The Influence of Laminitis on the Economic Efficiency of Dairy Cows

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Abstract
The influence of laminitis on the productivity of dairy cows varies depending on the type of condition encountered. The increase in the number of cases presenting lameness leads to economic losses by decreasing milk production/lactation and fecundity on the farm. The present work was carried out at the Research and Development Institute for Bovine Balotesti, where the production and reproduction performance of a herd of 60 dairy cows, diagnosed with different types of pododermatitis in the period 2021-2023, was monitored. The prevalence of cows with laminitis was 20.3% in year 2021, 18.6% in year 2022 and 17.4% in year 2023. The data obtained showed that 31.66% of the herd studied was diagnosed with digital dermatitis, 43.33 % presented diseases at the level of the horn box (8.33% haemorrhagic ulcer, 28.33% double sole, and 6.66% abscesses of the white line) and 26.66% interdigital dermatitis. Laminitis caused economic losses by decreasing milk production and worsening reproductive indicators. Thus, cows diagnosed with digital dermatitis recorded a 5.7% lower milk production, in cows with horn box diseases the milk production was 4% lower and those with interdigital dermatitis 4.8% more small compared to the healthy cows on the farm.

Keywords: cow, laminitis, milk production, reproduction indicators.

1. Introduction

Laminitis represents a group of medical diseases that are located at the level of the acropodial region. They negatively influence the animal's ability to move, to feed, to drink, and because of the pain produced when touched, the cow prefers long periods of time in the decubitus position. Naturally, the consequences produced are the decrease in meat production through weight loss, the decrease in milk production and the appearance of infertility. All these causes lead to economic losses with consequences in the early reformation of the animal, before reaching the maximum production potential.

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2. Materials and methods

The present work was carried out at the Balotesti Bovine Development Research Institute, on a herd of 60 heads, Romanian Black Spotted cows the property of the Institute. The analysed data capture the activity on the farm between 2021-2023, the period in which the prevalence of cows with acropodial diseases was between 17.4% and 20.3%. Cows identified with lameness were restrained in the containment stall, toileted, examined and treated after establishing the diagnosis. Digital dermatitis, diseases at the level of the horn box (double sole, haemorrhagic ulcer, abscesses on the white line) and interdigital dermatitis were identified. For each diagnosed cow, milk production/305 days was calculated and reproductive activity was interpreted with the help of reproductive indicators. Milk production was monitored by the specialists who carry out the Official Control of Milk Production and the

reproduction data were taken from the TAURINE.EXE farm program. The reproductive indicators monitored were: duration of calving interval - first insemination, duration of uterine rest, number of IA/G, % fecundity. The data obtained were related to the production and reproduction performances recorded by the healthy animals on the farm. The pregnancy diagnosis was performed 30 days after the artificial insemination with the help of the portable ultrasound device.

The statistical processing of the data was carried out with the help of the Microsoft Excel program.

3. Results and discussion

In graphic image no. 1, the cows diagnosed with acropodial diseases in the period 2021-2023l are shown.

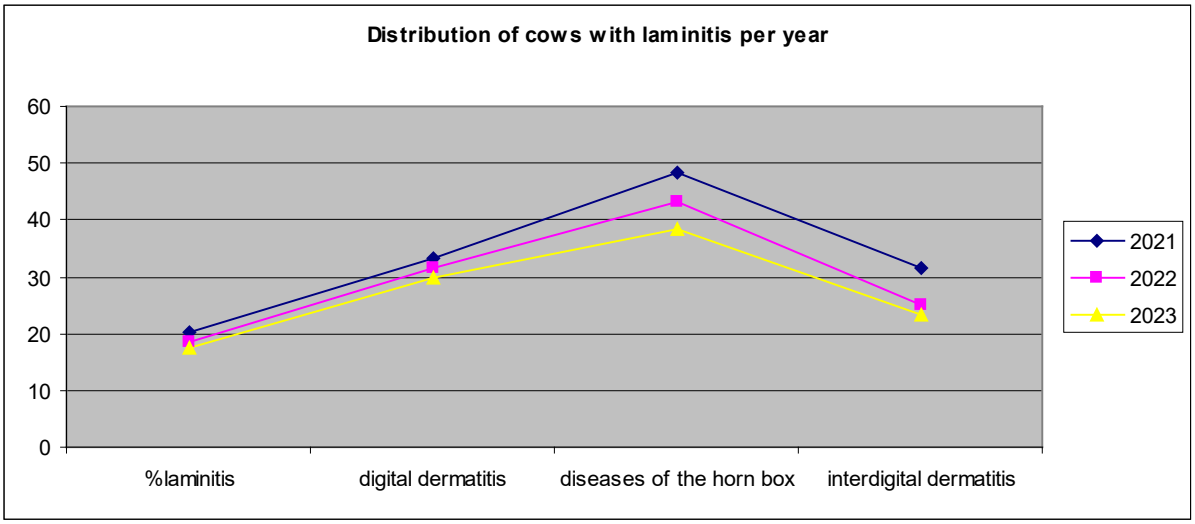

Figure 1. Graphic representation of cows diagnosed with lameness in the period 2021-2023

From figure 1, it can be seen that the most cows that showed lameness were registered in 2021, more precisely 20.3%. These were 9.13% more compared to those found in 2022 and 16.66% more numerous than the number of cases diagnosed with laminitis in 2023. The data obtained are comparable to those found in the specialized literature. Thus, Thomasen et al. [1] reported in a study carried out in 2023 a prevalence of 22% in cows with moderate lameness.

From the analysed data, it is found that in 2021 the most common pathology was at the level of the horn box. Thus, 48.33% of the analysed cases presented a double sole, haemorrhagic ulcer or abscess at the white line. These were 11.53% more compared to the number of cases registered in 2022 and 26.08% more numerous than the share of cases registered in 2023. In second place were the cows that were diagnosed with digital dermatitis. Thus, in 2021, the prevalence of cows with digital dermatitis was 33.33% of the number of cows identified with lameness. These were 5.24% more than the number of cases encountered in 2022 and 11.1% more numerous than in 2023. Cows that were diagnosed with interdigital dermatitis had a prevalence of 31.66%, in 2021, of the total number of cows that showed lameness. These were 26.6% more numerous than the number of cases registered in 2022 and 35.70% more than the number of cows registered in 2023. Table 1 shows the influence of laminitis on milk production/305 days.

Table 1 shows that the average production of milk/lactation of the group of healthy cows was 6687.31 kg. The dispersion in this group was 793.51 kg of milk. The variability within the batch was 11.86%. Average milk production/305 days of cows diagnosed with digital dermatitis is 6306.11 kg. The dispersion within this batch was 503.54 kg and the variability was 7.98%. From the data presented, it can be seen that in the group of healthy cows, the average production of milk/lactation was +6.04% higher compared to the cows diagnosed with digital dermatitis. The results are comparable to what other authors have

reported. Thus, Relun et al. [2] found a decrease in milk production between 0.5 kg and 0.75 kg/day in cows diagnosed with digital dermatitis. The small variability within the batch diagnosed with digital dermatitis shows the negative influence of this condition on the productivity of cows by the uniformity of individuals.

Table 1. Influence of laminitis on milk production/305 days

Statistical indicators	Healthy cows	Digital dermatitis	Diseases of the horn box			Interdigital dermatitis
			Rusterholz ulcer	Double sole	Abscesses of the white line	
X	6687.31	6306.11	6177	6635.89	6556.75	6366.29
SD	793.51	503.54	421.79	588.94	524.73	534.61
CV%	11.86	7.98	6.82	8.87	8.13	8.39
Milk production/305 days healthy cows ~Milk production/305 days cows with digital dermatitis						0.03127
Milk production/305 days healthy cows ~Milk production/305 days cows with diseases of the horn box						0.102232
Milk production/305 days healthy cows ~Milk production/305 days cows with interdigital dermatitis						0.103004

The average milk/lactation production of cows diagnosed with disorders at the level of the horn box was 6518.57kg. The dispersion in this batch was 552.11 kg and the variability within the group was 8.46%. Within this batch, the lowest average milk/lactation productions were recorded in cows diagnosed with haemorrhagic ulcer, 6177 kg of milk. The dispersion within this group was 421.79 kg and the variability was 6.82%. Cows with abscesses on the white line ranked second. The average milk production obtained from them was 6556.75 kg. The dispersion in this group of cows was 524.73 kg and the variability was 8.13%. The best productions in this batch were recorded in the cows that presented the double sole. The average production of milk/lactation obtained from these cows was 6635.89 kg. The dispersion within this group was 588.94 kg and the variability was 8.87%. From the data presented, it can be seen that the average milk production/305 days in healthy cows was +2.58% higher than in cows identified with diseases of the horn box. The biggest difference in productivity was recorded in the group of cows diagnosed with haemorrhagic ulcer. The average milk/milk production obtained in this batch was 8.26% lower compared to the average milk production obtained from healthy cows. The obtained result is comparable to the results recorded in the specialized literature. Thus, Amory et al. showed a decrease in milk production/lactation by 570 kg [3] in cows diagnosed with haemorrhagic ulcer. Cows diagnosed with abscesses on the white line ranked second. From these, an average production of milk/lactation with 1.99% lower compared to the production obtained from healthy cows was obtained. Similar results were recorded by J.R. Amory et al who reported lower productions in cows diagnosed with abscesses on the white line. The smallest difference in productivity was recorded between healthy cows and those diagnosed with double sole. The average milk production obtained from them was 0.77% lower compared to the average milk production obtained from healthy cows. It seems that this condition, even if it is not desirable, does not significantly influence the productivity of the cows on the farm. The average production of milk/lactation in cows diagnosed with interdigital dermatitis was 6366.29 kg. The dispersion within this lot was 534.61 kg and the variability was 8.39%. The average milk production/lactation obtained in this batch was 5.04% lower compared to the average milk production obtained from healthy cows. Similar results were recorded by Hernandez et al. [4]. They found that interdigital dermatitis negatively influences the milk production of affected cows compared to healthy ones.

The significance analysis of the differences performed with the Fisher test shows that there are significant production differences between healthy cows and those diagnosed with digital dermatitis ($p<0.05$; $p=0.03127$). Insignificant productivity differences were recorded between healthy cows and those with horn box diseases ($p>0.05$; $p=0.102232$) and between healthy cows and those diagnosed with interdigital dermatitis ($p>0.05$; $p=0.103004$).

Table 2 shows the influence of laminitis on reproductive performance in dairy cows.

Table 2. Influence of laminitis on reproductive performance in dairy cows

Cows	Healthy animals	Digital dermatitis	Diseases of the horn box			Interdigital dermatitis
n	20	19		26		16
Reproduction indicators			Rusterholz ulcer	Double sole	Abscesses of the white line	
Interval parturition first insemination (days)	79.86	88.38	92	80.06	88.75	84.93
Service period (days)	109.4	113.03	120.6	105.31	114.75	110.25
% fecundity	68.18	57.69	60	68.75	50	62.5
services per conception	2.2	2.53	3.33	2.27	2.5	2.6

Table 2 shows that in the group of healthy cows the interval from calving to the first insemination was 79.86 days and the duration of the service period was 109.4 days. The percentage of fecundity recorded in this group was 68.18%. To obtain a pregnancy, 2.2 inseminations were performed. In the group of cows diagnosed with digital dermatitis, the first insemination was performed on average at 88.36 days. The duration of the service period for this group was 113.03 days. The fecundity percentage recorded in this lot was 57.69% and to obtain a pregnancy, 2.53 inseminations were performed. From the data presented, it can be seen that in the cows diagnosed with digital dermatitis, the analysed reproduction indicators recorded lower scores compared to the group of healthy cows. Thus, in healthy cows, the duration of the interval from calving to the first insemination was 10.66% shorter compared to cows diagnosed with digital dermatitis. The duration of the service period in healthy cows was 3.31% lower. The percentage of pregnancies obtained in healthy cows was 18.18% higher and to obtain a pregnancy, 15% fewer inseminations were performed in healthy cows.

Similar results were recorded by Biemans et al. who demonstrated that digital dermatitis worsens reproduction rates [5].

In the cows diagnosed with diseases of the horn box, the worst results in terms of reproductive performance were recorded in the group of cows with Rusterholz ulcer. In these, the first insemination after parturition was performed at 92 days. The duration of the service period for this batch was 120.6 days. The fecundity percentage obtained was 60% and to obtain a pregnancy, 3.33 inseminations were performed. From the analysis of the reproduction indicators, it is found that in the group of cows diagnosed with haemorrhagic ulcer, the duration of the interval from calving to the first insemination was 15.20% longer compared to the group of healthy cows. The duration of the service period was 10.23% longer in cows with Rusterholz ulcer compared to healthy cows. The percentage of fecundity obtained was 13.63% lower in the group of cows with diseases of the horn box, and to obtain a pregnancy, 51.36% more inseminations were performed compared to the group of healthy cows. The obtained results show that this condition negatively influences the reproduction activity on the farm. Comparable results were recorded by Hultgren et. al. [6] who found a worsening of reproductive activity caused by this pathology.

In the group of cows diagnosed with double sole, the first insemination after parturition was performed at 80.06 days. The duration of the service period for this lot was 105.31 days. The fecundity percentage obtained was 68.75% and to obtain a pregnancy, 2.27 inseminations were performed. From the data presented, it can be seen that the results obtained are comparable to those recorded in the group of healthy cows, which shows that this condition does not influence the reproductive performances of the cows.

In the group of cows diagnosed with abscesses on the white line, the first insemination after parturition was performed at 88.75 days. The duration of the service period for this group was 114.75 days. The fecundity percentage obtained was 50% and to obtain a pregnancy, 2.5 inseminations were performed. The analysis of reproduction indicators shows that in this batch the duration of the interval between parturition and first insemination was 11.13% longer compared to the batch of healthy cows. The duration of the service period in the group of cows with horn box diseases was 4.89% higher. The fecundity percentage in the group of cows with abscesses on the white line was 36.36% lower and

to obtain a pregnancy, 13.63% more inseminations were performed.

In the group of cows diagnosed with interdigital dermatitis, the first postpartum insemination was performed at 84.93 days. The duration of the service period for this lot was 110.25 days. The fecundity percentage obtained was 62.5% and to obtain a pregnancy, 2.6 inseminations were performed. From the data presented, it can be seen that in this batch the duration of the calving-first insemination interval was 6.34% longer than that of the batch of healthy cows. The duration of the service period was 0.77% longer than in healthy cows. The percentage of pregnancies obtained was 9.08% lower and to obtain a pregnancy, 18.18% more inseminations were performed than in cows without lameness. The obtained results are comparable to those in the specialized literature. Vermeersch and Opsomer [7] demonstrated that pododermatitis negatively influences the reproductive activity on the farm.

4. Conclusions

Laminitis negatively influences milk production/305 days

Cows diagnosed with digital dermatitis had a milk production/305 days lower by -6.04%

Cows diagnosed with Rusterholz ulcer recorded a milk production/305 days lower by -8.26%

Cows diagnosed with abscesses on the white line recorded a milk production/305 days lower by -1.99%

Cows diagnosed with interdigital dermatitis recorded a lower milk production by -5.04%

Laminitis negatively influences reproductive activity

Cows diagnosed with digital dermatitis recorded an increase in the calving-first insemination interval by 10.66%; the duration of the service period was longer by 3.31%. The fecundity percentage was 18.18% lower and to obtain a pregnancy, 15% more inseminations were performed.

Cows diagnosed with Rusterholz ulcer registered an increase in the calving interval before the first insemination by 15.20%. The duration of the service period was 10.23% longer. The percentage of pregnancies obtained was 13.63% lower and to obtain a pregnancy, 51.36% more inseminations were performed.

Cows diagnosed with abscess of the white line recorded an increase in the interval between parturition and first insemination by 11.13%. The duration of the service period was 4.89% higher. The fecundity percentage obtained was 36.36% lower and to obtain a pregnancy, 13.63% more inseminations were performed.

Cows diagnosed with interdigital dermatitis recorded an increase in the calving-first insemination interval by 6.34%. The duration of uterine rest was 0.77% longer. The percentage of pregnancies obtained was 9.08% lower and to obtain a pregnancy, 18.18% more inseminations were performed.

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