THE IMPACT OF LAMENESS ON BODY CONDITION SCORE, MILK YIELD AND SOMATIC CELL COUNT IN A DAIRY CATTLE FARM

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Abstract: *The aim of the present study was to examine the impact of lameness on BCS and SCC and milk yield during the lactation. The ANOVA method was used to investigate the relationship between lameness and BCS and SCC. A linear regression analysis was conducted between BCS and SCC and between BCS and Daily Milk Yield in different parity. Pearson correlations were calculated between the parameters in the groups of lame and not lame cows and in the whole herd. There were moderate correlations between milk yield and BCS ($r_{all\ cases}$=-0,38, $r_{not\ lame}$= -0,43 and $r_{lame\ animals}$ =-0,33). Also it was negatively moderate correlation between milk yield and SCC ($r_{all\ cases}$ =-0,32, $r_{not\ lame}$ =-0,29, $r_{lame\ animals}$= -0,37) and a low correlation between the BCS and SCC ($r_{all\ cases}$ =0,13, $r_{not\ lame}$ =' 0,15, $r_{lame\ animals}$=' 0,15). During the lactation the increased BCS was associated with an increased SCC but this tendency was stronger for not lame cows.*

Key words: *Lameness, SCC, Milk Yield, Dairy Cow, BCS*

INTRODUCTION

The Holstein-Friesian cows producing high milk yield, strongly overwork their body. The metabolic disorders, udder problems, lameness and reproductive disorders can grow along with the increasing milk production [6,11]. Lameness is a very prominent factor in culling [14].

Due to lameness, the animal's feed intake is reduced, worsening of the body condition and state of health, and reduce milk production [18]. If the lameness of the cow becomes worse, the body condition score (BCS) also can be weaker [8]. The animal body condition changes during the lactation. The BSC is influenced by many factors, such as the quantity of milk production, animal nutrition and health condition. So, it is difficult to determine which condition is ideal. Most researchers agree that what is the limit of the BCS, which is not ideal, for the different periods of lactation. On this basis, is inappropriate the BCS of the cow if it is less than 2.5, or greater than 3 [2,3,5]. The non-ideal body condition (2 <BCS <3) is associated with numerous health problems. Difficult calving have occurred more in overfed cows than in thinner animals. The incidence of multifactorial diseases (mastitis, ketosis, lameness) is higher if the condition is inadequate [9]. There are a number of studies about the relationship between body condition and lameness. There is a negative correlation between the two parameters [10] in most studies. The cows are more prone to lameness, where the body condition score decreased significantly after parturition [12]. We can also read in other studies, that the BCS below 2.5 greatly increases the risk of laminitis, and if the condition increases than the chance of healing increases as well [7, 16, 19]. At the same time we cannot say with certainty that the lameness worsens due to body condition. There is a positive correlation between the condition score and the thickness of the cushion digital [4]. The thinning of the digital cushion can be associated with lameness [13]. Of all diseases, the mastitis of cows means one of the biggest economic damage, because during the disease the quantity of milk and the fat of milk are reduced [1]. The seriousness of mastitis is expressed by the increase of SCC. In one study, we read that milk production of sub-clinically infected cows was 2.45 kg less per day than that of the healthy cows. According to a Hungarian study, of all economic damages, 71% is resulted from reduced milk production and the need to discard milk from sick animals, 25% culling of incurable cows, and 4 % costs of medical treatment [15]. The risk of developing high somatic cell counts and clinical mastitis is higher if the animal has poor body condition [17].

MATERIAL AND METHODS

Our examinations were carried out on a cattle farm in south-eastern Hungary; we analyzed the 4491 data of 862 cows. Between 2008-2009 there were 10 times recorded data (body condition score, foot health status). We have examined the movement of cows, in terms of lameness then we divided them into two groups: lame (l) and not lame (nl). At the same time we determined the body condition scores (BCS) too. We analyzed the somatic cell count (SCC). The milk samples were given during the test milking. The SCC counts were transformed by a logarithmic scale. We looked for correlation between the body condition status (BCS <2.5; BCS = 2.5; 3> BCS> 3.5; BCS> 4) and daily milk yield, furthermore between the BCS and somatic cell count (SCC). These examinations were performed both in the lame and non-lame groups. We examined the difference between the two groups in milk production and milk somatic cell count by variance analysis.

RESEARCH RESULTS

The correlation analysis established moderately strong negative relationship between daily milk yield and BCS (Table 1). When the milk production increased, the body condition decreased.

Table 1.

Correlation values between BCS, SCC and milk yield

		SCClog	BCS
All cases	Daily Milk Yield (kg)	-0,318**	-0,381**
	SCClog		0,129**
Not lame group	Daily Milk Yield (kg)	-0,290**	-0,426**
	SCClog		0,145**
Lame group	Daily Milk Yield (kg)	-0,365**	-0,326**
	SCClog		0,150**

**. Correlation is significant at the 0.01 level (2-tailed).

This correlation was stronger in the not lame group (r_{nl} =-0.43) than in the lame cows (r_l=-0.33). There was weak, positive relationship between the BSC and the SCC in both groups (r_{nl} =0.14; r_l=0.15). The changes of BCS do a very poor effect the milk somatic cells.

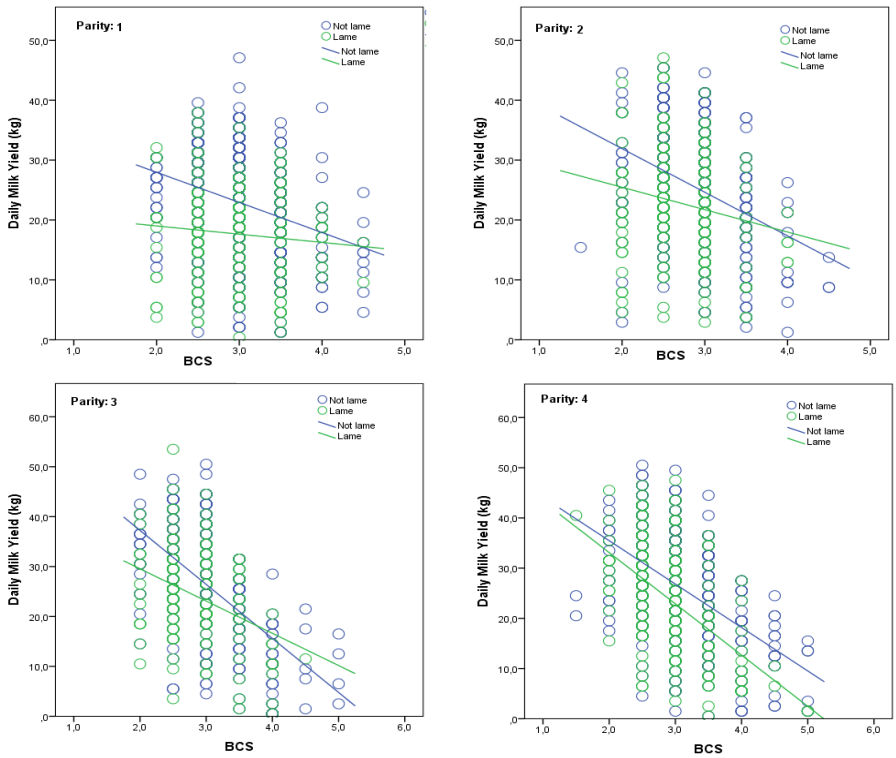

Figure 1. Relationship between BCS and daily milk yield during four lactations

In Figure 1 we can see the relationship between BCS and daily milk yield during four lactations. In each parity, with the increase of BCS, the milk production decreased. This negative tendency was stronger in the third and fourth lactation. Changes of body condition influence the milk production in 29%, in the non-lame groups in the third lactation (R^2= 0.29), and the correlation shows a strong, negative relationship (r= -0.54)(table 2.).

able 2.

R^2 and r values between BCS and milk production in different lactations in the lame and non-lame cows

	I. lactation		II. lactation		III. lactation		IV. lactation	
	L	NL	L	NL	L	NL	L	NL
r	-0.10	-0.23	-0.14	-0.38	**-0.34**	**-0.54**	**-0.45**	**-0.41**
R^2	0.01	0.05	0.06	0.15	**0.12**	**0.29**	**0.21**	**0.17**

L = Lame; NL = non-lame, r = correlation coefficient; R^2 = coefficient of determination

In the case of lame cows was the most powerful relationship between BCS and SCC in the fourth lactation (R^2= 0.21). Although the non-lame cows produced more milk, than the lame cows, in each parity.

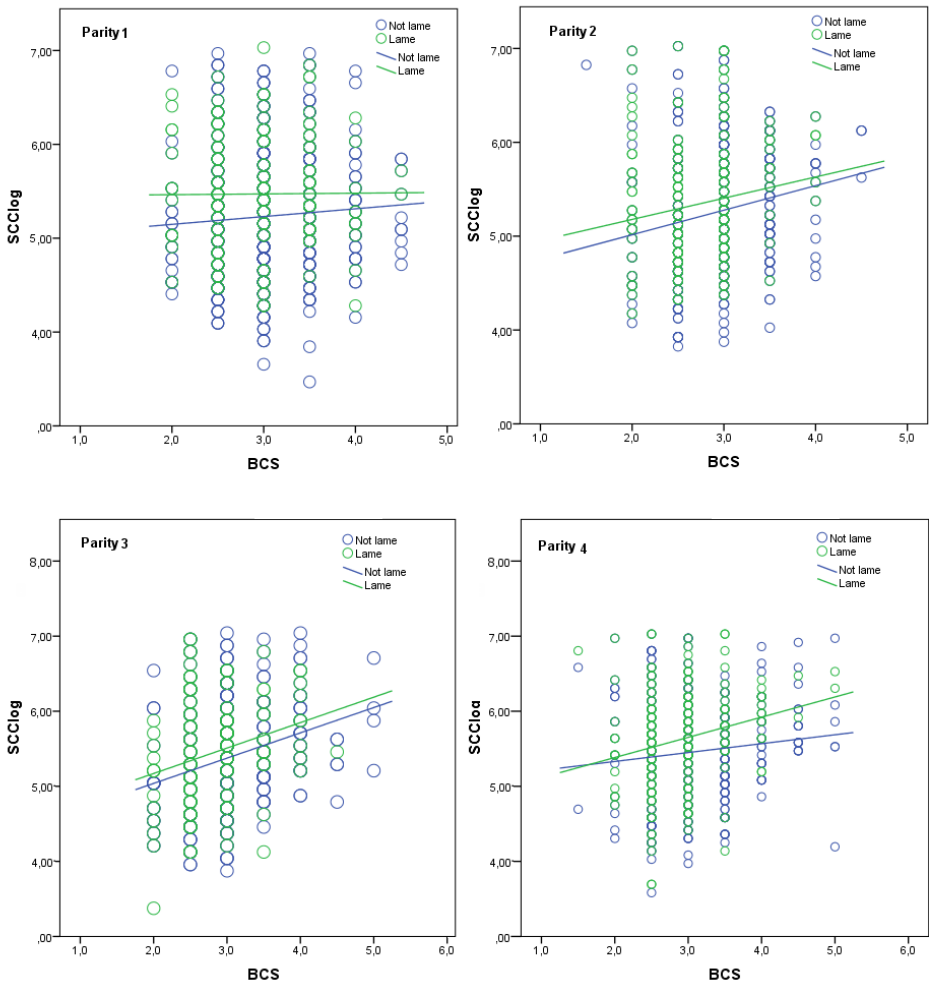

Figure2. Relationship between BCS and SCC during four lactations

Figure 2 shows the relationship between BCS and SCC during four lactations. In every parity there was a positive, but poor relationship between BCS and SCC. If the BCS increased, than the SCC also increased and the values of SCC were higher in the lame cows. The SCC indicates the state of health of the udder. Most of the cells are immune,

white blood cells in the composite of SCC. If the logarithmic value of somatic cell count is above 5.6, then the cow has mastitis.

Table 3.

R^2 and r values between BCS and SCC in different lactations in the lame and non-lame cows

	I. lactation		II. lactation		III. lactation		IV. lactation	
	L	NL	L	NL	L	NL	L	NL
r	0.00	0.06	0.21	0.20	0.22	**0.28**	0.13	0.09
R^2	0.00	0.00	0.04	0.04	0.05	**0.08**	0.02	0.01

L = Lame; NL = non-lame, r = correlation coefficient; R^2 = coefficient of determination

Although, the relationship was poor between two parameters, it was a little stronger in the non-lame cows, in the third lactation (r_{nl} =0.28) (table 3.). The relationship was stronger between body condition and milk production (table 2.), than between body condition and the somatic cell count of milk (Table 3.).

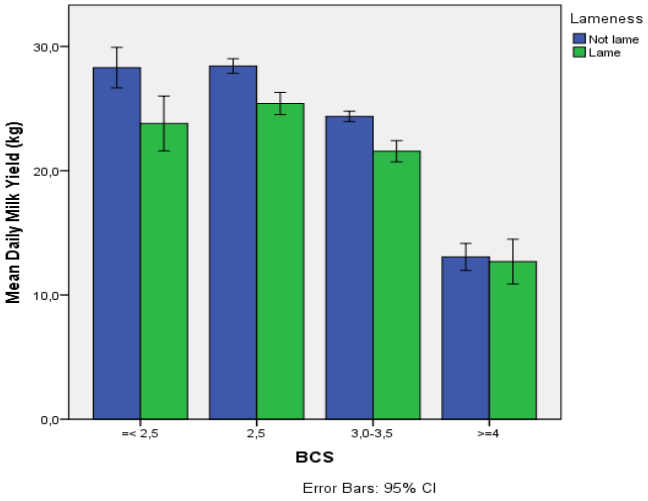

Figure 3. Milk production with regard to BSC (lame, not lame)

The cows produced the largest amount of milk at 2- 2.5 BCS (Figure 3.). It seems that it is the ideal body condition for dairy production of Holstein- Friesian cows. At the same time of the increase of BCS, the milk production decreased. However, the milk production of lame cows was less in each group. The correlation analysis showed a little weaker relationship in the lame cows, (r_{nl}=-0.40; r_l=-0.35), than in the non-lame group. The non-lame cows produced significantly more milk than the lame cows in each case, with the exception of fat (BCS> 4) cows.

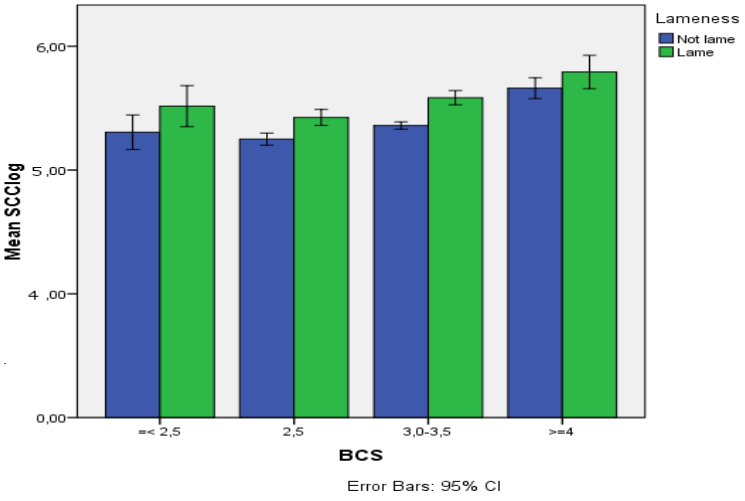

Figure 4. SCC with regard to BSC (lame, not lame)

The logarithmic value of somatic cell count was the lowest at the 2.5 BCS cows (2.25) and the milk of fat cows (BCS>4) contained most of SCC (figure 4). The correlation coefficient value (r_{nl} = 0.15; r_l = 0.13) showed a weak, positive relationship between BCS and SCC. The milk had most SCC in the lame cows, independent of body condition, in each case. There was a significant difference in SCC, between the lame and non-lame cows, the biggest difference (0.28) was observed in the case of thin cows.

CONCLUSIONS

The greatest economic damages of milk producing farms are caused by two diseases, lameness and mastitis (the mastitis was investigated via SCC).

The correlation analysis found moderately strong, negative relationship between daily milk yield and BCS. When the milk production increased, the body condition decreased. This correlation was stronger in the not lame group (r_{nl} =-0.43) than at the lame cows (r_l=-0.33). This negative tendency was stronger in the third and fourth lactation. Although the non-lame cows produced more milk, than the lame cows, in each lactations.

In every parity there was a positive, but poor relationship between BCS and SCC, but the values of SCC were higher in the lame cows.

The cows produced largest amount of milk at 2- 2,5 BCS in both groups (lame and non-lame), but the milk production of lame cows were less. It seems, that is the ideal body condition for dairy production of Holstein- Friesian cows. The non-lame cows produced significantly more milk than the lame cows independently of body condition with the exception of fat (BCS> 4) cows. The logarithmic value of somatic cell count was the lowest at the 2.5 BCS cows (2.25) and the milk of fat cows (BCS>4) contained most of SCC. But in each case the milk had most of SCC in the lame cows, independent of body condition,

These results support the results of other authors that due to lameness, the animal's feed intake is reduced, worsening the body condition and the state of health, and reduced the milk production [18]. If the cow lameness becomes worse, the body condition score (BCS) also can be weaker [8].

REFERENCES

1. **BALTAY ZS., JÁNOSI SZ**., 2001, Összefüggések a tehenek egyedi elegytejének Fossomatic-módszerrel mért és tőgynegyedtejének California Mastitis Test módszerrel meghatározott szomatikus sejtszáma között. Magyar állatorvosok lapja 123: 596-599.
2. **BERNABUCCI, U., RONCHI B., ET AL.,** 2005, Influence of Body Condition Score on Relationships Between Metabolic Status and Oxidative Stress in Periparturient Dairy Cows*. Journal of Dairy Science 88: 2017-2026.
3. **BEWLEY J.M., SCHUTZ M.M.**, 2008**,** Review: An Interdisciplinary Review of Body Condition Scoring for Dairy Cattle..The Professional Animal Scientist 24: 507.
4. **BICALHO, R.C., MACHADO, V.S. , CAIXETA, L.S.,** Lameness in dairy cattle: A debilitating disease or a disease of debilitated cattle? A cross-sectional study of lameness prevalence and thickness of the digital cushion. 2009. Journal of Dairy Science 92: 3175-3184.
5. **CHAGAS, L.M., BASS, J.J., ET AL.,** 2007, Invited Review: New Perspectives on the Roles of Nutrition and Metabolic Priorities in the Subfertility of High-Producing Dairy Cows. Journal of dairy science 90: 4022.
6. **DECHOW, C.D., ROGERS, G.W., ET AL.,** 2004, Correlations Among Body Condition Scores from Various Sources, Dairy Form, and Cow Health from the United States and Denmark.. Journal of Dairy Science 87: 3526-3533.
7. **DIPPEL, S., DOLEZAL, M., ET AL.,** 2009, Risk factors for lameness in cubicle housed Austrian Simmental dairy cows. Preventive veterinary medicine 90: 102.

8. **ESPEJO, L.A., ENDRES, M.I., SALFER, J.A.,** 2006, Prevalence of Lameless in High- Producing Holstein Cows Housed in Freestall Barns in Minnesota. Journal of Dairy Science, Vol.:89/8: 3052-3058.
9. **FEKETE S.,** 1993, Fajok takarmányozása (Részletes takarmányozástan). Az Állatorvos-Tudományi Egyetem jegyzete Budapest.232-235.
10. **GUDAJ R., BRYDL E., KOMLÓSI I.,** 2012, Analysis of lameness traits and type traits in Hungarian Holstein-Friesian cattle. Animal welfare, etológia és tartástechnológia 8: 215-222.
11. **HUXLEY, J.N.,** 2012, Lameness in cattle: An ongoing concern. The Veterinary Journal 193: 610-611,
12. **LIM P.Y., HUXLEY J.N., ET AL.,** 2015, Unravelling the temporal association between lameness and body condition score in dairy cattle using a multistate modelling approach. Preventive Veterinary Medicine 118: 370-377.
13. **O'DRISCOLL, K., LEWIS, E., KENNEDY, E.,** 2015, Effect of feed allowance at pasture on lying behaviour and locomotory ability of dairy cows. Applied Animal Behaviour Science 166: 25-34.
14. **OIKONOMOU, G., BANOS, G., ET AL.,** 2014, Short communication: Genetic characterization of digital cushion thickness. Journal of Dairy Science 97: 532-536.
15. **OZSVÁRI L., GYÖRGY K., ILLÉS B.C., BÍRÓ, O**., 2003, A tőgygyulladás által okozott gazdasági veszteségek számszerűsítése egy nagyüzemi holstein-fríz tehenészetben. Magyar állatorvosok lapja (125. évf.): 273-279.
16. **RANDALL, L.V. , GREEN, M.J., ET AL.,** 2015, Low body condition predisposes cattle to lameness: An 8-year study of one dairy herd. Journal of Dairy Science 98: 3766-3777.
17. **ROCHE, J.F.,** The effect of nutritional management of the dairy cow on reproductive efficiency. 2006. Animal Reproduction Science 96: 282.
18. **SIMON, F., SZITA, G., MERÉNYI, I.,** 2001, Tőgyegészség és tehéntejminőség. Mezőgazda Kiadó Budapest,
19. **SOLANO, L., BARKEMA, H.W., ET AL.,** 2015, Prevalence of lameness and associated risk factors in Canadian Holstein-Friesian cows housed in freestall barns.. Journal of Dairy Science 98: 6978-6991.