

INCIDENCE OF DEFORMATIONS OF THE EXTREMITIES OF SIMMENTAL COWS IN DIFFERENT TYPES OF STALLS

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Abstract: Problems with legs and various forms of lameness of cows, in intensive milk production, are the third significant problem occurring in this production, after mastitis and reproductive disorders, both globally and in our country. The paper analyzes the incidence of the deformation of legs of 145 cows of the Simmental breed in the Kolubara region, and the influence of paragenetic factors (housing/holding and type of stall/bedding and lactation) on the incidence of deformations. The obtained results show that, of the total number of cows assessed, 3.45% had "X" position of the front legs, 14.8% had a "X" position of the hind legs. The convergent position of the front legs was recorded in 35.86%, and divergent in 8.28% of animals. The convergent position of the hind legs was observed in 16.55% of cows, and divergent in 2.76%. The outward position of the front legs was observed in 4.14% of cows, inward position in 11.03%, and broad position in 4.14% of studied cows. Also, 17.24% of the cows had a so called sable like position of hind legs, and 7.59% showed steep angle of hind legs. The pronounced soft front leg pasterns were observed in 7.59% of the cows, and the soft pasterns of the hind legs in 33.79% of the total number of observed cows. The observed changes in the ankles in the shape of swelling were recorded in 1.38% of cattle on the carpal joint and 2.76% on the tarsal ankle. The damaged shoulder and body joint (scabbed shoulder) was observed in 43.45% of the total number of cows evaluated. Scores for the front and hind legs front, back and side views, varied at different levels of significance under the influence of the type of stall/bedding, while the scores for the condition of the hind leg pasterns varied highly significantly ($p < 0.001$) under the influence of the type of stall/bedding. The scores for the front leg pasterns and scores for shoulder and body joint were not significant ($p > 0.05$) depending on the type of stall/bedding and the method of housing/holding of cows.

Key words: Simmental breed, extremities, stall/bedding

Introduction

According to the literature data, leg problems and various forms of lameness of cows, in intensive milk production, are the third significant problem occurring in this production, after mastitis and reproductive disorders, both globally and in our country. Significant economic losses occur caused by the expense of treatment, reduction of milk production, deterioration of fertility and increase in the repair rate. Leg problems with cows are continuously have been increasing on dairy farms in the world over the last 20 years, so that in some farms, lameness occurs in more than half of the animals (*Enting et al., 1997*). Leg problems and various forms of lameness can contribute to reducing the amount of milk, according to individual authors, up to 30% (*Bicalho et al., 2008; Ettema et al., 2007*). Therefore, research in this field is considered very significant in economic terms. The increase in the incidence of hoof lesions and the occurrence of infectious causes of laminitis in cows is more striking after calving (*Blowey, 1993*). Particular importance is given to the consideration of all possible factors, the consideration of their individual and complex action on the cause and severity of lameness. As major environmental impacts of lameness, the following are mentioned in the literature: the type and characteristics of the floors, the type and quantity of the bedding/litter, the possibility for use of free range, the hygienic conditions in the stalls, etc. (*Dippel et al., 2009*).

Significant economic losses are due to the costs of treatment, reduction of milk production, deterioration of fertility and increase in the repair rate. Lameness considerably reduce milk production, and is usually the result of a combination of different factors that persist for a long period of time. These factors include: heredity, nutrition, housing and environment. The lameness of cattle is a major health problem for the dairy industry. In herds where lameness is strongly expressed, there are great economic losses. Regardless of the cause, early detection and rapid treatment reduce losses, reduce animal suffering, and raise important issues for animal welfare (*Shearer, 2000*).

Lameness is a consequence of the disturbed morphologically-functional integrity of the muscular skeletal system. The causes of lameness are many mechanical or predisposing factors (housing, unhygienic conditions, humidity, environment, nutrition, heredity) that have long-term impact on animals (*Tadić and Milosavljević, 1991*).

Today laminitis is the main cause of lameness in cattle. The risk increases when cattle stand for a long time on wet and sharp edges of concrete where the softening and mechanical damage to the hoofs occur. The outer part of the hoof is most often

affected by laminitis (Rogers, 2001). Regardless of the way the cows are housed, the main cause of lameness is the use of a solid floors, usually concrete used in the construction of the flooring of the stables (Boon, 2009).

The heredity is one of the factors that influence the condition of the hoofs. It is not yet sufficiently scientifically proven, but it is known to breeders that animals that have irregular standing position often transfer this property to their offspring. This only implies that in the selection of cattle it is necessary to pay attention to the fact that, in addition to certain production performance traits, adequate attention should be focused on the choice of animals with healthy feet and hoofs. This is particularly true in the selection of bulls used for artificial insemination, given the many offspring they give. A cow that has become clinically lame exhibits estrus less often and the period from calving to subsequent fertilization and successful conception is extended (Sprecher et al., 1996).

Based on the research carried out by Perišić (2007), the problem with the hoofs was observed and stated as the third reason for excluding the animals from the production on individual farms. Of the total number of animals, 10% presented with hoof problems as the primary cause for culling, resulting in their poor consumption of food, poor reproductive abilities and pronounced leg problems.

Material and methods

The study of the frequency of the incidence of leg deformation in Simmental cows, in the tied system, was carried out on private farms in the municipalities of Lajkovac and Mionica, on a total of 145 cows.

The studied population of the Simmental cows included cows of different age-lactation number (cows were from 1st to 10th lactation), but the groups were formed so that the cows in the first 6 lactation comprised 6 groups, and the older cows (7th to 10th lactation) together formed one group.

Based on the differences that existed in the housing/holding and the type of stall/bedding, all examined cows were classified into three groups:

- Stall/bedding type and method of housing/holding 1: cows were kept on farms, which had stables with tied system, full-concrete stalls (190 centimeters long), with manure removal canal, and free housing (free housing during dry period, or daily free housing in free range areas over the day).
- Stall/bedding type and method of housing/holding 2: cows were kept in stables with a tied system throughout the year. The stalls were made of full concrete (190 centimeters long), with a manure removal canal.

- Stall/bedding type and method of housing/holding 3: cows were kept in stables with a tied system throughout the year. The stalls were made of full concrete (160 centimeters long), with a manure removal canal, with gutters placed over the canal, of tubular type, in the direction of manure removal canal.

In determining the occurrence of deformation of the extremities and their frequency, the leg positions were scored as follows:

- front legs: (the disturbed leg position, front and side view) "X" position, "O" position, convergent position, divergent position, outward position, inward position, broad position, narrow position, changes in the carpal, ankle, shoulder to body joint ("detached shoulder") and the frequency of "soft pasterns".
- hind legs: (the disturbed leg position side and rear view) "X" position, "O" position, convergent position, divergent position, saber-shaped position, steep angle position, changes in the tarsal ankle and the frequency of "soft pasterns"

The processing of collected data consisted in determining the parameters of descriptive statistics (average, minimum, maximum, standard deviation, variation coefficient) for the observed exterior properties: front leg score (FLFV) front view, hind leg score (HLRV) rear view, front leg score (FLSV) side view, hind leg score (HLSV) side view, front (FP) and hind leg (HP) pastern score and shoulder to body joint score (SB). In the variance analysis, the unified impact of the type of stall/bedding and housing/holding (3 classes) and the influence of animal age (observed through the lactation) on the frequency of leg deformation was studied using a single factorial analysis model.

Results and discussion

The average scores for front and hind leg positions, front and rear view, were not statistically significant different ($p > 0.05$), depending on the effect of cow age, expressed by lactation number (Table 2). The average score was 4.1 for front and 4.2 for hind legs (Table 1).

Table 1. Mean value and variability of the extremity scores of Simmental cattle

| Traits | N | Average | Min | Max | SD | CV |
|---|-----|---------|-----|-----|------|-------|
| Front leg score front view | 145 | 4.1 | 3.0 | 5.0 | 0.60 | 14.63 |
| Hind leg score rear view | 145 | 4.2 | 3.0 | 5.0 | 0.63 | 15.00 |
| Front leg score side view | 145 | 4.4 | 3.0 | 5.0 | 0.53 | 12.05 |
| Hind leg score side view | 145 | 4.2 | 2.0 | 5.0 | 0.70 | 16.67 |
| Front leg pasterns | 145 | 4.9 | 2.0 | 5.0 | 0.35 | 7.14 |
| Hind leg pasterns | 145 | 4.6 | 3.0 | 5.0 | 0.58 | 12.61 |
| Shoulder and front legs to body joint score | 145 | 4.5 | 3.0 | 5.0 | 0.6 | 13.33 |

Table 2. Average scores for observed exterior properties of extremities by lactations

| lactation | N | FLFV score | HLRV score | FLSV score | HLSV score | FP score | HP score | SB score |
|-----------|-----|---------------------|---------------------|---------------------|---------------------|--------------------|--------------------|--------------------|
| 1 | 46 | 4.1 | 4.3 | 4.4 | 4.3 | 4.9 | 4.8 | 4.7 |
| 2 | 40 | 4.0 | 4.1 | 4.4 | 4.3 | 5.0 | 4.8 | 4.5 |
| 3 | 15 | 4.0 | 4.1 | 4.3 | 4.1 | 4.9 | 4.3 | 4.4 |
| 4 | 17 | 4.1 | 4.1 | 4.4 | 4.4 | 4.6 | 4.3 | 4.3 |
| 5 | 12 | 4.2 | 4.3 | 4.6 | 4.1 | 5.0 | 4.4 | 4.4 |
| 6 | 8 | 3.9 | 3.9 | 4.1 | 3.8 | 4.9 | 4.5 | 4.0 |
| 7 | 7 | 4.0 | 3.9 | 4.3 | 3.9 | 5.0 | 4.4 | 4.1 |
| F exp. | 145 | 0.313 ^{ns} | 1.072 ^{ns} | 0.669 ^{ns} | 1.727 ^{ns} | 3.33 ^{**} | 3.25 ^{**} | 2.302 [*] |

***- $p < 0,001$; ** - $p < 0,01$; * - $p < 0,05$; ns - $p > 0,05$

In case of side view, the score for the front leg positions was 4.4, and the hind legs 4.2 (Table 1). Lactation number, did not influence statistically significantly ($p > 0.05$) the positions of the front and hind legs, in the side view (Table 2).

The scores for the front leg pasterns ranged from 2.0 to 5.0, with an average of 4.9 (Table 1). A highly significant ($p < 0.01$) effect of animal age (lactation number) on the condition of the front leg pasterns was established (Table 2). Variation of the scores for the hind leg pasterns was from 3.0 to 5.0 with an average of 4.6 (Table 1). A highly significant ($p < 0.01$) effect of the animal age (lactation number) on the condition of the hind leg pasterns was established (Table 2). The score for the blade and front leg joint with the body ranged from 3.0 to 5.0, with an average of

4.6 (Table 1). The age of animal (lactation number) showed significant ($p < 0.05$) impact on the attachment of the front legs to the body (Table 2).

In case of front and rear view, scores for the positions of the front and hind legs varied significantly ($p < 0.05$) under the influence of the stall/bedding type (Table 3). Scores for the position of the front legs, side view (Table 3), varied statistically highly significantly ($p < 0.001$) under the influence of the stall/bedding type, and in the hind legs very significantly ($p < 0.01$).

The condition of the front leg pasterns and the blade joint showed no significant variation depending on the type of stall/bedding, while scores for the condition of the hind leg pasterns varied highly significantly ($p < 0.001$) under the influence of the stall/bedding type (Table 3).

Table 3. Average scores for observed exterior properties of the limbs by type of stall/bedding

| Stall/bedding | N | FLFV score | HLRV score | FLSV score | HLSV score | FP score | HP score | SB score |
|---------------|-----|------------|------------|------------|------------|--------------------|-----------|---------------------|
| 1 | 89 | 4.1 | 4.3 | 4.5 | 4.4 | 4.9 | 4.8 | 4.5 |
| 2 | 28 | 3.8 | 4.0 | 4.1 | 4.1 | 4.9 | 4.5 | 4.3 |
| 3 | 28 | 4.1 | 4.0 | 4.2 | 3.9 | 4.8 | 4.3 | 4.5 |
| F exp. | 145 | 3.804* | 4.538* | 8.691*** | 5.421** | 1.34 ^{ns} | 10.202*** | 1.129 ^{ns} |

***- $p < 0,001$; ** - $p < 0,01$; * - $p < 0,05$; ns - $p > 0,05$

The analysis of the frequency of the occurrence of irregular positions, joint defects and the shoulder to body joint in cows of Simmental breed in tied holding system on a sample of 145 animals resulted in the following data: of the total scored cows, disturbed position of the front legs ("X" position) was present in 5.62% of cows kept on the first type of stall/bedding. Convergent position of the front legs was observed in 52 heads, of which 35.96% were housed in the stables with the first type, 40.74% on the second type of stall/bedding, and on the third type of stall/bedding 31.03% of the total number of evaluated cows for each type of stall/bedding. The divergent position of the front legs was observed in 8.28% of the total number of estimated cows. Outward and inward positions of the front legs were recorded in 4.14% and 13.03% of cows, respectively, relative to the total number of cows evaluated. Carpal joint changes were observed in a small number of cows, only 1.38% i.e. 2 cows had carpal joint problems. In 134 cows, the front legs showed good angle to the ground, while in 11 cows that angle was irregular. A weak joint of the shoulder blade to the body was observed in a total of 63 estimated animals or 43.45%. The correct position of the hind legs was observed in 125 cows, while the "X" position of the hind legs was observed in 20 animals depending on the type of stall/bedding. The convergent position of the hind legs

had 16.55% of the observed cows, while the divergent position was only recorded in 2.76% of the total number of cows evaluated. A saber-shaped position of the hind legs was observed with 25 cows, or 17.24%, while 7.59% of the cows showed steep angles in hind legs. Changes on the tarsal ankle, in the form of thickening, swelling of the skin, wounds, etc., was observed in 2.76% of cows. The regular hind leg pasterns were observed in 106 cows, and 49 or 33.79% had soft pasterns on the hind legs. When assessing irregular positions, a large percentage of the convergent position of the front and hind legs was observed, also the shoulder blade to body joint presented very low scores in cows. A total of 82 heads did not show a bad fit/joint of shoulder blades with the body. The incidence of poor positions is contributed by both the stall/bedding, with or without litter, and its length.

Table 4. Frequency of the incidence of the leg deformations in cows

| Deformation | | Stall/bedding type | | | | | | N | Cows with deformations (%) |
|--------------------------------|---|--------------------|-------|------|-------|-------|-------|-------|----------------------------|
| Type of deformation | 1 | | 2 | | 3 | | | | |
| | N | % | N | % | N | % | | | |
| Front legs | „X“ position | 5 | 5.62 | - | 0.00 | - | 0.00 | 5 | 3.45 |
| | convergent | 32 | 35.96 | 11 | 40.74 | 9 | 31.03 | 52 | 35.86 |
| | divergent | 7 | 7.87 | 2 | 7.41 | 3 | 10.34 | 12 | 8.28 |
| | outward | 5 | 5.62 | 1 | 3.70 | - | 0.00 | 6 | 4.14 |
| | inward | 14 | 15.73 | - | 0.00 | 2 | 6.90 | 16 | 11.03 |
| | wide | 4 | 4.49 | - | 0.00 | 2 | 6.90 | 6 | 4.14 |
| | Carpal joint swelling | 2 | 2.25 | - | 0.00 | - | 0.00 | 2 | 1.38 |
| | „soft pasterns“ | 5 | 5.62 | 3 | 11.11 | 3 | 10.34 | 11 | 7.59 |
| | Poor fit of shoulder blade to body („scraped shoulder“) | 34 | 38.20 | 16 | 59.26 | 13 | 44.83 | 63 | 43.45 |
| | Hind legs | „X“ position | 6 | 6.74 | 6 | 22.22 | 8 | 27.59 | 20 |
| convergent | | 22 | 24.72 | 2 | 7.41 | - | 0.00 | 24 | 16.55 |
| divergent | | 3 | 3.37 | - | - | 1 | 3.35 | 4 | 2.76 |
| Sable shaped | | 12 | 13.48 | 6 | 22.22 | 7 | 24.14 | 25 | 17.24 |
| Steep angle | | 10 | 11.24 | - | 0.00 | 1 | 3.35 | 11 | 7.59 |
| Tarsal joint swelling | | 3 | 3.37 | - | 0.00 | 1 | 3.35 | 4 | 2.76 |
| „soft pasterns“ | | 17 | 19.10 | 14 | 51.85 | 18 | 62.07 | 49 | 33.79 |
| Total number of evaluated cows | | 89 | 100% | 27 | 100% | 29 | 100% | 145 | 100% |

Conclusion

On the basis of the obtained results, it can be concluded that the average scores for the extremities/limbs of Simmental Cows ranged from 4.1 to 4.9. By examining their variability under the influence of lactation number and type of stall/bedding, it has been concluded that the scores for front and rear leg positions front, rear and side view, varied at different levels of significance under the influence of the type of stall/bedding, while scores for the condition of the pasterns on the hind legs varied highly significantly ($p < 0.001$) under the influence of the type of stall/bedding. Scores for front leg pasterns and scores for shoulder blade to body joint were not under significant ($p > 0.05$) influence of the type of stall/bedding and the method of housing/holding of cows.

Of the total number of cows assessed, 3.45% had "X" position of the front legs, 14.8% had "X" position of the hind legs. The convergent position of the front legs was observed in 35.86%, and divergent in 8.28% of cows. Convergent position of the hind legs was observed in 16.55% of cows, and divergent in 2.76%. The forward position of the front legs was observed in 4.14% of cows, inward position in 11.03%, and wide position in 4.14%. 17.24% of cows had sable-shaped position of hind legs, and 7.59% showed steep angles. The pronounced soft front leg pasterns were observed in 7.59% of the cows, and in hind legs 33.79% of the total number of estimated cows. The observed changes in the joints, in the form of swellings was observed in 1.38% of cattle on the carpal joint and 2.76% on the tarsal joint. The affected shoulder blade and body joint (scraped shoulder) was observed in 43.45% of the total number of cows. The body weight of Busha cows on the territory of the Pirot district amounted to 226.07 kg, the height of the ridge 104.33 cm, the height of the cross 104.12 cm, pelvis width 32.52 cm, breast depth 53.97 cm, breast circumference 130.48 cm, and body length 119.67 cm.

Problems with legs and hoofs are a common cause of culling of animals from production. Outgrowths of the hoofs lead to a reduction in the angle of the pasterns to the ground and the creation of irregular legs, which is reason why animals get up and move with increased difficulty, the food consumption is reduced, as well as the production and they become more susceptible to various diseases. Regular and correct correction of the hoofs would prevent the excessive and irregular growth of the hoof mass. Problems with extremities are more pronounced than stated in the literature, since these problems are often the primary reason for the incidence of sterility that is not recorded during the culling of cows from production, but rather its consequence, i.e. sterility is recorded as the reason.

Pojava deformacije ekstremiteta krava simentalске rase u različitim tipovima ležišta

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Rezime

Problemi sa nogama i različiti oblici šepavosti krava, u intenzivnoj proizvodnji mleka su treći problem po značaju posle mastitisa i reproduktivnih poremećaja, kako u svetu tako i u našoj zemlji. U radu su analizirane pojava deformacije stavova nogu 145 krava simentalске rase na području Kolubarskog okruga, i uticaj paragenetskih faktora (način držanja i tip ležišta i laktacija po redu) na pojavu deformacija. Od ukupnog broja ocenjenih krava 3,45 % je imalo „X“ stav prednjih nogu, 14,8% je imalo „X“ stav zadnjih nogu. Konvergentan stav prednjih nogu imalo je 35,86%, a divergentan 8,28%. Konvergentan stav zadnjih nogu imalo je 16,55% krava, a divergentan 2,76%. Isturen stav prednjih nogu imalo je 4,14% krava, podvučen 11,03%, a širok stav 4,14%. Sabljast stav zadnjih nogu imalo je 17,24% krava, a stubast 7,59%. Izražene mekane kičice prednjih nogu imalo je 7,59% krava, a mekane kičice zadnjih nogu imalo je 33,79% od ukupnog broja ocenjenih krava. Uočene promene na zglobovima u vidu otoka imalo je 1,38% krava na karpalnom zglobu i 2,76% na tarzalnom zglobu. Narušen spoj lopatice i tela (odvaljena plećka) imalo je 43,45% od ukupnog broja ocenjenih krava. Ocene za stavove prednjih i zadnjih nogu posmatrano sprema, otpozadi i sa strane varirale su na različitom nivou značajnosti pod uticajem tipa ležišta, dok ocene za stanje kičica na zadnjim nogama su vrlo visoko značajno ($p < 0,001$) varirale pod uticajem tipa ležišta. Ocene za kičice prednjih nogu i ocene za spoj lopatice i trupa, nisu značajno ($p > 0,05$) zavisile od tipa ležišta i načina držanja krava.

Ključne reči: simentalска rasa, ekstremiteti, ležište

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