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# Prevalence of Teat End Callosity in East Azerbaijan Dairy Herds

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**Abstract:** Teat end callosity is a very important problem which affects cows in the farms of Iran and many other countries. This disease mainly caused by the over milking and defects in the milking machine. In this survey, we focused on the four large dairy Holstein herds consist 860 dairy cows at around of Tabriz (North-west of Iran) and we assisted the teat end callosity or hyperkeratosis and its relation with milking frequency per day. In the herds A (n = 300) and B (n = 160), cows were milked 3 times day$^{-1}$. In the herds C (n = 162) and D (n = 190) cows were milked 2 times day$^{-1}$. Prevalence of the teat end hyperkeratosis in the herds of A and B were recorded as 14.1%. In the herds of B and C this prevalence was 12.3%. Also, according to the Wilson's grading schedule the grades of 2 and 3 of hyperkeratosis more prevalent between the cows with 3 times milking day$^{-1}$ than cows with 2 times milking day$^{-1}$. Statistical analyses indicated significant differences between the herds of A, B (3 times milking day$^{-1}$) and herds of C, D (2 times milking day$^{-1}$). In conclusion, according to the results, significant relationship exists between the cow's teat end callosity and milking frequency/day.

**Key words:** Teat, callosity, Holstein, dairy cows, milking, Iran

## INTRODUCTION

After repeated milking, changes appear in teat-end tissue, resulting in the development of a callous ring around the teat orifice. Cow factors like teat-end shape, teat position, teat length, milk production, lactation stage and parity show a relationship with callused teat-ends (Bakken, 1981; Johansson, 1957; Michel *et al*., 1974; Neijenhuis *et al*., 2000; Rathore, 1977; Sieber and Farnsworth, 1981). As early as 1942, eroded teat orifices were linked to machine milking (Espe and Cannon, 1942). It is clear from more recent histological studies that the observed changes result from an increase or buildup of callous tissue around the orifice rather than an erosion of teat tissue or the orifice. The changes are associated with mechanical forces exerted by vacuum and the moving liner during machine milking. The magnitude of the force depends on milking vacuum, pulsation vacuum, machine-on time, liner type and teat shape (Ebendorff and Ziesack, 1991; Hamann, 1987; Mein and Thompson, 1993; Rasmussen, 1993). The huge variation in the frequency of callosity between herds using similar milking systems suggests that a major genetic influence to susceptibility should not be overlooked (Shearn and Hillerton, 1996). The teat canal is a primary barrier against invasion of mastitis pathogens into the udder. Maintenance of good condition of teat skin and tissues surrounding the canal is an important part of a program to obtain high quality milk. Short-term physiological effects of machine milking include teat congestion indicated by tissue swelling, hardness and color changes while heperkeratosis is a longer-term of teat skin (Mein *et al*., 2001).

Teat ends with rough surface is more difficult to clean during pre-milking preparation and provide a site for bacteria colonization. Neijenhuis *et al*. (2001) found a correlation between increased risk of clinical mastitis and very rough teat-ends. Hyperkeratosis (HK) of the skin surrounding the teat canal opening is a result of the stresses applied to skin when the milking liner collapses on the teat end. Liner Compression (LC) is a critical factor in reducing teat tissue congestion during milking and it can also influence peak flow rate and milking speed. At the same time, excessive Liner Compression (LC) contributes to the development of teat-end hyperkeratosis (Capuco *et al*., 1994). Too much LC may also remove excessive amounts of keratin from the teat canal which makes teats more susceptible to infections. Hyperkeratosis is also an undesirable condition also

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because it may contribute to cow discomfort during milking (Hamann, 2000). Liner Compression (LC) equal to mean arterial pressure (about 12 kPa) is thought to be sufficient to relieve congestion with additional Liner Compression (LC) providing no additional benefit for congestive relief (Mein *et al*., 1987).

More recently, it has been speculated that the Liner Compression (LC) required to relieve congestion has also been thought to increase as the milking vacuum level increases (Mein *et al*., 2003). The aim of this research was to assessment of teat end callosity or hyperkeratosis and its relation with milking frequency per day.

## MATERIALS AND METHODS

This research was carried out on May 2007 in the four large dairy herds (A-D) of Tabriz suburb (North-West of Iran) with the Mediterranean climate and 2000 m altitude above sea level. The herds were as following: Herd A included of 300 dairy Holstein cows with mean milk production of 32 kg/day/cow and 3 times milking day$^{-1}$ (8 a.m. and 14, 22 p.m.) cows were breed in open shade parlor. Herd B was included of 160 dairy Holstein cows with mean milk production of 30 kg/day/cow and 3 times milking day$^{-1}$ (5 a.m. and 13, 21 p.m.) cows were breed in free stall parlor. Herd C was included of 180 dairy Holstein cows with mean milk production of 28 kg/day/cow and 2 times milking day$^{-1}$ (4 a.m. and 16 p.m.) cows were breed in open shade parlor. Herd D was included of 220 dairy Holstein cows with mean milk production of 31 kg/day/cow and 2 times milking day$^{-1}$ (5 a.m. and 17 p.m.) cows were breed in open shade parlor. Nutrition of herds consisted of alfa alfa and corn silage as hay compartment of diet and concentrate consist corn, oat, cottonseed meal, soybean meal, fishmeal, vitamine and mineral supplements. In all of the herds, milking procedure was performed by West Valia Company or Delaval Company and in on herd by Ravand Company (native company) milking machines. Most of these machines work for >10 years. Before milking, teats of the cows were washed and dried by special papers and then we were inspected very carefully and categorized teat end callosity according to Wilson's grading schedule. According to this schedule, grade 1 is the normal teat end and grade 4 is the teat end with maximum hyperkeratosis. After milking post milking teat dipping were performed by iodine solutions. In this study, researchers used Cluster Random Method for sampling. Finally, collected data were analyzed by software of SPSS Version 13 and statistical method of Chi-square and Mann-Whitney tests.

## RESULTS AND DISCUSSION

Overall rate of teat end hyperkeratosis in the four groups (a total number of 860 cows) was 26.4% (Fig. 1). But in detail, the rate of teat end hyperkeratosis in the groups of 2 times milking/day/cows was 12.3% and in the groups of 3 times milking/day/cows was 14.1% (Fig. 2 and 3).

The rates of teat end hyperkeratosis in the two groups analyzed by Crosstab and Chi-square tests. The difference between two groups of cows (3 vs. 2 times milking day$^{-1}$) was highly significant ($p<0.01$) (Table 1 and 2). On the other hand, according to the Wilson's grading schedule, the rates of grade 2 teat end hyperkeratosis were more prevalent than of grades 3 and 4 in the herds (Fig. 4).

By using the Mann-Whitney U test for all of the quarters, it was revealed that the intensity of teat end hyperkeratosis in the 3 times milking day$^{-1}$ cows is >2 times milking day$^{-1}$ cows ($p<0.01$) (Table 3). Teat end callosity is a very important complication in the dairy herds of Iran and many other countries. A study categorized the forms of teat end hyperkeratosis into four

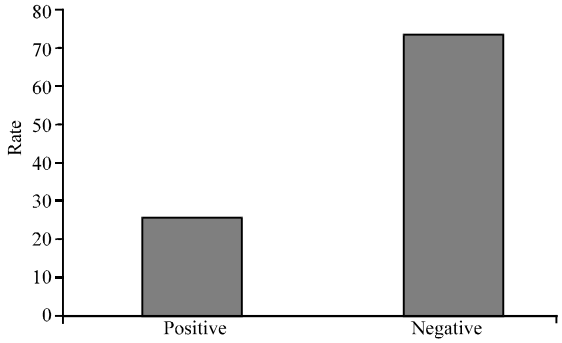


Fig. 1: Overall rate of teat end hyperkeratosis prevalence in the herds (A-D)

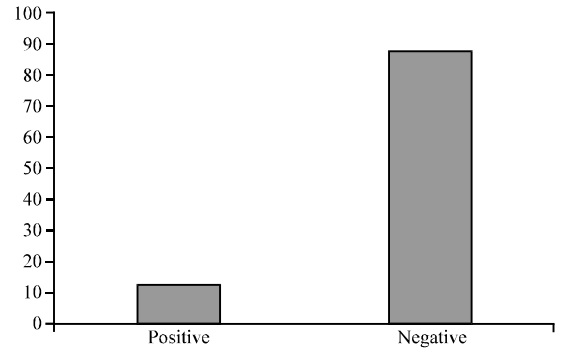


Fig. 2: Prevalence of teat end hyperkeratosis in the herds with 2 times milking day$^{-1}$ (C and D)

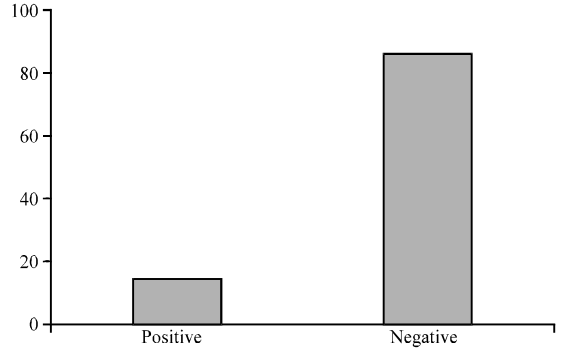


Fig. 3: Prevalence of teat end hyperkeratosis in the herds with 3 times milking day$^{-1}$ (A and B)

Table 1: Comparing the rates of teat end callosity between the herds with 2 and 3 times milking day$^{-1}$ by Crosstab test

| | Crosstab milking | | |
|---|---|---|---|
| Measuring rates | 3 | 2 | Total |
| Disease | | | |
| Negative count | 284.0 | 181.0 | 429.0 |
| Expected count | 296.1 | 132.9 | 429.0 |
| Percent within disease | 57.8 | 42.2 | 100.0 |
| Percent within milking | 44.5 | 72.4 | 53.2 |
| Percent of total | 30.7 | 22.4 | 53.2 |
| Positive count | 309.0 | 690.0 | 378.0 |
| Expected conunt | 260.9 | 117.1 | 378.0 |
| Percent within disease | 81.7 | 18.3 | 100.0 |
| Percent within milking | 55.5 | 27.6 | 46.8 |
| Percent of total | 38.3 | 50.6 | 46.8 |
| Total count | 557.0 | 250.0 | 807.0 |
| Expected conunt | 557.0 | 250.0 | 807.0 |
| Percent within disease | 69.0 | 31.0 | 100.0 |
| Percent within milking | 100.0 | 100.0 | 100.0 |
| Percent of total | 69.0 | 31.0 | 100.0 |

Table 2: Comparing the rates of teat end callosity between the herds with 2 and 3 times milking day$^{-1}$ by Chi-square test

| | Chi-square tests | | | | |
|---|---|---|---|---|---|
| Statistical tests | Values | df | Asymp. sig. (2-sided) | Exact sig. (2-sided) | Exact sig. (1-sided) |
| Pearson Chi-square | 53.848[b] | 1 | 0.000 | - | - |
| Continuity correction[a] | 52.735 | 1 | 0.000 | - | - |
| Likelihood ratio | 55.474 | 1 | 0.000 | - | - |
| Fisher's exact test | 53.782 | 1 | 0.000 | 0.000 | 0.000 |
| linear-by-linear association | | | | | |
| No. of valid cases | 807 | 1 | 0.000 | - | - |

[a]Compured only for a 2×2 table; [b]Cells have expected count <5. The minimum expected count is 117.10

grades which grade 1 was the normal teat end and grade 4 was the teat end with the maximum hyperkeratosis. The results of the study show that prevalence of teat end callosity in 3 times milking/day/cows was significantly higher (14.1) than the groups of 2 times milking/day/cows was (12.3%). Although, overall rate of teat end hyperkeratosis in this study was 26.4% that higher than world mean reported for this injury (15%).

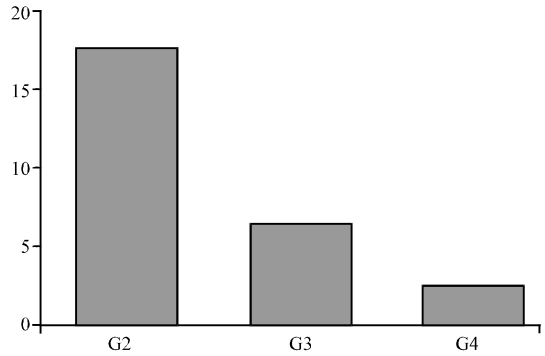


Fig. 4: Prevalence of grades 2-4 in the herds (A-D)

Table 3: Comparing intensity of teat end callosity between the herds with 2 and 3 times milking day$^{-1}$ by Mann-whitney U test

| | Ranks | | |
|---|---|---|---|
| Milking | N | Mean rank | Sum of ranks |
| Rcr 3 | 456 | 444.02 | 202471.50 |
| 2 | 350 | 350.71 | 122749.50 |
| Total | 506 | | |
| Rca 3 | 457 | 454.99 | 207930.50 |
| 2 | 349 | 336.08 | 117290.50 |
| Total | 806 | | |
| Lcr 3 | 456 | 444.13 | 202525.00 |
| 2 | 349 | 349.26 | 121890.00 |
| Total | 805 | | |
| Lca 3 | 456 | 440.46 | 200852.00 |
| 2 | 350 | 355.34 | 124369.00 |
| total | 806 | | |

| Test statistics[a] | Rcr[1] | Rca[2] | Lcr[3] | Lca[4] |
|---|---|---|---|---|
| Mann-whitney U | 61324.500 | 56215.500 | 60815.000 | 62944.000 |
| Wilcoxon W | 122749.500 | 117290.500 | 121890.000 | 124369.000 |
| Z | -7.533 | -9.233 | -7.763 | -6.975 |
| Asymp. Sig. (2-tailed) | 0.000 | 0.000 | 0.000 | 0.000 |

[a]Grouping variable: Milking; [1]Right cranial quarter, [2]Right caudal quarter; [3]Left cranial quarter; [4]Left caudal quarter

On the other hand according to the Wilson's grading schedule, the prevalence of grade 2, 3 and 4 teat end hyperkeratosis in the study were 17.5, 6.4 and 2.5%, respectively. This show that the prevalent of grades 2 and 3 teat end callosity is significantly higher than grade 4 in Azerbaijan dairy herds. Gleeson *et al.* (2004) in a study reported that the rate of teat end hyperkeratosis in the Irish Holstein dairy herds is 31.4% and the rates of grades 2-4 hyperkeratosis are 20, 5.5 and 0.5%, respectively. Kirk reported that the rate of teat end hyperkeratosis in the dairy farms of California is 23.8% and the rates of grades 2-4 are 24, 4.4 and 0.25%, respectively. In contrast with the above mentioned data, the results showed high rate teat end hyperkeratosis prevalence in the Tabriz dairy herds, especially in the herds with 3 times milking day$^{-1}$. Also, the rates of grades 2-4 teats end hyperkeratosis more prevalent than of other countries (Mein *et al.*, 2001). Shearn and Hillerton (1996) in UK studied deferent injures of teat end causes by milking machine and milking parlor

staffs. In this study, teats end hyperkeratosis have the highest prevalence (12.3%). These differences partly are related to the utilization of non-standard milking machines and non-standard teat dippers. But the most important factor in this case is the milking frequency/day. The following factors could be affecting the rate of teat end hyperkeratosis in a herd:

- Teat shape: convex teat ends are more susceptible to the hyperkeratosis than flat teat ends
- Incidence of teat end hyperkeratosis is more prevalent in the cold seasons (Winter and Spring) than warm seasons
- Defect in the milking machine function, directly lead to hyperkeratosis
- Hyper sensitivity to the teat dippers could be cause hyperkeratosis
- Increases in the cow age
- High milk production (Andrews *et al*., 1992)

## CONCLUSION

According to the results, milking frequency/day has a direct effect on the rate of teat end hyperkeratosis in the herds. In other word, increase in the milking frequency/day lead to increase in the teat end hyperkeratosis and consequent diseases such as black spot and mastitis in the herd.

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