely influenced by the low number of animals reared after the 5th day after birth.

We found a statistically significant effect of the age of their placement into lambing pens on average daily gains among lambs of 1st group and 3rd group ($P<0.05$), and among lambs of the 2nd group and the 3rd group ($P<0.05$). This is in line with the expectation, as it is generally known that lambs placed in the lambing pens later have a lower growth rate as soon as they are placed in but also for the entire rearing period. The lambs placed in later were harder to get used feed slots than lambs placed in at a younger age. It is generally known that younger lambs tend to get easier accustomed to feeding slots than older lambs. In our case, the significant difference could also be affected by the low number of animals reared after the 5th day after birth.

CONCLUSION

This research evaluated the influence of selected non-genetic factors on the intensity of lambs' growth during artificial lactation. We evaluated the influence of breeding group, sex, litter size and age on average daily gains of lambs during lactation. Based on the results we can state the following: The average daily gains of lambs at the end of milk rearing were the same for all surveyed breeds. The breeding group factor had no statistically significant effect on the average daily gain during milk rearing. The ewe lambs at the end of milk rearing reached a higher average daily gain than ram lambs. We did not detect statistically significant influence of sex on the average daily gain. The litter size had a highly significant effect ($P<0.01$) only on the growth rate of lambs during the first week after being placed in the lambing pens. At the end of milk rearing, the average daily gain was the same for single-litter-lambs and twin-litter-lambs. The difference of the age of their placement into lambing pens had no statistically significant effect on the weight of the lambs at the end of milk rearing. Statistically significant effect ($P<0.05$) was found in lambs of different age at their placement in the lambing pens on the average daily gain from placing in to the end of milk rearing. The lambs involved in rearing had a lower weight gains when placed into the lambing pens at an older age.

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