

## Study on Distribution of Dairy Cattle Hoof Lesions and its Relation to Locomotion Scoring

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### Abstract

**Objectives-** To evaluate the most important bovine digital lesions in shahrekord area and its correlation with locomotion scoring.

**Study Design-** Cross- Sectional descriptive study.

**Animals-** five hundred and eighteen cows inspected in two seasons.

**Methods-** Three dairy farms on three scales (1: Large, approximately 900 milking cows, 2: Medium, approximately 100 milking cows, and 3: Small, approximately 20 milking cows) were watched for lameness in 2005-2006. Locomotion scoring by Sprecher method (1-5 point scale) has been done for detection of lameness. Digital lesions in according to the area have been recorded. Sole ulcer, double sole and digital dermatitis were watched during study. Results were compared in different scores, parities, and days in milk (DIM).

**Results-** Forty eight percent of the inspected hooves affected with different digital lesions in autumn that was lower than spring (58.8%). No statistical difference between prevalence of each disease were recorded between autumn and spring ( $P>0.05$ ). Cows in score 1-5 were as 43.6, 46.9, 52.9, 61.8 and 77.7 % respectively, the number of affected digits (AD) significantly increased with the scores. More digital lesions were recorded in cows with higher scores. Digital Dermatitis (DD), sole ulcer (SU) and double sole (DS) show a significant difference between different scores as the highest distribution recorded in score 3. By increasing the locomotion scores (LS) the percent of the lesions like DD and DS return to its original or lower than original level, but in SU the percent of the disease is still higher than percent of the animals in score 1 ( $P<0.05$ ) that show the better ability of the scoring system in predicting SU. DD and DS was reduced significantly by

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increasing the parity, but SU significantly were increased by increasing the parity ( $P < 0.05$ ). No significant effect of days in milk has been detected on the prevalence of lesions under study, but descriptively most lesion was recorded in 31-60 days after parturition. Although percent of lesions decreased by parity but this decrease was not significant.

**Conclusions and Clinical Relevance-** Digital dermatitis is the most prevalent lesion of the hooves in Shahrekord area. Lameness scoring is a reasonable tool in investigation of the lameness that is specially capable of detecting heel horn erosions like sole ulcer.

**Key words-** Cow, Lameness, Locomotion scoring, Digital dermatitis, Sole ulcer, Double sole.

## Introduction

Lameness in dairy cows is a major concern for producers. Lameness tends to exhibit reduced productivity<sup>1</sup> and lower fertility<sup>2</sup>, which have economic implications for dairy producers<sup>3</sup>. Aside from production concerns, lameness can be a problem with respect to animal welfare<sup>4</sup>, particularly if the animal is exhibiting gait abnormalities because of discomfort. Singh et al. demonstrated that lame cows display abnormal behavior such as “sitting” and standing with the affected feet off the ground, indicating discomfort or pain<sup>3</sup>. Lameness may be culled from the herd at younger ages than their sound counterparts, thus shortening their lifespan<sup>1,4</sup>.

The causes of lameness are many and have not been fully elucidated<sup>5</sup>. The presence of lesions or joint pain can be influenced by a multitude of factors including increased standing time<sup>2</sup>, dietary level<sup>6</sup> and type<sup>8</sup> of concentrates, dietary levels of crude protein<sup>9</sup>, flooring type<sup>10,11</sup>, reproductive stage<sup>12</sup>, and physical conformation and genetics<sup>4</sup>. Given this wide range of factors, it is difficult to isolate a specific factor or set of factors contributing to lameness in a single cow.

Claw disorders are frequently reported in dairy cattle all over the world. Weaver reported that diseases of the claw account for about 90% of all lameness incidents<sup>13</sup>. Claw disorders are distinguished at clinical level (i.e. being lame) and at subclinical level (i.e. digital disorders recognizable at hoof trimming). Galindo and Broom noted that low-ranking cows spent more time standing half-in cubicles and thus had an increased incidence of lameness<sup>14</sup>.

The most common lesions detected in acute lameness in dairy cows recorded as sole ulcer, white line abscess, digital dermatitis and interdigital phlegmon<sup>15</sup>. Interdigital dermatitis and heel horn erosion are, in most cases subclinical hoof lesions that are related to inferior hygiene and the presence of contagious agents.

As the tough tissue of cattle hooves contains a large amount of keratin, a lack of this substance will compromise the integrity of the hoof, predisposing the sole to ulceration<sup>16</sup>. Other authors such as Livesey et al. demonstrated that lesions may not be caused by laminitis, and therefore are likely the result of external factors such as floor surface<sup>6</sup>. Choquette-Lévy et al. found that 95% of lesions occurred on the hindclaws<sup>5</sup>, which is similar to the findings of other authors such as Greenough and Vermunt and Clarkson et al.<sup>17</sup>. Despite the obvious relationship between the presence of lesions and exhibition of lameness, Logue et al. demonstrated that lameness may occur in the absence of lesions, or that the presence of lesions may not result in a lame cow<sup>18</sup>. Lesions are not the sole cause of lameness, or that lesions may not cause pain because their presence at the bottom surface of the hoof may be stemmed from corium damage that occurred several months earlier, and thus the injury is no longer painful.

Locomotion scoring (LS) is one of the most common ways for lameness detection and evaluation of its magnitude in dairy herds<sup>19</sup>, but no constant correlation between hoof lesions

and LS have been reported. Many authors believe that predictive value of LS is related to the most important hoof lesion in the herd<sup>18</sup>.

Current study were done to evaluate the current status of the lameness and hoof lesions in Shahrekord area. Regarding to geographic situation with more than 2000 meter altitude from sea level, very cold winters of the area (up to -40 °C for more than 30 days), 800 mm annual rain and a meter snow falling, this area somehow is different from other parts of Iran. Also using of LS as a constant measure in detecting lameness status could sometimes tricky and leads to over or underestimation of lameness that makes its evaluation useful regarding to hoof lesions.

## **Materials and Methods**

**Dairies:** Three dairy farms on three scales (1: Large, approximately 900 milking cows, with average milk production of 26 lit/day, 2: Medium, approximately 100 milking cows, with average milk production of 24 lit/day and 3: Small, approximately 20 milking cows, with average milk production of 25 lit/day) in Shahrekord area were watched for lameness and digital lesions during November 2005 – April 2006.

In farm one all cows were housed in 10 different partitions in according to milk production and days in milk. The number of the animals in each partition was not the same but their proportions to the surface area were approximately the same and were milked three times a day. In farm two and three, cows divided in two different partitions in according to their milk production and milked three times a day.

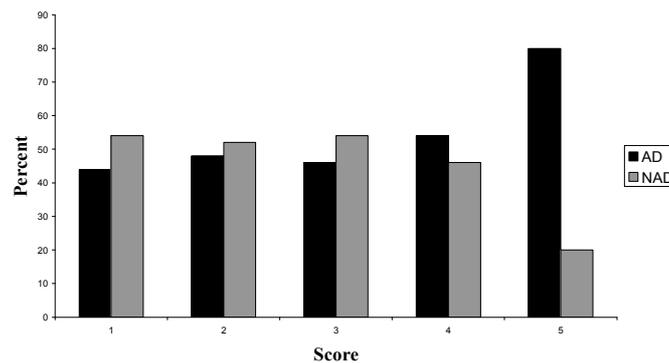
**Locomotion scoring (LS):** Locomotion scoring by 1-5 point scale<sup>19</sup> was done immediately after exit of the animals from milking parlor in a same time for all farms. At least 10 meter of their walk was videoed to get the best results. Results were watched by two observers who knew the method for lameness scoring and average of two scores were used as lameness score of each cattle. Two times of locomotion scoring were done (autumn and spring) and records of hoof trimming after each scoring were selected in current study.

**Hoof inspection:** Hoof trimming was done on a normal basis; normally each cow was trimmed two times a year as one time is immediately before drying period and the other time is around 100 days after parturition (DIM, 100 day). In addition to normal hoof trimmings cattle with scores 4 and 5 also referred to trimming for detection of any possible lesion in the hoof. Records of cows were collected in a hoof trimming record sheet, which contains number of the animal for getting individual details and also any possible injury in each digit. Digital dermatitis (DD), Sole Ulcer (SU) and Double Sole (DS) were notified during current study. All trimmers were trained to have enough information about each disease and its recording in a proper way in hoof trimming record sheet. Only the data of the cows who were trimmed from 15 days before to 15 days after trimming were used for analysis in this current study. All digits also divided in according to presence of obvious lesions (Affected Digits, AD) and without presence of obvious lesions (Non Affected Digits, NAD).

**Data gathering and analysis:** All data were described in different categories. In current study cows with locomotion scores of one and two recorded as non-lame animals and scores 3-5 recorded as lame animals. Days In milk and parity of each cow was recorded from farm data. Most numbers were reported descriptively, and according to what we were looking for, data were analyzed statistically. Numbers of lame and non-lame animals in each score were compared by Chi-Square test in each category by Sigmastat software (Jandel Scientific).

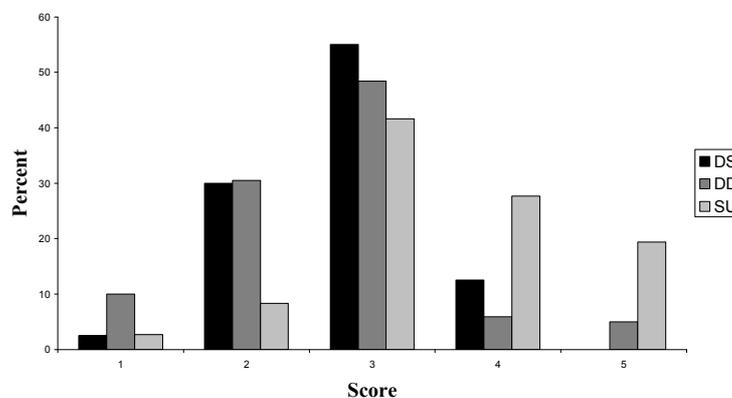
## **Results**

Two hundred and eighty four (284) cows were inspected in autumn that resulted in 138 (48.6%) AD and 146 (51.4%) NAD that was less than spring (Fig 1). DD, DS, and SU recorded as 69.56%, 14.49% and 15.94% respectively. In spring 234 cows were inspected that number of AD and NAD cows were 94 (40.17%) and 140 (59.83%) respectively. Total distribution of the AD in this season recorded as 58.8%. DD, DS and SU recorded as 82.98, 10.3 and 6.7% respectively. No statistical difference between distribution of each disease were recorded between autumn and spring ( $P>0.05$ ). Cows in score 1-5 were as 43.6, 46.9, 52.9, 61.8 and 77.7 % respectively, the number of AD significantly increased with the scores (Fig 2 & 3) (Chi-square,  $p<0.05$ ). More digital lesions were recorded in cows with higher scores (Fig 1).



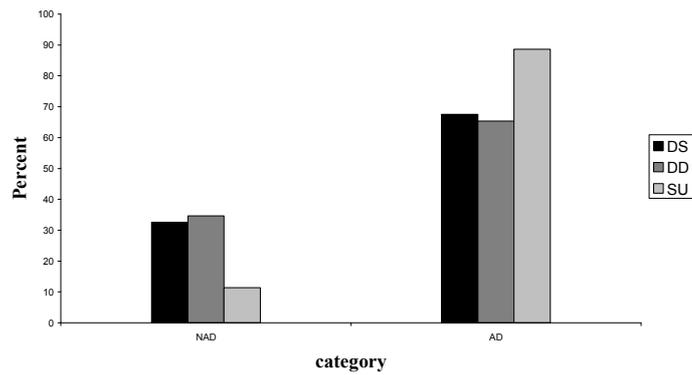
**Fig. 1: Distribution of AD and NAD cows in different scores.**

DD, SU and DS show a significant difference between different scores as the highest distribution recorded in score 3 (Fig 2).



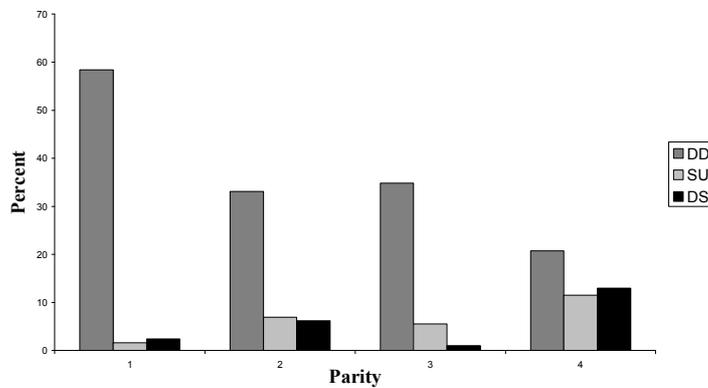
**Fig. 2: Distribution of different lesions in different scores**

Increasing the LS is concurrent with increasing of the percentage of the lesions like DD and DS that return to its original or lower than original level, but in SU the percent is still higher than score 1 ( $P<0.05$ ) that show the better ability of the scoring system in predicting SU (Fig 2). No significant difference between lame and non-lame cows in DD and DS was recorded but the percent of SU is significantly higher in lame group that once again showing the better predictive potential of the scoring system on detection of sole ulcer (Fig. 3).



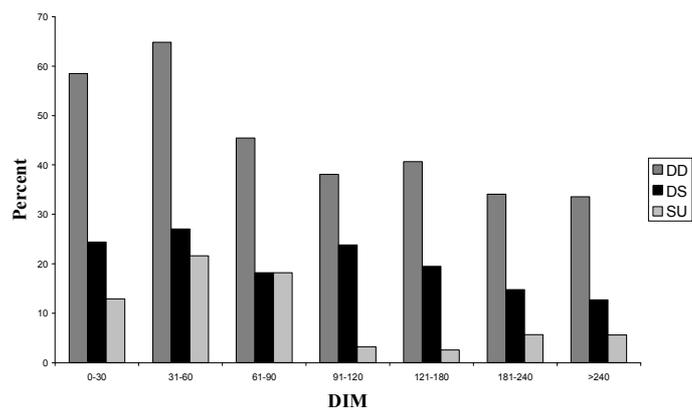
**Fig. 3: Distribution of lesions in NAD and AD cows**

In higher parities, DD and DS was reduced significantly (Fig 4), but SU were increased in higher parities ( $P < 0.05$ ).



**Fig. 4: Distribution of different lesions in different parities.**

No significant effect of days in milk has been detected on the prevalence of lesions under study, but descriptively most lesion was recorded in 31-60 days after parturition (Fig. 5).



**Fig. 5: Distribution of digital lesions in different DIM**

## Discussion

Digital dermatitis has the highest prevalence among lesions under study without any significant difference between autumn (69.56%) and winter (82.98%) ( $P < 0.05$ ). In most studies regarding prevalence of the lesions in dairy farms, heel horn erosions resemble the highest prevalence. Murray reported 40, 29 and 40% prevalence for sole ulcer, white line disease and digital dermatitis respectively<sup>20</sup>. The same order has been reported by Clarkson<sup>21</sup>, as prevalence of heel horn erosions and skin recorded as 79% and 36% respectively. Sole ulcers are the highest among these lesions. The same finding has been reported by Kossaibati as 60% of lesions recorded in horny covering and 36% affected skin of the digits in different areas as sole ulcer and digital dermatitis are the most important lesions in each category<sup>22</sup>. In contrast Offer reported a 44% prevalence of the lesions in skin and 38% in horny tissue of the digits<sup>23</sup>, and Laven reported a 41% prevalence of Digital dermatitis<sup>24</sup>. However regarding to Hedges findings prevalence of digital dermatitis is somehow the same as sole ulcer<sup>25</sup>.

Elevation of digital lesions by age has been reported previously as most of the cases have been reported on 5-8 years old cows<sup>26</sup>. Also parity 3 and higher reported the most prevalent parities for digital lesions<sup>27</sup>. In current study highest prevalence of the lesions recorded in first parity and by increasing parities the prevalence of the lesions is reduced. Digital dermatitis recorded as the most prevalent disease in current study and as documented by producing immunity in the herd and increasing the quality of the hoof, older cows are more resistant to the disease and this is why reduced percentage of the disease has been recorded in current study<sup>24,28,29</sup>.

By recognizing that many producers do not detect mild cases of lameness<sup>30</sup>, gait assessment or lameness scoring methods have been developed. The most common method of lameness detection involves observation of cows for any obvious gait abnormalities that has been improved by Sprecher<sup>19</sup>. Despite the obvious relationship between the presence of lesions and exhibition of lameness, Logue et al. demonstrated that lameness may occur in the absence of lesions, or that the presence of lesions may not result in a lame cow<sup>18</sup>. In a UK study of 111 cows with digital dermatitis on six different farms, Laven and Proven reported that 90% of cattle showed a pain response when light pressure was applied to the lesion, but only 27% of cows were lame<sup>20</sup>. What has been found in current study is that distribution of the lesions between scores did not follow a similar pattern in different lesions. For example in case of digital dermatitis a significant decrease of the lesions has been recorded by increasing the scores (as has been reported previously), but in sole ulcer, it has been increased by score and it seems that locomotion scoring is a good way to find new cases of sole ulcer. As it appears in Fig 1, it is obvious that total number of lesions has been improved by increasing locomotion score, but it may be different in different lesions.

In according to results descriptively more lesions have been recorded in second month after parturition. Laven and Blowey describe more lesions after parturition as a result of lower immunity; however metabolic stress in peak of production also may be resulted in softening of the horny covering of the hooves<sup>24,28</sup>. Livesey et al. showed that decrease of integrity and production of amino acids after parturition can be a reason for lower quality of the hooves<sup>31</sup>. More prevalence of the sole ulcer has been documented by Scott and Eddy<sup>32</sup>, however Kossaibati and Esselmont showed a higher prevalence of the sole ulcer 91-180 days after parturition<sup>22</sup>. Collick reported a decrease in prevalence of digital and interdigital dermatitis by increasing DIM<sup>33</sup>.

It can be concluded that digital dermatitis is the most prevalent lesion of the hooves in Shahrekord area that follows by double sole and sole ulcer. Lameness scoring is a reasonable

tool in lameness detection that is especially capable of detecting heel horn erosions like sole ulcer.

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## بررسی توزیع ضایعات سم گاوهای شیری و ارتباط آن با درجه بندی حرکتی گاو

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**هدف:** ارزیابی فراوانی بیماری های انگشتی گاو در ناحیه شهرکرد و ارتباط آن با درجه بندی حرکتی.  
**طرح مطالعه:** مطالعه توصیفی.

**حیوانات:** پانصد و هشتاد گاو که در دو فصل مورد مطالعه قرار گرفتند.

**روش کار:** سه گاوداری شیری در سه اندازه مختلف (۱: بزرگ با حدود ۹۰۰ گاو دوشا، ۲: متوسط با حدود ۱۰۰ گاو دوشا، و ۳: کوچک با حدود ۲۰ گاو دوشا) در سالهای ۱۳۸۵-۱۳۸۴ مورد مطالعه قرار گرفتند. درجه بندی حرکتی با استفاده از روش اسپرچر (پنج نقطه ای) انجام گرفت و ضایعات انگشتی با توجه به منطقه ابتلا سم نیز ثبت گردیدند. زخم کف سم، سم دولایه و درمانیت انگشتی در این مطالعه مورد ارزیابی قرار گرفته و یافته ها در درجات گوناگون حرکتی، شکم های زایمان و روزهای شیر دهی مطالعه گردید.

**نتایج:** چهل و هشت درصد سم های مورد مطالعه مبتلا به ضایعات مختلف در پاییز بودند که این میزان به طور معنی داری از میزان ۵۸/۸ درصدی ابتلا در بهار کمتر بود ( $P < 0.05$ ). ضایعات سم در اسکورهای حرکتی یک تا پنج با افزایش اسکور افزایش می یابد به گونه ای که ضایعات انگشتی بیشتری در اسکورهای بالاتر ثبت گردید. درمانیت انگشتی (DD)، زخم کف سم (SU) و سم دولایه (DS) در بین اسکورهای مختلف دیده می شود و بیشترین فراوانی در اسکور حرکتی سه ثبت گردید. با افزایش اسکور درصد فراوانی به میزان اولیه و یاحتی کمتر از آن بازمی گردد، اما در مورد زخم کف سم درصد بیماری در اسکورهای بالا به شکل معنی داری بیشتر از اسکوریک می باشد ( $P < 0.05$ )، که نشانگر توان بیشتر سیستم درجه بندی در شناسایی زخم کف سم می باشد. درمانیت انگشتی و سم دو لایه با افزایش شکم زایمان به شکل معنی داری کاهش می یابد و لیکن کف دو لایه با افزایش شکم زایمان افزایش می یابد. افزایش روزهای شیردهی تاثیر معنی داری روی فراوانی ضایعات مورد مطالعه نشان نمی دهد و لیکن به شکل توصیفی در روزهای ۶۰-۳۱ پس از زایش بیشترین فراوانی جراحات سم ثبت گردیده است. همچنین رخداد جراحات با افزایش شکم زایش کاهش می یابد هرچند که این کاهش معنی دار نیست.

**نتیجه گیری:** درمانیت انگشتی فراوان ترین ضایعه انگشتی در منطقه شهرکرد می باشد. درجه بندی حرکتی وسیله ای قابل قبول در مطالعه لنگش بوده که بویژه توانایی شناسایی ضایعات بافت شاخی مانند زخم کف سم را دارد.  
**کلید واژگان:** گاو، لنگش، درجه بندی حرکتی، درمانیت انگشتی، زخم کف سم، سم دو لایه