



## The implementation of the standard lactation length and standard milking length in milk recording of dairy sheep and goats breeds in Slovenia

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The aim of the study was to introduce the standard lactation length and standard milking length in milk recording of Slovenian dairy sheep and goat breeds in breeding programs to achieve better comparability among animals within the same breed in milk production traits (total milk yield, total milked milk as well as protein, fat and lactose contents). In Slovenia, there are two local dairy sheep breeds, Bovec sheep and Istrian Pramenka and an Improved Bovec sheep. There are three dairy goat breeds, a local Dreznica goat and two locally adapted breeds, Slovenian Alpine goat and Slovenian Saanen goat. According to the recommendations in the ICAR guidelines, every approved organisation should define the standard lactation length (and/or standard milking length), which is close to the average lactation length (milking length) of the considered breed according to the production system. At the beginning, an average age at weaning of offspring (beginning of milking) and average milking length (end of milking) were calculated. Based on these calculations the standard lactation length and standard milking length were defined. Due to two different production systems used for Slovenian Alpine and Slovenian Saanen goats, animals of both breeds were divided in two subpopulations. In the first one, where kids are early weaned (until the 5<sup>th</sup> day of age) it was determined that standard lactation length lasts from the day of kidding to 240<sup>th</sup> day after kidding in both breeds. In the second subpopulation, where kids are weaned later than the 5<sup>th</sup> day of age (late weaning) we defined a standard milking length from 40<sup>th</sup> to 240<sup>th</sup> day after kidding. In the case of Dreznica goat and in all Slovenian dairy sheep breeds early weaning practically does not exist. Consequently, only a standard milking length was defined. The standard milking length in Dreznica goat, Bovec sheep and Improved Bovec sheep was in the period from 40<sup>th</sup> to 210<sup>th</sup> day after giving birth, while in the case of Istrian Pramenka from 60<sup>th</sup> to 210<sup>th</sup> day after lambing. In the future, we will continue with monitoring of total milk yield, total milked milk as well as protein, fat and lactose contents produced in the standard lactation length and in the standard milking length according to the breeding program of each breed and adjust if necessary.

### Abstract

*Keywords: Standard lactation length, standard milking length, dairy sheep, dairy goats, Slovenia.*

## Introduction

The lactation length is one of the main factors, which affect total milk yield and milk composition in dairy cattle, sheep and goats, and it is often used as one of the criteria for comparison among animals within the same flock, population or breed. However, milk production traits are easier to compare among animals when a milking length is of the same length. For this reason, standard lactation length is used in dairy cattle breeding for many years and it is accepted worldwide. It lasts from calving to the 305<sup>th</sup> day of lactation in all cattle breeds, while there is no such uniform standard lactation length in dairy sheep and dairy goats. However, in several breeding programs around the world standard lactation length is used to compare animals within different sheep and goat breeds. In the breeding programs for German Alpine goat (Zuchtprogramm Bunte Deutsche Edelziege, 2021) and German Saanen goat (Zuchtprogramm Weise Deutsche Edelziege, 2021) a standard lactation length lasts 240 days, while in the breeding program for the East Friesian sheep in Germany (Zuchtprogramm Ostfriesisches Milchschaaf, 2021) the dairy traits are recorded in a period of 150 days. In the guidelines for the implementation of milk recording in sheep and goats in Austria, a standard lactation length is determined as a period from giving birth to the 240<sup>th</sup> day of lactation (LKV Austria, 2022). One of the most important criteria in the implementation of standard lactation length is the average lactation length of each breed. Some researchers also considered some other criteria such as genetic parameters and genetic correlations between milk production traits in the standard lactation and milk production traits in the whole lactation. Based on described criteria, Basdagianni *et al.* (2018) determined that standard lactation length in the Chio dairy sheep lasts 220 days or 190 days in ewes in the first lactation, respectively. The implementation of standard lactation length is reasonable in the intensive production systems where kids and lambs are weaned in the first few days after birth. Consequently, the milking length is practically identical to the whole lactation length. On the other hand, in less intensive systems, lambs and kids are weaned later, and the milking length is shorter than the whole lactation length. In the extensive production systems, the implementation of the standard milking length (a period between the weaning of offspring and the end of lactation) is more appropriate than the implementation of the standard lactation length.

The aim of the study was to introduce the standard lactation length or standard milking length, respectively, in the milk recording of Slovenian dairy sheep and goat breeds in the breeding programs to achieve better comparability among animals within the same breed in the milk production traits (total milk yield, total milked milk as well as protein, fat and lactose contents).

## Material and methods

Records were provided by the Slovenian breeding programs for dairy sheep and dairy goats collected from the year 2005 to 2019. Data of animal birth date, breed, flock, lambing/kidding date, parity, weaning date, date of the end of lactation and records of milk recording were obtained from the Central Database for Small Ruminants in Slovenia. Only records with the ewes'/does' lactation length between 0 and 300 days and lambs'/kids' suckling period length between 0 and 100 days were included in the analysis. Likewise, ewes and does, which had less than three milk recordings within the same lactation, were excluded from the analysis. Sheep flocks with less than 50 records as well as goat flocks with less than 30 records were excluded as well. After the records control, the number of included records was 27,234 for dairy sheep and 12,289 for dairy goats.

Based on these records, the average age at weaning of offspring (beginning of the milking) and the average milking length (end of milking) for each breed were calculated according to the ICAR guidelines which recommends that each approved organisation should define the standard lactation length (and/or standard milking length) which is

close to the average lactation length (average milking length) of the considered breed according to the production system (ICAR, 2018). Due to two different production systems of Slovenian Alpine goat and Slovenian Saanen goat in Slovenia, animals of both breeds were divided into two subpopulations. In the approximately 25% of flocks of these two breeds kids are early-weaned (till the 5<sup>th</sup> day after birth), immediately after the end of the colostrum phase of suckling. Especially in the case of Slovenian Saanen goat, the percentage of flocks where early weaning occurs has increased in the last few years. In the first subpopulation, standard lactation lasts from the day of kidding to the 240<sup>th</sup> day after kidding in both breeds. In the second subpopulation, where kids are weaned later than the 5<sup>th</sup> day of age (late weaning), a standard milking length from 40<sup>th</sup> to 240<sup>th</sup> day after kidding were determined. In the case of Dreznica goat and all dairy sheep breeds in Slovenia, early weaning is practically not in use. Consequently, for these breeds, only a standard milking length was defined. The standard milking length in Dreznica goat as well as in Bovec sheep and Improved Bovec sheep was agreed in the period from 40<sup>th</sup> to 210<sup>th</sup> day after giving birth, while in the case of Istrian Pramenka it lasts from 60<sup>th</sup> to 210<sup>th</sup> day after lambing.

The total milk yield in the standard lactation length and the total milked milk in the standard milking length are calculated from the records obtained in milk recordings where daily milk yield is measured with milk meters and a milk sample is taken for the determination of protein, fat and lactose contents in the milk of each ewe or doe in a flock. The equation 1 is used for the total milk yield and the total milked milk estimation based on the daily milk yields from milk recordings and intervals between two successive milk recordings:

$$\text{TMY (TMM)} = (I_0 * M_1 + I_1 * (M_1 + M_2) / 2 + \dots + I_n * M_n) / 1000$$

where:

TMY = total milk yield in the standard lactation length (kg),

TMM = total milked milk in the standard milking length (kg),

$I_0$  = the interval between the beginning of standard lactation/standard milking and the first milk recording (days),

$M_1, M_2, \dots, M_n$  = daily milk yield (g),

$I_1, I_2, \dots$  = the interval between two successive milk recordings (days),

$I_n$  = the interval between the last milk recording and the end of the standard lactation length/standard milking length (days).

The protein, fat and lactose yields in the standard lactation length or in the standard milking length are estimated from the daily milk yields multiplied by the protein, fat and lactose contents determined in the milk sample taken at each milk recording divided by 100.

The total milk yield in the standard lactation length and the total milked milk in the standard milking length are estimated just for ewes and does which comply with the following conditions:

- an animal had at least three milk recordings per lactation; two of them were within the standard lactation length or within standard milking length;
- first milk recording must take place within 52 days after the weaning of offspring;
- the average interval between two successive milk recordings is within a range from 28 to 34 days;

- there is a tolerance of one missed milk recording per lactation as well.

## Results

Descriptive statistic for the total milked milk and milk composition of dairy sheep breeds in the standard milking length from the year 2015 to 2021 is presented in Table 1. Improved Bovec sheep had the highest average total milked milk and the lowest average protein and fat contents (191.9 kg, 5.2% and 5.7%), respectively. On the other hand, Istrian Pramenka had the lowest average total milked milk and the highest average protein and fat contents (99 kg, 5.9% and 7.2%), respectively.

In the Table 2 is descriptive statistics for the total milked milk and milk composition of dairy goat breeds in the standard milking length in the years 2015-2021. On average, the total milked milk was the highest in Slovenian Saanen goat (376.9 kg) and the lowest in Dreznica goat (267.7 kg). On the contrary, the average protein, fat and lactose contents were the highest in the milk of Dreznica goat (3.4%, 4.1% and 4.5%), respectively and the lowest in the milk of Slovenian Saanen goat (2.9%, 3.0% and 4.2%), respectively.

Descriptive statistic for the total milk yields and milk composition of dairy goat breeds in the standard lactation length in the years 2015-2021 is presented in Table 3. Slovenian Saanen goat had higher average total milk yield (517.0 kg) and lower average protein and lactose contents (2.9% and 4.4%) in comparison with Slovenian Alpine goat (511.6 kg, 3.2% and 4.5%), respectively, while the average fat content was the same in both breeds (3.2%).

## Discussion

The goal of this study was to define and to introduce the standard lactation length and the standard milking length appropriate for each breed of dairy sheep and dairy goats in Slovenia. In the estimation of the standard lactation length and standard milking length the production system of ewes and does was also considered. Although the standard lactation length or standard milking length in sheep and goats is primarily used as criteria for comparison among animals within the breed, in some cases animals of different breeds could be compared as well. The Bovec sheep is possible to compare to the Improved Bovec sheep due to the same standard milking length. However, the Improved Bovec sheep is a result of improving Bovec ewes with East Friesian rams. A higher total milked milk in the Improved Bovec sheep on average (191.9 kg) was expected compared to Bovec sheep (137.7 kg), which means that improving had a positive effect on the milk yield. In the same time, the Improved Bovec sheep had lower average dry matter content (sum of protein, fat and lactose contents; 15.5%) than Bovec sheep (16.3%) which is a consequence of higher milk yield in Improved Bovec sheep. Istrian Pramenka had the lowest average total milk yield (99.9 kg) and the highest dry matter content (17.6%) in the standard milking length than other two breeds. However, the total milked milk of all three breeds could not be compared because the standard milking length in Istrian Pramenka is 20 days shorter in comparison with Bovec sheep and Improved Bovec sheep.

The subpopulations of Slovenian Saanen goat and Slovenian Alpine goat where kids are late-weaned are compared to each other because of the same standard milking length. Slovenian Saanen goat had higher total milked milk on average (376.9 kg) than Slovenian Alpine goat (323.9 kg). Likewise, Slovenian Saanen goat had lower average dry matter content (10.1%) in comparison with Slovenian Alpine goat (10.6%). Dreznica goat had 267.1 kg of milk and it had the highest average dry matter content (12.0%) in the standard milking length than Slovenian Saanen goat and Slovenian Alpine goat

*Table 1. Descriptive statistics for the total milked milk and milk composition of dairy sheep breeds in the standard milking length from 2015 to 2021.*

Breed/ Standard milking length	Variable	N <sup>1</sup>	Mean	SD <sup>2</sup>	Min	Max
Bovec sheep 40 <sup>th</sup> to 210 <sup>th</sup> day	Total milked milk (kg)	8,750	137.7	53.7	12.4	450.7
	Protein content (%)	8,672	5.3	0.4	3.3	10.1
	Fat content (%)	8,672	6.4	0.8	3.1	13.9
	Lactose content (%)	8,672	4.6	0.3	2.3	7.9
Improved Bovec sheep 40 <sup>th</sup> to 210 <sup>th</sup> day	Total milked milk (kg)	3,128	191.9	75.1	21.0	514.7
	Protein content (%)	3,127	5.2	0.4	3.9	7.8
	Fat content (%)	3,127	5.7	0.8	2.8	9.7
	Lactose content (%)	3,126	4.6	0.3	2.3	6.9
Istrian Pramenka 60 <sup>th</sup> to 210 <sup>th</sup> day	Total milked milk (kg)	1,972	99.9	31.5	22.3	350.2
	Protein content (%)	1,922	5.9	0.5	4.5	8.3
	Fat content (%)	1,922	7.2	0.8	3.4	10.8
	Lactose content (%)	1,922	4.5	0.3	1.9	6.5

<sup>1</sup>Number of records.

<sup>2</sup>SD – Standard Deviation.

*Table 2. Descriptive statistics for the total milked milk and milk composition of dairy goat breeds in the standard milking length from 2015 to 2021.*

Breed/ Standard milking length	Variable	N <sup>1</sup>	Mean	SD <sup>2</sup>	Min	Max
Slovenian Saanen goat 40 <sup>th</sup> to 240 <sup>th</sup> day	Total milked milk (kg)	1,107	376.9	127.3	51.9	954.4
	Protein content (%)	1,107	2.9	0.3	2.2	4.1
	Fat content (%)	1,106	3.0	0.6	1.5	5.9
	Lactose content (%)	1,107	4.2	0.2	3.6	4.8
Slovenian Alpine goat 40 <sup>th</sup> to 240 <sup>th</sup> day	Total milked milk (kg)	2,602	323.9	153.0	12.7	1102.2
	Protein content (%)	2,595	3.1	0.3	2.2	5.3
	Fat content (%)	2,595	3.2	0.6	1.6	7.4
	Lactose content (%)	2,595	4.3	0.2	3.2	6.6
Dreznica goat 40 <sup>th</sup> to 210 <sup>th</sup> day	Total milked milk (kg)	1,972	267.1	129.5	41.6	833.2
	Protein content (%)	1,922	3.4	0.3	2.7	5.6
	Fat content (%)	1,922	4.1	0.7	2.1	7.5
	Lactose content (%)	1,922	4.5	0.2	3.6	7.1

<sup>1</sup>Number of records.

<sup>2</sup>SD – Standard Deviation.

*Table 3. Descriptive statistics for the total milk yields and milk composition of dairy goat breeds in the standard lactation length in the years 2015-2021.*

Breed/ Standard lactation length	Variable	N <sup>1</sup>	Mean	SD <sup>2</sup>	Min	Max
Slovenian Saanen goat 1 <sup>st</sup> to 240 <sup>th</sup> day	Total milk yield (kg)	1,040	517.0	196.4	66.0	1,385.3
	Protein content (%)	1,039	2.9	0.2	2.3	3.9
	Fat content (%)	1,039	3.2	0.5	1.8	6.0
	Lactose content (%)	1,039	4.4	0.2	3.7	5.4
Slovenian Alpine goat 1 <sup>st</sup> to 240 <sup>th</sup> day	Total milk yield (kg)	694	511.6	177.4	76.8	1,219.8
	Protein content (%)	694	3.2	0.3	2.4	4.4
	Fat content (%)	694	3.2	0.4	1.5	4.5
	Lactose content (%)	694	4.5	0.2	4.0	4.9

<sup>1</sup>Number of records.

<sup>2</sup>SD – Standard Deviation.

(subpopulations with late weaning of kids). However, a direct comparison of the total milked milk of all three goat breeds is not reasonable, because the standard milking length in Dreznica goats lasts 30 days less compared to other two goat breeds.

The total milk yield of Slovenian Saanen goat and Slovenian Alpine goat (subpopulations with early-weaned kids) could be compared due to the same standard lactation length. Slovenian Saanen goat had a little higher average total milk yield (517.0 kg) and a lower average dry matter content (10.5%) than Slovenian Alpine goat (511.6 kg and 10.9%). The standard lactation length in both breeds lasts from kidding to the 240<sup>th</sup> day of lactation, which is the same as in breeding programs for German Saanen goat (Zuchtprogramm Weise Deutsche Edelziege, 2021) and German Alpine goat (Zuchtprogramm Bunte Deutsche Edelziege, 2021) in Germany. For this reason, a direct comparison of total milk yield in considered Slovenian and German breeds is possible. In Slovenian Saanen goat, the average total milk yield in the standard lactation length (517.0 kg) was lower in comparison with German Saanen goat (750 – 1,000 kg). On the other hand, the protein (2.9%) and fat (3.2%) contents in the milk of Slovenian Saanen goat were similar to the milk of German Saanen goat (2.8 - 3.0% protein content and 3.2 – 3.5% fat content). In the Slovenian Alpine goat, the average total milk yield in the standard lactation length (511.6 kg) was lower in comparison with the German Alpine goat (850 – 1,200 kg). Fat content (3.2%) in Slovenian Alpine goat was in accordance with the fat content in the milk of German Saanen goat (3.2 – 3.5%), while the protein content in the milk of Slovenian Alpine goat (3.2%) is even above the protein content in the milk of German Saanen goat (2.8 – 3.0%).

## Conclusion

In the year 2022, we have introduced the standard lactation length and standard milking length in milk recording of Slovenian dairy sheep and goat breeds in breeding programs to achieve better comparability in the milk production traits among animals within the same breed. In the future, we will continue with the monitoring of total milk yield and total milked milk as well as protein, fat and lactose contents in the standard lactation length and standard milking length according to each breed and adjust if necessary.

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