MEDWELL PUBLISHING
Journal of Animal and Veterinary Advances 8 (5): 880-882, 2009
ISSN: 1680-5593

Estimation of Milk Yield and Economic Loss Resulting to Laminitis in Holstein Cow: A Case Study

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Abstract: This study was conducted to determine laminitis prevalence and evaluation of production and economic loss resulting to this disorder with use 100 Holstein cows in summery season. Cows distribute in 3 groups, High (H), Mild (M) and Low (L) producing with milk yield of 35 (SD 4.2), 26 (SD 3.6) and 18 (SD 3.4) kg and total number of cows in each group 26, 52 and 22 cows, respectively. Locomotion scores determined within each group with use back line and gait characteristics according to Sprecher's method. In this method, cows divided to 5 score where a score 1 show a cow that walks normally and a score of 5, a cow that is 3-legged lame. Scores 2 and 3 settled in subclinical and scores 4 and 5 considered to represent clinical group. Decrease of milk production and economic loss resulting to laminitis determined by Loss Calculator Software. Results indicated that the most number of normal; subclinical and clinical dairy cows were in L, M and H groups, respectively. Laminitis frequency, production and economic loss in H and M groups were greater than the L group. Milk production loss for H, M and L groups, were 0.98, 0.68 and 0.26 kg/cow/day. Also, economic loss was 791.4 US$ monthly, in dairy. This study showed that laminitis is important factor that affect production and incoming in Iranian dairy farms.

Key words: Laminitis, locomotion score, economic loss, Holstein cow

INTRODUCTION

Several studies have been stated milk losses caused by diseases (Rajala-Schultz *et al*., 1999). Lameness is an important disease in dairy cattle because of economic and welfare considerations and frequency of occurrence. Lameness ranks third in losses from diseases on dairy farms, following mastitis and fertility problems (Kocak and Ekiz, 2006).

Lameness has a high incidence and causes welfare problems, beside the financial losses. Some of the financial losses caused by lameness are decrease in milk production, the need for extra work and treatment expenses. Point prevalence for lameness of 8-15% in US studies and an average prevalence of 20.6% in Britain were reported. Economic decisions related to the value of preventing and treating lameness in dairy cows require accurate estimates of the associated costs.

Animal behavior could be as tool for evaluation of welfare and use for determination of adaptation of dairy cow with environmental and physiological circumstances (Warnik *et al*., 2001)

For definition of lameness in cattle, Manson and Leaver (1988) and Sprecher *et al*. (1997) developed a system that in these methods, cow can be locomotion scored. These scores include a category for imperfect locomotion or uneven gait to define a cow that is unsound (favoring on leg) but no clinically lame. Locomation score in Sprecher *et al*. (1997) method difine from 1-5 that 1 is healthy and 5 is sever lameness. In other division, scores 1 is healthy cow, 2 and 3, subclinical lameness and 4 and 5, clinical lameness.

The purpose of this study, is the determination of milk and economic losses in a known dairy cow's farm.

MATERIALS AND METHODS

The study was conducted in a dairy herd with approximately 100 dairy cows at Gonabad town (East of Iran) in October 2008. This herd consisted of purebred Holstein cattle and was totally confined in barn housing without access to pasture. The means of body weight of dairy cows was 620 (SD 50 kg). Animals were divided based on milk yield in 3 groups, High (H), Mild (M)

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Table 1: Locomotion scoring guide that used in this study

Score	Description	Back	Assessment
1	Normal	Flat	Cow stand and walks with a level back. Gait is normal
2	Mildly lame	Flat or arch	Cow stand level backed, but develops an arched back to walk. Normal gai
3	Moderately lame	Arch	Arched back is evident while, standing and walking. Gait is short stride
4	Lame	Arch	Arch back is always evident and gait is one deliberate step at a time. Cow favors one or more legs/feet
5	Severely	3-legged	Cow demonstrates an inability, or extreme reluctance to bear weight on one or more limbs/feet

Adapted from Sprecher *et al.* (1997)

and Low (L) producing with milk yield of 35 (SD 4.2), 26 (SD 3.6) and 18 (SD 3.4) kg and total number of cows in each group 26, 52 and 22 cows, respectively. Dairy cows were scored in a passageway with 10 m length and 2 m width. For determination of locomotion scores used Sprecher *et al.* (1997) method. Visually scored on a scale of 1-5 (Table 1), where a score of 1 reflects a cow that walks normally and a score of 5 reflects a cow that is 3-legged lame, LS is visually assessed in only a few seconds/cow. LS of 2 and 3 are considered to represent subclinically lame cows; whereas, LS of 4 and 5 represent those cows that are clinically lame.

Economic and milk yield losses were determined by use of loss calculator software (Robinson, 2003).

RESULTS AND DISCUSSION

The results are summarized in Table 2 and 3. Means (±SD) of locomotion scores were 2.32 (0.25), 2.22 (0.19) and 1.7 (0.15) for H, M and L groups, respectively. We found that lameness was more common in high producing dairy cows.

Barkema *et al.* (1994), Green *et al.* (2002) and Deluker *et al.* (1991) reported the important relationship between the milk production level or lactation stage and lameness incidence. These researchers were stated that high yielding dairy cows had a greater risk of lameness and the occurrence of lameness after peak yield associate with high milk production.

Cows with higher milk production have higher metabolic pressure due to more milk production. Feeding high amount of concentrate feedstuffs in this group cause to acute and Subacute Ruminal Acidosis (SARA). SARA-induced damage to the ruminal epithelium, allowing for the absorption of histamine and endotoxins. These and possibly other compounds disrupt normal circulation and cause inflammation with in the hoof, leading to the condition commonly referred to as laminitis (Stone, 2004).

The importance of reducing SARA was demonstrated in a 500 cows dairy diagnosed with SARA by Stone (2004), who replaced high-moisture corn with corn meal. In an apparent response to increased ruminal pH, milk production increased by 2.7 kg day^{-1} and milk fat and protein increased by 0.3 and 0.1 percentage points, respectively.

Table 2: Lameness prevalence and distribution (%) in different group of dairy cows

		Group[1]		
Type	LS*	H	M	L
Normal	1	26.3	21.8	52.9
Total normal		26.3	21.8	52.9
Subclinical	2	32.1	36.4	25.3
	3	36.6	40.1	21.1
Total subclinical		68.7	76.5	46.4
Clinical	4	2.8	1.2	0.6
	5	2.2	0.5	0.1
Total clinical		5	1.7	0.7

[1]H: High, M: Mild and L: Low producing cows, *LS: Locomotion Score, 1-5

Table 3: Milk yield and economic losses outcome from loss calculator software

	LS mean	Milk yield loss (kg)	Economic loss (US$*)	
Groups	(SD)	Cow day^{-1}	Cow day^{-1}	Group month^{-1}
H	2.32 (0.25)	0.98	0.39	304.2
M	2.22 (0.19)	0.68	0.27	421.2
L	1.7 (0.15)	0.26	0.10	66.0
Total				791.4

*Price of each kg milk was 0.401 US$

The results of yield and economic losses were shown in Table 3. The occurrence of lameness in this herd resulted in a decrease monthly yield and income 2761 kg and $791.4 for the dairy presumably in large part from an increase in the prevalence of SARA.

Warnick *et al.* (2001) investigate the effect of lameness on milk production for 1.5 year on 2 New York dairy farms. These researchers reported that in both herds, milk production decreased significantly for cow's diagnosed lame. Milk production was 1.5 kg day^{-1} lower ≥2 weeks after lameness compared with cows that had not yet been diagnosed lame in the current lactation in the larger herd. In the 2nd herd, milk production of lame cows was 0.8 kg day^{-1} lower in the 1st and 2nd week after lamenes and 0.5 kg day^{-1} lower ≥3 weeks after diagnosis.

In study of Stone (2004), replacing high-moisture corn with corn meal, the production and component increases resulted in an increased monthly income $20,000 for a dairy due to increase ruminal pH and decrease SARA prevalence.

Stone (2004) concluded that the nutrition program affects rumen health, which influences hoof health. Ration formulation involves a balance between acid and buffer production. The risk of SARA can be minimized by

considering the feed ingredients used to formulate the ration, along with the environment and management specific to that dairy. The formulation balance should be shifted toward additional physical effective NDF (peNDF) and less or slower fermenting Non Structural Carbohydrates (NSC) sources when the cow's environment (heat stress abatement, stall comfort, degree of overcrowding, etc.) or management (DM and ration accuracy, feed availability, etc.) is not as comfortable or reliable as desired.

ACKNOWLEDGEMENT

The authors are highly thankful to Payame Noor University of Bojnord for financial support of this research.

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