Lambing Interval in Jezersko-Solčava and Improved Jezersko-Solčava Breed

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Summary

The effects on lambing interval (LI) in Improved Jezersko-Solčava (IJS) breed were studied. Due to the reason that IJS breed originates from Jezersko-Solčava (JS) breed, both breeds were included into the analysis. The data were obtained from the Republic Data Base for Selection of Small Ruminants, between 1993 and 2008. The analysis included 66,755 lambings from 280 breeders. The statistical model included breed, parity, litter size at previous lambing, month of the previous lambing, year of the previous lambing, breed of the ram, geographical location of the flock, interaction between month of the previous lambing and breed of the ram, interaction between parity and month of the previous lambing, interaction between breed of the ewe and month of the previous lambing, and interaction between breed of the ewe and litter size at previous lambing as fixed effects. Flock and interaction between year of the previous lambing and flock were treated randomly. Month of the previous lambing affects LI, which is gradually shortening from February to August, and prolonging from August to February. The number of live born lambs significantly affected LI. LI between the first and the second parity and between the second and the third parity was longer than between higher parities. From 1993 to 1999, the LI was decreasing, and increasing thereafter. Ewes mated with JS ram had longer lambing interval than ewes mated with IJS ram. Among all observed effects, flock affected LI the most.

Key words

sheep, Improved Jezersko-Solčava breed, reproduction, lambing interval

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Aim

The Improved Jezersko-Solčava (IJS) sheep is a traditional Slovenian sheep breed. The breed originates from the native Jezersko-Solčava (JS) breed which was improved with Romanov breed (Kompan et al., 1996) to get a sheep breed with good maternal characteristics, all year round fertility, early maturing, well adapted to our environment, and have a great number of viable lambs. As such, the IJS breed is suitable for rearing in good farming conditions - mainly through better nutrition. The estimated population of the IJS sheep in 2010 was 60,000 breeding animals (around 50% of the whole sheep population), where around 6,000 were included in the Republic Selection Program for Small Ruminants (Cividini et al., 2010). The breed is specialized for meat production. It is characterized by a good fertility (three lambings in two years), all year round fertility, early sexual maturity, good maternal instinct, good resistivity and adaptability to the steep pastures.

Lambing frequency and litter size are important components of an efficient lamb production system. The lambing interval is a period between two successive parities where the gestation lasts around 150 days (Kompan et al., 1996). The all year round fertility is a cyclic mating ability of the animal, which is not known in all sheep breeds. Zagožen (1981) stated that the season of sexual activity is shorter in areas with large fluctuations in day length. Therefore, lambings near the equator are mostly arranged over the whole year, since the fluctuation in day length there is the least. The effectiveness of a photoperiodic program based on continuous alternating 4-month sequences of long days and short days in controlling the annual reproductive cycles in ewes was studied by Cameron et al. (2010). The photoperiodic treatment induced intense oestrous activity at any time of the year, leading to greater ewe fertility and prolificacy throughout the year. Breeder can plan lambings with the presence or withdrawing ram in the flock in such conditions. Lassoued et al. (2004) confirmed that the continuous presence of ram in the flock could substantially hasten rebreeding in autumn postpartum Barbarine ewes. The first postpartum ovulation occurred 20.3 ± 9.7 days after lambing in ewes with the permanent presence of the ram, being shorter than the mean interval of 50.4 ± 28.7 days for ewes totally isolated from rams.

Fertility of the sheep and consecutively lambing interval depends on nutrition to a large extent (Zagožen, 1981). Supplementation with concentrates in native JS breed increased litter size (from 1.08 to 1.25) and consecutively extended lambing interval (from 208 to 218 days). Length of the suckling interval is connected with becoming pregnant again. JS and IJS breeds could become pregnant also during lactation, but number of born lambs in a litter is then reduced (Kompan et al., 1996). Lambing interval in Yankasa breed (Niger) was 253 days (Awemu et al., 2000), which was affected by litter size at previous lambing, season, and year of the previous lambing. Salz, Rasa Aragonesa, Romanov, and Rasa Aragonesa x Romanov ewes (Spain) lambed in spring or summer had longer lambing interval than those lambed in autumn and winter (Maria and Ascaso, 1999).

Tosh (2011) showed that interval between the first and the second lambing could not be interpreted the same as lambing interval between parities higher than 2. Between the first and the second lambing, ewe is still young and beginning her reproductive life. The interval between the first and the second lambing seems to be associated with litter size at birth and weaning interval. Longer lambing intervals are associated with larger litters. Lambing interval between the first and the second lambing in Rideau Arcott ewes (Canada) affected lambing interval at later parities. Ewes with shorter lambing interval between the first and the second parity had shorter lambing intervals between later parities. Lambing interval between the first and the second parity in Salz, Rasa Aragonesa, Romanov, and Rasa Aragonesa x Romanov was longer (264 days) than those observed between later parities (between 250 and 256 days) (Maria and Ascaso, 1999). Differences in length of the lambing interval among breeds also exist. For example, lambing interval for Romanov ewes (280 days) was significantly longer than that observed for Rasa Aragonesa x Romanov (228 days), Rasa Aragonesa (257 days), and Salz (255 days) (Maria and Ascaso, 1999).

The aim of our study was to assess the lambing interval in native JS and IJS breeds and to find the effects on lambing interval.

Material and methods

Data for the analysis were obtained from the Republic Data Base for Selection of Small Ruminants. They are collected in sheep flocks participating in Breeding Program for JS and IJS breed. Data were not collected in the experiment, therefore, there can exist some effects on lambing interval, which are not recorded. There is a possibility that breeder makes use of the breeding technology "lambings once per year" where ram is present in the flock just for a few months. Lambing interval in these flocks could not be shorter than around a year. Information about the presence of the ram in the flock does not exist.

Data were collected between 1993 and 2008. Each record included the identity number of the ewe and flock, breed, birth date of the ewe, number of the parity, date of the lambing, age of the ewe at lambing, the number of born lambs, the number of live born lambs, year of the lambing, month of the lambing, ram, breed of the ram, and geographical location of the flock in Slovenia. Illogical records (the number of live born lambs higher than the number of born lambs, the number of born lambs was 0, parities higher than 10, lambing interval shorter than 150 days or longer than 500 days) were excluded from the data set. After editing data, 40,604 records for IJS breed from 209 flocks and 26,151 records for JS breed from 167 flocks (Table 1) were included into the analysis. Almost one hundred flocks (96) had animals

Table 1. Descriptive statistics for lambing interval, litter size, and parity in JS and IJS breeds

	Breed	Number of recordings	Average	SD	Median
Lambing interval (days)	IJS	40,604	251	68.86	230
	JS	26,151	266	75.46	245
Number of born lambs	IJS	40,604	1.61	0.63	2
	JS	26,151	1.23	0.43	1
Number of liveborn lambs	IJS	40,604	1.54	0.64	1
	JS	26,151	1.19	0.44	1
Parity	IJS	40,604	4.79	3.23	4
	JS	26,151	4.48	3.00	4

of both breeds. The average lambing interval was shorter in IJS (251 days) than in JS breed (266 days). IJS (1.61 live born lambs) had larger litters in comparison to JS (1.23 live born lambs).

The distribution of records is inclined to the left, considering that lambing interval could not be shorter than 150 days. Length of the lambing interval is limited with the following mating and parturition, what depends on the breeder very much and some other effects. Statistical model included all significant main effects and significant interactions:

$$y_{ijklmnop} = \mu + B_i + P_j + L_k + M_l + Y_m + R_n + GL_o + MR_{ln} +$$
$$+ PM_{jl} + BM_{il} + BL_{ik} + f_p + Yf_{mp} + e_{ijklmnopr}$$

where fixed effects were: B_i - breed of the ewe, P_j - parity, L_k - the number of born - live born lambs at previous lambing, M_l - month of the previous lambing, Y_m - year of the previous lambing, R_n - breed of the ram, GL_o - geographical location of the flock, MR_{ln} - interaction between month of the previous lambing and breed of the ram, PM_{jl} - interaction between parity and month of the previous lambing, BM_{il} - interaction between breed of the ewe and month of the previous lambing, and BL_{ik} - interaction between breed of the ewe and the number of live born lambs at previous lambing. Flock (f_p) and interaction between year of the previous lambing and flock (Yf_{mp}) were treated randomly. The analysis of data was done by Excel, while the model was developed by statistical program SAS, GLM (general linear models) and Mixed procedures (SAS, 2001).

Results and discussion

Effect of the breed. IJS breed originates from the native JS breed, therefore JS was also included into the analysis and the comparison between these two breeds was done. The difference between breeds was found in the interactions between breed and month of the previous lambing and between breed and number of the born - live born lambs. There were no differences between JS and IJS breeds for other effects. As found out by the statistical model, the lambing interval in JS breed was 6 days shorter than in IJS breed (Table 2) but the difference was not statistically significant. Maria and Ascaso (1999) found differences in lambing interval among breeds, where Romanov breed had longer lambing interval than Rasa Aragonesa x Romanov, Rasa Aragonesa, and Salz breeds. Results from our study and study of Maria and Ascaso (1999) show that native breeds can have comparable length of lambing interval as Romanov breed.

Effect of month of the previous lambing. Month of the previous lambing affected lambing interval. Ewes lambed in winter had the longest postnatal interval, while ewes lambed in late summer and autumn had significantly shorter postnatal interval. Lambing interval is gradually shortening from February to August (Figure 1), and prolonging from August to February. If ewe lambed in February, its next lambing is expected to be after 282 ± 4.39 days (nine months). If ewe lambed in August, its next lambing is expected to be after 221 ± 6.36 days (seven months). Ewes should be mated between February and April to lamb in late summer (between July and September). In winter months, the lambing interval could be longer due to mating ewes only once per year (in autumn) in some flocks. Between JS and IJS breed, there was no statistically significant difference in lambing interval within month of the previous lambing. The estimated difference in lambing interval between the two breeds was 16.2 ± 5.4 days. The opposite results for lambing interval were found in four Spain sheep breeds by Maria and Ascaso (1999), where ewes lambed in spring and summer had longer lambing interval than those lambed in autumn and winter.

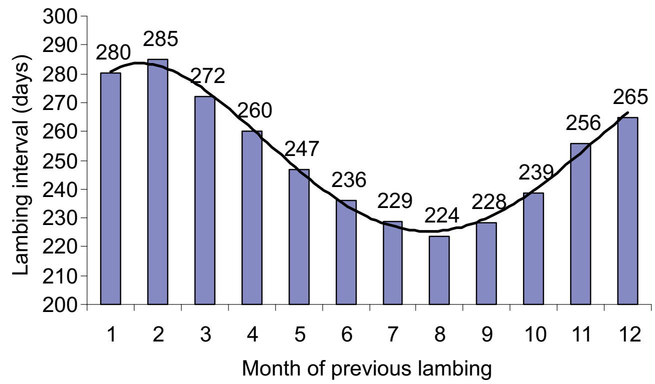

Figure 1. Estimated average for the effect of month of the previous lambing on lambing interval

Effect of the litter size. Litter size is largely affecting the lambing interval (Table 3). The lambing interval is prolonging in different combinations of born - live born lambs. The estimated difference in lambing interval is 8.22 ± 2.28 days from 1-0 and 1-1, 8.65 ± 4.76 days from 2-0 and 2-1, and 13.57 ± 4.30 days from 2-0 and 2-2. The combinations with the different number of live born lambs were also statistically significant. The estimated dif-

Table 2. Estimation of the effect of breed on lambing interval

Breed	Number of records	Proportion of records	Estimated lambing interval	Standard error	95% confidence interval	
JS	26,151	39.2	246	4.8	236.9	255.7
IJS	40,604	60.8	252	2.9	245.8	257.2

Table 3. Estimation of the effect of litter size on lambing interval

Number of born – live born lambs	Number of records	Estimated lambing interval	Standard error	95% confidence interval	
1-0[1]	805	242	3.3	235.9	248.9
1-1[2]	40,438	251	2.5	245.8	255.5
2-0	285	243	4.9	233.5	252.8
2-1	1,263	252	3.2	245.4	258.1
2-2	21,281	257	2.5	251.8	261.6
3-0	45	229	12.5	204.5	253.5
3-1	134	256	11.7	233.2	278.9
3-2	364	253	7.5	238.2	267.5
3-3	2,140	257	4.6	248.5	266.4

[1] = (1-0) 1-number of born lambs, 0-number of live born lambs,
[2] = (1-1) 1-number of born lambs, 1-number of live born lambs.

ference in lambing interval is 9.36 ± 3.10 days from 1-0 and 2-1, 6.06 ± 0.64 days from 1-1 and 2-2, and 14.98 ± 4.48 days from 1-0 and 3-3. There was no statistically significant difference in lambing interval among the number of born lambs, when the number of live born lambs was the same (1-0 and 2-0, 1-0 and 3-0, 1-1 and 2-1,…). It could be noticed that if lambs were stillborn, ewe is able to mate earlier than other ewes. Zagožen (1981) confirmed that ewes with larger litter size had longer lambing interval and vice versa, what also showed our study. Similar results were found also in Yankasa breed (Niger) by Awemu et al. (2000).

Effect of the parity. The effect of parity on lambing interval was statistically significant. Lambing interval from the first to the second parity was much longer than lambing interval between the next parities. Lambing interval is shortening to the fifth parity, and it starts to prolong after the sixth parity. The interval between the first and the second parity was 9.63 ± 1.09 days longer than the interval between the second and the third parity. Between the second and the third parity, the interval was 6.47 ± 0.97 days longer than between the third and the forth parity. Tosh (2011) stated that the lambing interval between the first and the second parity is longer due to the beginning of the ewe's reproductive life. Lambing interval between the first and the second parity was longer than between higher parities also in Romanov, Rasa Aragonesa x Romanov, Rasa Aragonesa, and Salz breeds (Maria and Ascaso, 1999).

Effect of year of the previous lambing. There is a trend of shortening the lambing interval from 1993 to 1999. Afterwards, the lambing interval is gradually prolonging. The shortest (247 days) lambing interval was found in 1999 and the longest (264 days) in 2006. The estimated difference of the lambing interval between 1999 and 2006 was 16.70 ± 3.04 days. The other estimated differences between years of the previous lambing ranged from 0 to 16 days. Awemu et al. (2000) confirmed that year of the previous lambing affected lambing interval in Yankasa sheep.

Effect of the ram which impregnated litter. Lassoued et al. (2004) found that presence of the ram in the flock increases the rate of the occurrence of the first oestrus in the ewe after lambing for 30 days. In our study, information about the presence of the ram in the flock does not exist. The difference between JS and IJS breed of the ram was found. Ewes mated with JS ram had on average 13.62 ± 1.85 days longer lambing interval than ewes mated with IJS ram.

Effect of the region. Slovenia is divided into 12 units named statistical regions. The statistical region of the flock location was not statistically significant. However, the effect was included into the model to see the number of lambings by region and estimated averages of the lambing interval by region. There was one third of all observed lambings in Savinjska region, where the average lambing interval was 245 days long. The longest (263 days) lambing interval appeared in Goriška region, where 5% of all lambing was observed.

Effect of the flock. The flock effect on the lambing interval was the largest among all observed effects, where the rearing technology, nutrition management and other factors are combined and they can indirectly affect the lambing interval in a large extent. While the fixed part of the model explained only 7.5% of the variance in lambing interval, the random part explained 18.9% of the variance, where the flock effect explained 9.5% and the interaction between the flock and year of the previous lambing explained 9.4%.

Conclusions

The aim of this contribution was to asses lambing interval in JS and IJS breeds in Slovenia and factors affecting its variation. Lambing interval was six days longer in JS than in IJS breed, but the difference was not significant. Ewes lambing in winter had longer lambing interval in comparison to the ewes lambing in late summer and early autumn. Longer lambing interval was associated with larger litters. Between the first and the second parity, ewes had longer lambing interval than between higher parities. Year of the previous lambing affected lambing interval which was decreasing from 1993 to 1999 and increasing thereafter. Ewes mated with JS ram had longer lambing interval in comparison to the ewes mated with IJS rams. There were no significant differences in the length of lambing interval among the statistical regions of flock location. The effect of flock on lambing interval was the largest among all studied effects.

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