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Variability of mastitis occurrence in dairy Simmentals due to recording time

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Abstract

The aim of this research was to determine the mastitis occurrence in dairy Simmental cows regarding the year, month and season of milk recording. Therefore, test-day records were collected during regular milk recording on dairy cattle farms in the period from January / 2004 – December / 2022 were analysed. After logical control, the processed dataset contained 4,922,751 test-day records. The obtained results indicated the effect of the time of recording (year, month, and season) on mastitis occurrence in dairy Simmental cows. The highest occurrence of cows with mastitis was determined in the year 2020 (25.76%); in August (21.89%) and during the Summer season (20.89%). During the analysed period (2005 – 2022), 35% of cows experienced health problems caused by mastitis occurrence. Therefore, it is necessary to put into practice a system for monitoring and prevention of mastitis occurrence in order to ensure successful management and minimize the environmental impact of dairy farms.

Key words: dairy Simmentals, test-day records, mastitis, occurrence

Introduction

Mastitis represents the inflammation of the mammary gland or udder and could occur in an acute or chronic state, and subclinical or clinical phase. According, to many studies (Seegers et al., 2003; Petrovski et al., 2006; Gráff and Mikó, 2015; Ibrahim, 2017) mastitis is one of the most frequent and most expensive disease on dairy cattle farms. The prevalence of mastitis in dairy cattle herds varies from 20% (Hasan et al., 2018) to more than 70% (Sayeed et al., 2020)

and generates significant losses for the farm due to decreased milk production, increased treatment costs, declined udder functionality and finally decreased productive life of the infected dairy cow. Since subclinical mastitis is difficult to determine, it causes higher costs for dairy farms in comparison to the clinical forms that could be easily detected and treated (Gráff and Mikó, 2015). For dairy farmers, it is of vital importance to be able to detect any disorder or disease as earlier as possible so that they could act properly and timely in order to ensure that milk production is sustainable from an economic and environmental aspect. Early detection of possible problems and accurate monitoring of dairy herds could be obtained by the application of various sensors and systems of precision dairy cattle technologies. Bewley (2010) emphasised that precision dairy cattle technologies enable the maximisation of the genetic potential of animals at the individual level as well as the minimization of the use of medicaments by using preventive health measures.

Milk recording as well as the analysis and use of milk recording data for various evaluations and predictions represent one of the precision dairy technologies. These data could be used as an excellent tool for the early detection of various disorders and diseases at the individual animal level. Furthermore, early detection and prevention of further development of a particular disorder or disease of the animal enable the reduction of treatment and production, then optimization of management on a dairy farm as well as more climate-friendly milk production. The occurrence of mastitis harms the udder tissue and decreases the synthetic capacity of secretory cellular enzyme systems, resulting in reduced lactose biosynthesis (Kitchen, 1981) as well as elevated somatic cell count, SCC (Botton et al., 2019). Therefore, both milk parameters, lactose content and somatic cell count could be an indicator of inflammation of the mammary glands of lactating cows (Pyorala, 2003; Ivanov et al., 2016).

Considering the increasing importance of preventing the occurrence of various disorders and diseases on dairy farms, ensuring antibiotic-free farming and ensuring environmentally sustainable systems of animal production, this research aimed to determine the occurrence of mastitis in the population of dairy cows of the Simmental breed depending on the year, month and season of milk recording based on milk recording data.

Material and Methods

For statistical analysis, test-day records of dairy Simmental cows collected in the period from January, 2004 – December, 2022 were used. Data were collected during regular milk recording on dairy cattle farms situated in Croatia. Milk recording in Croatia has been performed accordingly to the alternative milk recording method (AT4 / BT4), which implies measuring

milk yield and sampling of milk of each cow in lactation during evening or morning milking every four weeks. Furthermore, milk recording was performed by field officers of the Croatian Agency for Agriculture and Food (AT4) or trained farm worker (BT4). The samples of milk were analysed in the Central Laboratory for Milk Quality Control in accordance with accredited laboratory methods; infrared spectrophotometry for determination of lactose content (ISO 9622:2013) and fluoro-optoelectronic method for somatic cell counting (ISO 13366-2:2006/AC:2007). The following equipment was used in the laboratory: Milcoscan FT6000 (Foss, Denmark) for determination of milk components, and Fossomatic FC5000 (Foss, Denmark) for somatic cell count. Logical control of the dataset implied the following thresholds: stage of lactation in (> 5 days and <500 days), parity from 1 to 9, age at first calving in (> 21 and < 36 months).

Furthermore, all test-day records with missing information regarding parity, breed and missing or senseless values of daily milk traits in line with ICAR standards (ICAR, 2017) were deleted from the dataset. Acordingly to the parity, test-day records were divided in four classes: 1, 2, 3, and 4+. After logical control, the processed dataset contained 4,922,751 test-day records. The basic statistical parameters of analysed traits regarding parity are presented in Table 1.

Table 1. Basic statistical parameters of analysed traits

Parity	Daily milk yield, kg				SCC log			
	N	Mean	SD	CV	N	Mean	SD	CV
1	1204187	16.5	5.48	33.266	1203876	6.4	1.97	30.918
2	1044570	17.4	6.42	36.814	1044313	6.7	2.05	30.791
3	850043	17.8	6.58	36.996	849830	6.9	2.08	30.170
4+	1823951	16.8	6.21	36.847	1823521	7.3	2.13	29.236
Total	4922751	17.0	6.17	36.198	4921540	6.9	2.10	30.582

Furthermore, concerning daily somatic cell count (SCC), cows were divided into three classes: cows with mastitis (SCC > 400,000/ml), healthy cows (SCC < 200,000/ml), and cows at mastitis risk (SCC = 200,000 - 400,000/ml). The occurrence of mastitis in the population of dairy Simmental cows was determined concerning the year (from 2005 to 2022), month (from January to December) and season (Spring, Summer, Autumn, and Winter) of milk recording. For logical control and statistical analysis of data SAS software (SAS Institute Inc., 2019) was used.

Results and Discussion

The occurrence of mastitis in the population of dairy Simmental cows regarding the year of milk recording (2005 to 2022) is presented in Table 2. The lowest percentage of cows with mastitis was determined in 2013 (17.58%), while the highest occurrence was observed in 2020 (25.76%). Furthermore, the highest occurrence of animals at risk (15.99%) was observed in 2019, while the lowest occurrence of animals at risk in the total population under the milk recording was observed in the year 2012.

Table 2. The occurrence of mastitis in population of Simmental cows regarding the year of milk recording (2005 to 2022)

Recording year	Mastitis score regarding the somatic cell count (000/ml)						Total	
	Mastitis > 400		Normal 400 - 200		At risk < 200			
	N	%	N	%	N	%	N	%
2005	17787	19.99	57815	64.99	13361	15.02	88963	100.00
2006	66238	19.32	228091	66.52	48547	14.16	342876	100.00
2007	67465	18.31	249946	67.82	51140	13.88	368551	100.00
2008	73565	18.40	270769	67.73	55429	13.87	399763	100.00
2009	72245	18.86	256979	67.09	53808	14.05	383032	100.00
2010	49339	19.01	173423	66.80	36845	14.19	259607	100.00
2011	50679	18.44	185686	67.56	38471	14.00	274836	100.00
2012	57141	18.29	211943	67.85	43280	13.86	312364	100.00
2013	52554	17.58	203743	68.16	42605	14.25	298902	100.00
2014	53131	18.05	199043	67.64	42104	14.31	294278	100.00
2015	54247	18.61	194884	66.84	42429	14.55	291560	100.00
2016	52231	18.53	189778	67.34	39820	14.13	281829	100.00
2017	50883	19.24	175282	66.28	38306	14.48	264471	100.00
2018	59361	22.81	161300	61.99	39527	15.19	260188	100.00
2019	63070	25.42	145400	58.59	39687	15.99	248157	100.00
2020	54325	25.76	123318	58.47	33255	15.77	210898	100.00
2021	57451	25.04	136561	59.51	35465	15.45	229477	100.00
2022	27847	23.97	71185	61.28	17139	14.75	116171	100.00
Total	979560	19.89	3235147	65.68	711218	14.44	4925925	100.00

The variability in the occurrence of mastitis in dairy Simmentals due to the month of milk recording is presented in Table 3. The highest occurrence of cows with mastitis in an amount higher than 21% was determined in summer months with the highest value in August (21.89%), while the lowest occurrence was observed in April (17.62%). Similarly, the lowest percentage of animals at risk (13.63%) was observed in April, while the highest occurrence of animals at risk in the total population under the milk recording was observed in December.

Table 3. The occurrence of mastitis in population of Simmental cows regarding the month of milk recording (January – December)

Recording month	Mastitis score regarding the somatic cell count (000/ml)						Total	
	Mastitis > 400		Normal 400 - 200		At risk < 200			
	N	%	N	%	N	%	N	%
1	85414	19.78	281924	65.30	64380	14.91	431718	100.00
2	85856	19.47	289720	65.72	65285	14.81	440861	100.00
3	86297	18.28	318329	67.44	67365	14.27	471991	100.00
4	70515	17.62	275222	68.75	54570	13.63	400307	100.00
5	75073	18.61	273283	67.73	55145	13.67	403501	100.00
6	69212	19.58	235194	66.55	49020	13.87	353426	100.00
7	79688	21.23	242339	64.55	53405	14.22	375432	100.00
8	72779	21.89	211739	63.68	47991	14.43	332509	100.00
9	96907	21.75	283947	63.73	64662	14.51	445516	100.00
10	90577	20.35	289514	65.05	65000	14.60	445091	100.00
11	89725	20.38	284504	64.62	66038	15.00	440267	100.00
12	77517	20.12	249432	64.74	58357	15.15	385306	100.00
Total	979560	19.89	3235147	65.68	711218	14.44	4925925	100.00

The variability in the percentage of Simmental cows with potential mastitis regarding the season of milk recording (Spring to Winter) is shown in Table 4. The highest percentage of healthy cows without mastitis-related problems in an amount of 67.94% was determined in the Spring season, while the highest occurrence of cows with mastitis was during the Summer season (20.89%). Furthermore, the highest percentage of animals at risk (14.95%) was observed in winter.

The fact that in the period from 2005 to 2022, only 65% of cows did not have health problems caused by mastitis indicates an extremely large and expensive problem for dairy farms due to

the occurrence of mastitis. Therefore, it is necessary to enable well-organized monitoring and prevention of the mastitis occurrence and ensure the successful management of dairy farms by minimizing the impact on the environment in aim of production of healthy and high-quality milk for the market.

Table 4. The occurrence of mastitis in population of Simmental cows regarding the season of milk recording (Spring – Winter)

Season	Mastitis score regarding the somatic cell count (000/ml)						Total	
	Mastitis > 400		Normal 400 - 200		At risk < 200			
	N	%	N	%	N	%	N	%
Spring	231885	18.18	866834	67.94	177080	13.88	1275799	100.00
Summer	221679	20.89	689272	64.94	150416	14.17	1061367	100.00
Autumn	277209	20.83	857965	64.47	195700	14.70	1330874	100.00
Winter	248787	19.78	821076	65.27	188022	14.95	1257885	100.00
Total	979560	19.89	3235147	65.68	711218	14.44	4925925	100.00

The obtained results in this analysis indicate the effect of the time of recording (year, month, and season) on mastitis occurrence in dairy Simmental cows. Similarly, Nóbrega and Langoni (2011) determined a higher incidence of cows with intramammary infections in the rainy season in comparison to the dry season. Changes in the composition of milk, somatic cell counts (SCC) and consequently mastitis occurrence due to heat stress environment during the summer season were reported by Gantner et al. (2011). Furthermore, Weber et al. (2020) confirmed the effect of the season on the quality and quantity of milk, indicating better quality during the winter and spring seasons, while the quality decreased in the hotter months of the summer and autumn seasons.

Conclusion

The results obtained in this research indicate the existence of the variability of mastitis occurrence in dairy Simmental cows due to the time of milk recording (year, month, and season). The highest occurrence of cows with mastitis was determined in the year 2020; in August and during the Summer season. Furthermore, during the analysed period (2005 to 2022), 65% of the dairy Simmental population was healthy, while 35% of cows experienced health problems caused by the occurrence of mastitis. Therefore, it is necessary to put a system for monitoring and prevention of mastitis occurrence into practice in order to optimize

management and minimize the environmental impact of dairy farms.

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