

Total financial and avoidable losses due to lameness in Turkish dairy herds

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ARTICLE INFO

Article History

Received : 05.12.2022

Accepted : 12.10.2023

DOI: 10.33988/auvfd.1214635

Keywords

Avoidable

Financial losses

Lameness

Türkiye

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How to cite this article: Sariözkan S, Küçükoflaz M (2024): Total financial and avoidable losses due to lameness in Turkish dairy herds. Ankara Univ Vet Fak Derg, 71 (3), 329-334. DOI: 10.33988/auvfd.1214635.

ABSTRACT

This study aimed to estimate the total financial (direct and indirect) and avoidable losses related to lameness in Turkish dairy herds. Official and previous published data were used for determining the mean (12.9%) and target prevalence (6.6%) values. Direct financial losses due to lameness were calculated as treatment costs, involuntary culling, and milk yield losses. Indirect losses consisted of extended calving intervals and extra insemination losses. As a result, the average financial loss of lameness per case on dairy farms was \$153.8 (\$116.8 for mild and \$264.7 for severe forms) in Türkiye. Avoidable losses (\$75.1) were calculated to be equivalent to 187 liters of cow's milk with current prices for the 2023 year. The share of direct and indirect financial losses was 49.6% and 50.4%, respectively. Total annual losses related to lameness in Türkiye are calculated at \$130.5 million (326 million Lt. milk eq.), although \$63.7 million (159 million Lt. milk eq.) of the losses could be avoided by farmers. The milk equivalent of avoidable losses corresponds to 0.77% of Türkiye's total annual milk production. In conclusion, lameness causes significant financial losses in Turkish dairy herds. However, almost half of these losses (48.8%) may be avoidable with better management practices which help to increase the productivity and profitability of dairy farmers.

Introduction

Lameness is an endemic disease that causes significant financial losses, particularly on intensive dairy cattle farms (25). The disease can cause direct financial losses such as loss of milk yield, involuntary culling, and treatment costs, as well as indirect losses such as extended calving intervals and additional insemination for pregnancy (18, 28, 35). Lameness is also responsible for the third most crucial monetary loss after mastitis and fertility disorders in dairy farms (34). Complete elimination of endemic diseases (mastitis, metritis, lameness, etc.) in dairy production is not feasible (32).

The total losses due to lameness can be divided into avoidable and unavoidable losses (14, 49). While unavoidable losses may be the minimum cost for eliminating the disease under current conditions, avoidable losses may be considered an extra cost and incur costs over the unavoidable losses. Thus, avoidable losses can be reduced and/or avoided with a better management system.

The prevalence of lameness in dairy cattle varies according to race, age, nutrition, breeding type, parity, genetic predisposition, disorders of digits, environmental factors, climate, and region (41, 49). In Türkiye, the prevalence of lameness was reported to range from 4.5-40 (2, 24, 26, 27, 33, 38, 45, 48, 50-52). Studies conducted in different countries about the prevalence of lameness reported 8% in New Zealand (16), 11.6-22.9% in Ireland (42), 24% in Australia (4), 30.5% in the Czech Republic (37), 17-39% in Kosovo (23), 19-40% in Hungary (34), 21.4-31.6% in the UK (20, 31), 10-37% in the USA (22, 36), and 26.6-42.8% in the Netherlands (10).

On the other hand, many studies from different countries have reported financial losses caused by lameness (9, 12, 15, 21, 23, 28, 30, 34, 40, 47). However, there is a lack of detailed loss estimation due to lameness in dairy herds in Türkiye. Also, it has been observed that studies on this topic in Türkiye are limited to the technical aspects of the disease, such as prevalence and treatment

procedures (26, 33, 48, 52). Therefore, dairy farmers and policymakers need to know all aspects of fiscal impact (total losses) and the share of unavoidable/avoidable losses to provide optimal decision support.

This study aimed to estimate the total financial (direct and indirect) and avoidable losses related to lameness in Turkish dairy herds.

Materials and Methods

Considering the results of the over 10 studies (given in Table 1) conducted in six different geographical regions of Türkiye, the weighted mean prevalence of lameness in dairy herds was calculated at 12.9%, and the target

prevalence was assumed to be 6.6% (49). Financial losses were calculated for two forms (mild and severe cases) of the disease and an average case (75% mild and 25% severe) (49). In the loss calculations, digital and interdigital dermatitis, hyperplasia, and erosion were categorized as mild. In contrast, phlegmon, ungular fissure, abscess, white line disease, and sole ulcer were categorized as severe. Total, unavoidable, and avoidable losses of lameness for the Turkish economy were calculated using the losses per average case with 2023 prices.

Some technical and financial data and criteria used to estimate lameness-related losses are given in Tables 1 and 2.

Table 1. Technical and financial data used in estimating lameness-related losses.

Technical information	Value	Reference
a. No. of a total milked cow (head)	6,580,753	(44)
b. Mean prevalence of lameness (%)	12.9	*
c. No. of total infected cow (head)	848,917	Calculation (a × b)
d. Target prevalence (%)	6.6	(49)
e. No. of infected cow in target prevalence (head)	434,330	Calculation (a × d)
f. No. of infected cow over target prevalence (head)	414,587	Calculation [a × (b - d)]
g. Total milk yield (lt/lactation)	3,170	(17)
h. Daily milk yield (lt)	10.4	Calculation (g / 305)
i. Daily feed consumption (kg/head)	12	(49)
j. Consumed feed for 1 lt of milk (kg)	1.2	Calculation
k. Treatment period (min./case/day)	30	(49)
Financial information		
l. Farm-gate milk price (\$/lt)	0.4	(46)
m. Concentrated feed price (\$/kg)	0.4	(46)
n. Refresh heifer price (\$/head)	2,000	(46)
o. Culled cow price (\$/head)	1,200	(46)
p. Cost of culling (\$/head)	800	Refresh heifer-culled cow
q. Cost of labour (\$/hour)	2	Calculation
r. Cost of sperma (\$/dose)	15	Field survey
s. Cost of extended calving interval (\$/day)	5	(49)

*: (2, 24, 33, 41, 45, 48-50, 52).

Table 2. Some criteria used in estimating lameness related losses in study.

Parameters	Mild cases	Severe cases	Reference
-Intensity of cases (%)	75	25	(49)
-Possibility of vet. treatment (%)	10	30	(49)
-Possibility of farmer treatment (%)	90	70	(49)
-Treatment period (day)	5	8	(49)
-Decrease in total milk yield (%)	1.5	3	(14)
-Culling rate due to lameness (%)	1.2	1.8	(49)
-Extended calving interval (day)*	10	30	(14)
-Extra insemination (%)*	30	50	(5)
-Decrease in feed consumption (%)	15	30	(32)
-Vet. fee (\$/case)	20	30	Field survey

*: Indirect losses

Mild, severe, and total loss estimation due to lameness in Türkiye was calculated according to technical and financial parameters and data, as shown in Table 3.

In the financial analysis, a decrease in feed consumption due to lameness was also considered. Direct financial losses due to lameness were calculated as treatment costs, involuntary culling, and milk yield losses. Indirect losses consisted of extended calving intervals and extra insemination losses. Total losses were the subtraction of the decrease in feed consumption from the sum of total losses (direct and indirect losses).

Avoidable losses were calculated using target prevalence values, and over-target prevalence values were given for the avoidable losses. The calculations of losses were provided in US dollars and for the current 2023 prices.

Results

Financial losses due to mild and severe forms of lameness and average losses per infected cattle are presented in Table 4.

Total losses per mild and severe case due to lameness were calculated at \$116.8 (292 lt. milk equivalent) and \$264.7 (662 lt. milk eq.). Average losses per infected cow were calculated at \$153.8 (385 lt. milk eq.) in lameness, and \$75.1 (187 lt. milk eq.) of losses were avoidable. The highest loss item was the extended calving interval, both in mild (41.5%) and severe cases (54.3%). At the same time, the share of direct losses in mild form was 56.7% of total losses and decreased to 43.0% in severe form. Indirect losses related to the reproductive efficiency of animals were increased in extreme cases. Due to lameness, total milk losses and involuntary culling costs vary between 25.5-33.0% and 5.3-8.0%, respectively (Table 4).

Total, unavoidable, and avoidable losses of lameness in Türkiye are given in Table 5.

Total losses related to the lameness in the dairy industry for the Turkish economy were calculated at \$130.5 million (326 million lt. milk eq.). However, \$63.7 million (159 million lt. milk eq.) of the total losses (48.8%) could be avoided with better management of dairy farms in Türkiye. Total unavoidable losses were \$66.8 million annually (Table 5).

Table 3. Loss estimation model used in the study.

Losses	Estimation model
A- Mild cases (\$/case)	$A = [\text{Total milk yield (lt)} \times \text{Decrease in milk yield (\%)} \times \text{Farm-gate milk price (\$/lt)}]$
B- Severe cases (\$/case)	$B = [\text{Total milk yield (lt)} \times \text{Decrease in milk yield (\%)} \times \text{Farm-gate milk price (\$/lt)}]$
C- Average losses (\$/case)	$C = [(A \times 0.75) + (B \times 0.25)]$
D- Total losses (\$/year)	$D = [C \times \text{No. of total infected cow (head)}]$
E- Unavoidable losses (\$/year)	$E = [C \times \text{No. of infected cow in target prevalence (head)}]$
F- Avoidable losses (\$/year)	$F = [C \times \text{No. of infected cow over target prevalence (head)}]$

Table 4. Financial losses due to lameness in mild and severe cases in Türkiye.

Loss item	Mild form (\$/case)	Severe form (\$/case)	Average losses (\$/case)**
A. Direct Losses (1+2+3)	65.9 (56.7%)*	118.7 (43.0%)	79.1 (49.6%)
1. Total milk losses	39.8 (33.0%)	71.3 (25.8%)	47.7 (29.9%)
a. Decreased yield	19.0	38.0	23.8
b. Discarded milk	20.8	33.3	23.9
2- Treatment costs	16.5 (13.7%)	33.0 (11.9%)	20.6 (12.9%)
a. Drug, vitamin etc.	10.0	16.0	11.5
b. Vet. med.	2.0	9.0	3.8
c. Extra labor	4.5	8.0	5.4
3- Culling cost	9.6 (8.0%)	14.4 (5.3%)	10.8 (6.8%)
B. Indirect Losses (4+5)	54.5 (45.3%)	157.5 (57.0%)	80.3 (50.4%)
4-Extended calving interval**	50.0 (41.5%)	150 (54.3%)	75.0 (47.1%)
5-Extra insemination**	4.5 (3.8%)	7.5 (2.7%)	5.3 (3.3%)
C. Decreased feed consumption	3.6	11.5	5.6
TOTAL LOSSES [(A+B)-C]	116.8	264.7	153.8

*The value in parenthesis indicates its share in total losses. **In total losses 75% was mild and 25% was severe form.

Table 5. Total, unavoidable and avoidable losses of lameness in Türkiye.

Loss item	Total cost in Türkiye (\$/year)	Unavoidable cost in Türkiye (\$/year)	Avoidable cost in Türkiye (\$/year)
A. Direct Losses (1+2+3)	67,149,335	34,355,474	32,793,861
1. Total milk losses	40,472,118	20,706,665	19,765,453
a. Decreased yield	20,161,779	10,315,329	9,846,450
b. Discarded milk	20,310,339	10,391,336	9,919,003
2- Treatment costs	17,508,913	8,958,049	8,550,865
a. Drug, vitamin etc.	9,762,546	4,994,791	4,767,755
b. Vet. med.	3,183,439	1,628,736	1,554,703
c. Extra labour	4,562,929	2,334,522	2,228,407
3- Culling cost	9,168,304	4,690,760	4,477,544
B. Indirect Losses (4+5)	68,125,589	34,854,953	33,270,637
4-Extended calving interval**	63,668,775	32,574,722	31,094,053
5-Extra insemination**	4,456,814	2,280,231	2,176,584
C. Decreased feed consumption	4,732,712	2,421,388	2,311,325
TOTAL LOSSES [(A+B)-C]	130,542,212	66,789,039 (51.2%)	63,753,173 (48.8%)

Discussion and Conclusion

Besides being a serious animal welfare issue, lameness is a significant endemic disease on dairy farms in Türkiye, as in many other countries (3). The reported prevalence values for lameness in Türkiye are mainly in line with the figures reported from other countries (1, 10, 20, 36, 37, 39, 42).

Lameness also causes significant financial losses not only on individual farms but also at the national level. In the current study, the mean loss per case was found to be \$153.8 (\$116.8 for mild and \$264.7 for severe forms). In the literature, financial losses due to lameness in an infected animal were reported as £246-323 in the UK (28, 47), \$95-127 in the Netherlands (6, 11, 12), €192 in Denmark (15), €100-300 (34), \$120-533 in the USA (8, 21, 30, 40), \$6.2-283 in Türkiye (3, 19, 49), \$53-622 in Spain (9), €54.5 in Hungary (29) and \$227 in Brasil (43).

Although prevalence values are effective in determining the magnitude of financial losses due to lameness, it is thought that some different methodological approaches encountered in the calculations and the severity of the disease also have a significant impact (8, 32, 34, 47). For example, while some researchers (13, 14, 47) consider losses more detailed (indirect losses, decrease in feed consumption of diseased cows, labor cost, etc.), as in this study, some other studies only consider direct losses (5, 12). Therefore, comparisons of the studies about the total losses and direct and indirect losses due to lameness are getting more complex.

In this study, besides the prevalence values due to lameness, determining the target prevalence level and calculating the avoidable losses are novel findings for Türkiye. Having knowledge about avoidable losses is significant for farmers to understand the extent of the disease problem and how much they can reduce these

losses. So, this evidence-based information can be used as a decision-support tool by dairy farmers.

Contrary to this study, avoidable losses are not considered in most studies. Almost half of the avoidable losses (48.8%) can be considered a potential opportunity for dairy farmers and decision-makers in disease control. The milk equivalent of avoidable losses corresponds to 0.77% of Türkiye's total annual milk production. Similarly, in the study conducted by Esslemont and Spincer (14) in British field conditions, it was reported that 82% of the total loss was an avoidable loss. In a previous study conducted in Türkiye, it was reported that 62% an avoidable loss (49).

In conclusion, besides total losses due to disease, knowing the amount of avoidable losses is vital to ensuring economic efficiency for farmers in disease prevention and control decisions. However, to provide healthier decision support to farmers and policymakers against lameness, determining the alternative control strategies and their effects on prevalence and losses can improve their success in production.

Financial Support

There is no funding source.

Ethical Statement

Ethical committee approval is not required.

Conflict of Interest

The authors declared that there is no conflict of interest.

Author Contributions

SS, designed the research, analysis, supervision, writing, and editing. MK, investigation, collecting the data, writing, and review.

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