

## Estimation of the Economic Losses Related to Calf Mortalities Kars Province, in Turkey

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### Abstract

In this study, calf in Turkey live cattle stock in an important position in terms of the Kars dairy cattle-feeding operation, maintenance practices and differences in the level of knowledge and is intended to determine the economic losses due to calf mortalities. The material of the study was constituted by the data obtained from the interviews conducted with 108 dairy cattle business owners in the central villages of Kars. In the interviews, data about 0-180 days old patients and deceased calves were collected from livestock enterprise owners in 2016-2017. In this study, economic losses due to calf mortality were determined by taking into account the calculation methods in the literature. In the study, it was determined that 281 (24.65%) of 1140 calves had various diseases in 2017 and 63 (5.52%) of them died. It was calculated that an average of 156.32 TRY (\$43.95) was spent per animal and the economic loss due to calves that died was estimated as 4.597 TRY (\$1.293). As a result, it has been shown that training studies aiming to increase producer knowledge levels in minimizing calf diseases and deaths are important.

**Keywords:** Calf mortality, Economic loss, Treatment and medicine expenses

## Kars İlinde Buzağı Ölümülerine İlişkin Meydana Gelen Ekonomik Kayıpların Tahmini

### Öz

Bu araştırmada Türkiye'de canlı sığır stoku açısından önemli bir konumda olan Kars ili süt sığırçılık işletmelerindeki buzağı bakım-besleme uygulamaları ve bilgi düzeyindeki farklılıklar ile buzağı kaybına bağlı ekonomik kayıpların tespit edilmesi amaçlanmıştır. Araştırmanın materyalini Kars merkez köylerinde bulunan toplam 108 adet süt sığırçılık işletme sahiplerinden elde edilen veriler oluşturmuştur. Yapılan görüşmelerde 2016-2017 yıllarında işletme sahiplerinden 0-180 günlük yaşındaki hasta ve ölen buzağılara ilişkin veriler toplanmıştır. Çalışmada buzağı ölümlerine bağlı ekonomik kayıplar literatürde yer alan hesaplama yöntemleri dikkate alınarak tahmin edilmiştir. Yapılan çalışmada 2017 yılında 1140 buzağıdan 281 (%24.65) tanesinin hastalandığı, hastalananlardan 63 (%5.52) tanesinin ise öldüğü belirlenmiştir. Yapılan çalışmada 2017 yılında cari fiyatlar üzerinden işletmelerin 281 hasta buzağı için tedavi, ilaç ve bakım masrafı olarak toplam 11.346 TL (\$3.190); hayvan başına ortalama 156.32 TL (\$43.95) harcama yapıldığı ve ölen bir buzağının ekonomik kaybının tahmini olarak ortalama 4.597 TL (\$1.293) olduğu hesaplanmıştır. Sonuç olarak buzağı hastalıkları ve ölümlerinin en azı indirilmesinde üretici bilgi düzeylerinin artırılmasına yönelik eğitim çalışmaları önem arz etmektedir.

**Anahtar sözcükler:** Buzağı ölümleri, Ekonomik kayıp, Tedavi ve ilaç masrafları

## INTRODUCTION

Breeding calves for meat and dairy production, which also ensures the continuation of the herd, has economic values for enterprises. The survival of each newborn calf, the income from the calf sale, the increase in the milk yield

of cows and the growth of the herd; these three reasons are important for dairy farms <sup>[1]</sup>. In dairy farming, milk accounts for 60% of the income, while the increase in calves and inventory value makes up 40% of the income. In other words, new-born calves are approximately 40% effective in the incomes of enterprises <sup>[2]</sup>.



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The husbandry and feeding of calves is very important in the first week following their birth. However due to differences in practice during the growth period of calves, the likelihood of disease prevalence in livestock enterprises, calf mortality and cost of growth can be change. In European countries, neonatal calf mortalities have been reported to be 10-15% in livestock enterprises while this rate can reach up to 50% in Turkey <sup>[3]</sup>.

One of the most important problem for dairy farming in Turkey, as in most countries in the world are calf disease. Because economic losses arise resulting from veterinary-treatment costs, husbandry costs and death of a calf due to diseases the calves can be catch. Growth retardation also affects the profitability of the livestock enterprises negatively, leading to loss of meat, milk and/or reproduction <sup>[2,4-6]</sup>. Due to a lack of records in Turkey, the rate of calf mortality is not exactly known. In this study, economic losses resulting from calf mortalities In this study, the economic loss of calf deaths, one of the most important problems of the livestock sector, which is important for the contribution of the produced animal food products to the economy has been investigated. In this study, the economic losses due to loss calf were identified in the dairy cattle farms are located in Kars province in Turkey.

## MATERIAL and METHODS

The material of this study was the data obtained during the interviews conducted with a total of 108 cattle breeding enterprise owners based in central villages of the province of Kars in Turkey. In this study, data on the owners of calves aged between 0 and 180 days were collected to determine the disease and mortality rates in calves in the study region and the economic losses associated with these rates.

In the interviews, a questionnaire was applied to the owners of the calves born in the years 2016 and 2017 and the information about diseased and dead calves were obtained. The questionnaire was consists of two main topics: the owner of the livestock enterprises and the information regarding the calves. The data obtained from the interviews were calculated by using percentage and frequency values, average values and Anova test via the SPSS 16 statistical package program <sup>[7]</sup>.

The disease prevalence ratio (PR) for the study was found using the following formula:

$$PR (\%) = (\text{Total calf number with a disease symptom} / \text{Total calf number (calf/year)}) \times 100$$

The mortality rate (MR) was calculated as follows <sup>[8]</sup>:

$$MR (\%) = (\text{Number of calf deaths (calf/year)} / \text{Total calf number (calf/year)}) \times 100$$

The economic losses in the participating enterprises were calculated considering only the diseased calves, regardless of the cause of the disease. In the economic analysis, the dead calves were divided into three groups according to their ages (1<sup>st</sup> group: younger than 30 days, 2<sup>nd</sup> group: 30-89 days, 3<sup>rd</sup> group: 90-180 days). The method used to estimate the calf mortalities is given in Table 1 <sup>[9-11]</sup>. However, for this study, the calculation methods used in the literature to calculate the economic loss due to calf mortalities were modified according to the research conditions. In the calculation of economic losses related to calf deaths, the loss of the mother's milk yield and the price of heifers and the developmental delays that occurred later were taken into consideration.

In the economic analysis of calf deaths, the financial values of calves, deaths, alternative costs and treatment costs due to diseases were taken into consideration. In interviews, it was determined that the owners of the calves applied traditional animal breeding methods in calves. In this context, it was found that calf mortalities reduced cows' milk yield by 20-30%. For all that, in calculating the economic losses due to calf mortalities within 30 days, milk yield loss was also taken into account. If the calf is alive, it is determined that milk, meat and reproductive performance are lower than diseased calves. For this reason, in calculating the opportunity cost, the value of the replacement heifer was taken into account in relation to the developmental retardation that occurred in the diseased calf. The value of the replacement heifer 65% (60-70%) of the healthy animal value was considered. In this study, 18-month-old animals were considered as heifer in calculating the opportunity cost. Therefore, the average cost of feeding the calves was calculated as a heifer (12, 15, 17 per month). In the analysis, the opportunity cost was calculated by decreasing the estimated maintenance- feed cost from the price of a replacement heifer (\$/head).

**Table 1.** Economic loss calculation method

Group	Calculation Method
<30 days old calf	(Dead calf's value) + (250 days * loss of dairy milk * dairy milk price) + (Veterinary and treatment costs) + Opportunity cost (Price of a replacement heifer - estimated 17 months maintenance feed costs)
30-89 days old calf	(Dead calf's value) + (Veterinary and treatment costs) + Opportunity cost (Price of a replacement heifer - estimated 15 months maintenance feed cost)
90-180 days old calf	(Dead calf's value) + (Veterinary and treatment costs) + Opportunity cost (Price of a replacement heifer - estimated 12 months maintenance feed costs)

The technical and financial parameters used in the financial analysis and the values obtained from the relevant producer opinions are given in *Table 2*.

## RESULTS

In the interviews conducted, it was found that 108 producers who participated in the survey study had a mean age of 43.24 (min: 18, max: 73), a mean experience of 21.89 years (min: 1, max: 50) and a monthly average income of 1.050 Turkish Lira (TRY)/\$287. General information regarding the participants is given in *Table 3*.

The months when births are frequent in the study region are shown in *Fig. 1a*. It can be seen from *Fig. 1a* that the enterprises experience birth in every period of the year, however, births were concentrated between January and May.

Questions regarding calf care asked during interviews are given in *Table 4*. As shown in *Table 4*, it is seen that 89% of the enterprises had a separate compartment for the calves in the barns. In addition, it was determined that 68.5% of the calves drank colostrum within the first 6 h after birth.

The obtained data on the number of animals in the enterprises are given in *Table 5*. In the interviews, it was determined that the total of 313 (29.50%) in 2016 and 281 (24.65%) in 2017, diseased calves in 108 enterprises.

*Table 6* shows the general condition of the animal shelters owned by the participants and the frequency of their cleaning owned by the participants. An average of 2.60 calves in 2017 was found to be diseased. In the analysis, no statistically significant relationship was found between educational status and number of diseases calves per

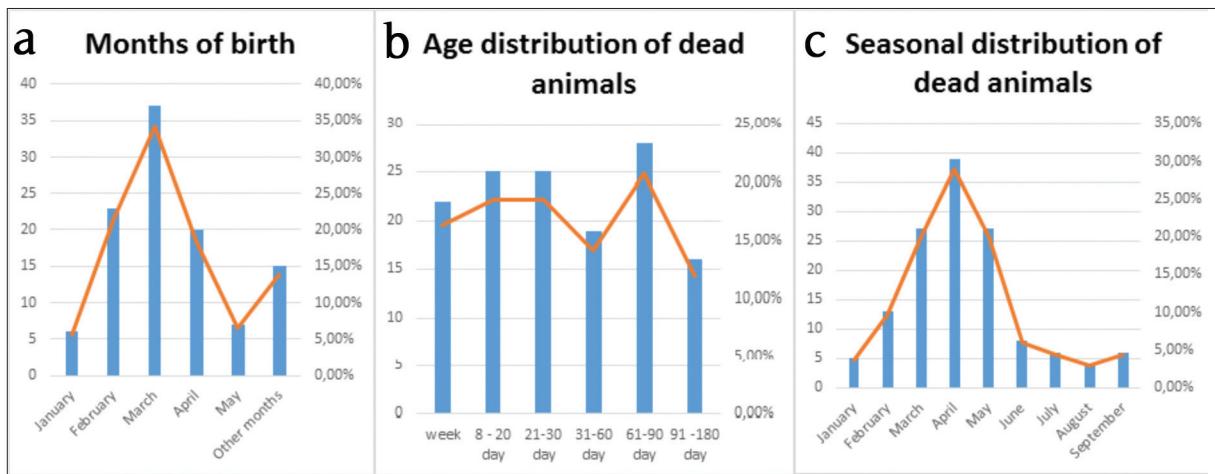
**Table 2.** Technical and financial parameters used in estimating calf mortality related losses

Parameters	Value	Parameters	Value
30-day average calf price	3000 TRY (\$ 845)	Cost for 30-day diseased calf (treatment + medication + care)	85 TRY (\$24)
30-89 day average calf price	3500 TRY (\$ 984)	Cost for 30-89 day diseased calf (treatment + medication + care)	145 TRY (\$41)
90-180 day average calf price	4000 TRY (\$ 1125)	Costs for 90-180 days of diseased calf (treatment + medication + care)	240 TRY (\$68)
Annual milk production (lt/cow)	10	Milk loss from cow due to loss of calf (%)	25% (20-30%)
Price of a replacement heifer	3900 (\$ 1097)	1 day calf care-feeding cost	7 TRY (\$2)

\*1 \$ = 3.556 TRY

**Table 3.** General information about the participants

Education Status	Frequency	%	Age Average	Experience Year	Income (TRY)
Illiterate	2	1.9	59.50	29.00	650.00
Primary school	38	35.2	46.89	25.51	885.71
Middle school	32	29.6	46.12	24.34	987.50
High school	29	26.9	36.93	16.03	953.44
University	7	6.5	31.71	13.85	1226.31



**Fig 1.** a- Months of birth; b- Age distribution of dead animals; c- Seasonal distribution of dead animals

<b>Table 4.</b> Calf care information					
Parameters	Yes		No		
	Frequency	%	Frequency	%	
Is there a separate compartment in the barn for the calves?	96	88.9	12	11.1	
Are diseased calves separated from other calves?	62	57.4	46	42.6	
Are umbilical cords cleaned with disinfectant after birth?	60	55.6	48	44.4	
Do you feed calves with colostrum within the first 6 hours of after birth?	74	68.5	34	31.5	
Parameters	Min.	Max.	Average	Std. Dev.	
Average daily amount of milk the calves drink (L/day)	1.00	5.00	2.20	1.00	
Mean duration of weaning of calves (Months)	1.00	8.00	4.07	1.05	

<b>Table 5.</b> Data on animal numbers							
Enterprises Data		Year	Min.	Max.	Total	Average	Std. Dev
Total cattle (head)		2016	3	150	2.584	24.14	19.28
		2017	2	140	2.637	24.65	18.65
Number of cows (head)		2016	2	35	1.380	12.89	6.88
		2017	2	35	1.458	13.50	7.25
Number of calves (head)		2016	1	22	1.061	9.92	5.08
		2017	1	25	1.140	10.65	5.69
Number of diseased calves (head)		2016	0	22	313	29.50	3.25
		2017	0	15	281	24.65	2.97
Cost for diseased calf (TRY/head) (treatment + medicine + care)		2016	20	300	7.279	103.98	64.75
		2017	25	1.000	11.346	156.32	162.99
Number of calf mortality (head)		2016	1	7	72	6.78	1.05
		2017	1	3	63	5.52	0.70

<b>Table 6.</b> General condition of barns and cleaning frequency									
Condition of the Barn	Frequency	%	Diseases Calf Rate	Std. Error	Cleaning Frequency	Frequency	%	Diseases Calf Rate	Std. Error
Good	23	21.3	1.65	0.375	1 per day	34	31.5	2.73	0.606
Middle	67	62.0	3.05	0.401	2 per day	55	50.9	2.60	0.335
Bad	18	16.7	2.11	0.598	3 per day	19	17.6	2.52	0.646
Total/Mean	108	100.0	2.60	0.283	Total/Mean	108	100.0	2.60	0.283
F/P Value	F=2.301 p=0.105				F=0.30 p=0.971				

enterprise ( $P>0.05$ ). In addition, there is no statistically significant relationship between the general structure of the barn and the frequency of cleaning and the number of diseases calves per enterprise ( $P>0.05$ ).

The diseases seen in the calves in 2016 and 2017 are given in [Table 7](#). [Table 7](#) shows that enteritis, respiratory diseases and foot-mouth disease are more common in calves and umbilical cord infections, tympani, meningitis and other causes were frequently seen.

[Table 8](#) provides information on a total of 135 calves that

died in 2016 and 2017. In the table, the first cause of death is seen as enteritis with a rate of 45.2%, followed by respiratory diseases with a rate of 22.2% and foot-and-mouth disease with a rate of 19.3%.

It was determined that 53.3% of the dead calves were female and 46.7% were male. No statistically significant difference was found between gender and calf death ( $P>0.05$ ). In the [Table 8](#), when grouped according to breeds, it is apparent that the deaths occurred in earlier days (47 days) for the local breed and in later days (60 days) for the simmental breed. However, no statistically

**Table 7.** Diseases seen in calves in 2016 and 2017

Disease	2016		2017		Average
	Frequency	%	Frequency	%	
Enteritis (Diarrhoea)	23	25.00	24	26.67	25.82
Respiratory Diseases	15	16.30	15	16.67	16.48
Foot-and-Mouth Disease (FMD)	12	13.04	13	14.44	13.74
Umbilical Lesions	4	4.35	4	4.44	4.40
Enteritis - Respiratory Diseases	14	15.22	14	15.56	15.38
Enteritis - Umbilical Lesions	6	6.52	11	12.22	9.34
Other	18	19.57	12	13.33	16.48
Total	92	100.00	90	100.00	100.00

**Table 8.** Information on the dead calves

Parameters		DAK/Local	Hybrid	Brown Swiss	Simmental	Total
Number of calves (head)		31 (23.0%)	46 (34.1%)	41 (30.4%)	17 (12.6%)	135 (100%)
Mean Age of Death (X±SS) (Day)		47.1±44.1	52.8±52.5	57.2±38.1	59.8±56.0	53.78±46.80
Gender (head)	Female	20 (64.5%)	27 (58.7%)	16 (39.0%)	9 (52.9%)	72 (100%)
	Male	11 (35.5%)	19 (41.3%)	25 (61.0%)	8 (47.1%)	63 (100%)
Cause of death (Head)	Enteritis	13 (21.3%)	20 (32.8%)	19 (31.1%)	9 (14.8%)	61 (100%)
	Respiratory diseases	9 (30.0%)	10 (33.3%)	9 (30.0%)	2 (6.7%)	30 (100%)
	FMD	5 (19.2%)	9 (34.6%)	9 (34.6%)	3 (11.5%)	26 (100%)
	Umbilical	0 (0.0%)	1 (25.0%)	1 (25.0%)	2 (50.0%)	4 (100%)
	Tympany	3 (37.5%)	2 (25.0%)	2 (25.0%)	1 (12.5%)	8 (100%)
	Other	0 (0.0%)	1 (16.7%)	2 (33.3%)	3 (50.0%)	6 (100%)

**Table 9.** Age of death and causes of death

Day	Enteritis	Respiratory	FMD	Umbilical	Tympany	Other	Total
1 week	16 (72.7%)	5 (22.7%)	0.0	0.0	0.0	1 (4.6%)	22 (100%)
8 -20 day	14 (56.0%)	6 (24.0%)	3 (12.0%)	0.0	0.0	2 (8.0%)	25 (100%)
21-30 day	14 (56.0%)	4 (16.0%)	2 (8.0%)	3 (12.0%)	2 (8.0%)	0.0	25 (100%)
31-60 day	5 (26.3%)	7 (36.8%)	5 (26.3%)	1 (5.3%)	1 (5.3%)	0.0	19 (100%)
61-90 day	7 (25.0%)	6 (21.4%)	11 (39.3%)	0.0	3 (10.7%)	1 (3.6%)	28 (100%)
91-180 day	5 (31.2%)	2 (12.5%)	5 (31.2%)	0.0	2 (12.5%)	2 (12.5%)	16 (100%)
Total	61 (45.2%)	30 (22.2%)	26 (19.3%)	4 (3.0%)	8 (5.9%)	6 (4.4%)	135 (100%)

**Table 10.** Estimated economic loss due to calf mortalities (TRY)

Groups	Per Animal	Total Loss
<30 day	3.978	194.922
30-89 day	4.395	184.590
90-180 day	5.420	238.480
Mean/Total	4.598	617.992

significant difference was found between race and age of death ( $P>0.05$ ).

The ages (days) of calves when they died are given in *Fig. 1b*. From the table it can be seen that 53.3% of calves died in less than 30 days, while 20.7% of deaths occurred within 61-90 days, followed by 18.5% within 8-20 days and 21-30 days after birth.

In *Table 9*, the findings regarding age and causes of death

are given. As can be seen from the table, enteritis with a rate of 72.7% and respiratory diseases with a rate of 22.7% were the leading causes of deaths within the first week after birth. More deaths were seen related omphalitis and tympani on the 21<sup>st</sup> and 30<sup>th</sup> days following birth and foot-and-mouth disease on the 31<sup>st</sup> and 90<sup>th</sup> days.

The breakdown of the deaths of calves seen in the enterprises over the years is shown in *Fig. 1c*. As can be seen from *Fig. 1c*, calf mortalities showed an increase with the start of winter and peaked in spring.

Estimated economic losses from animal and per calf deaths per farm are shown in *Table 10*. As can be seen from the table, economic loss due to calf mortalities is estimated to be 4.597 TRY (\$1.293) per animal, with a total loss of 617.992 TRY (\$173.788) considering the total of 135 calf mortalities.

## DISCUSSION

In the interviews, 62% rate of the participants stated that the current status of their stables is moderate. This result is close to the findings (58%) of the study conducted by Tilki et al.<sup>[12]</sup>. On the other hand, Demir et al.<sup>[9]</sup> and Demir et al.<sup>[13]</sup> reported that the majority of the barns in the region were technically inadequate, traditional and of the same type and that a large part of the barns was inadequate for ventilation and lighting. In this study, it was determined that 89% of the enterprises had calves present in the same barn but in separate sections and the barns were technically inadequate. In the interviews, it was stated that the winter was harsh and the animals were kept together due to heating problems. Bozukluhan and Gökce<sup>[14]</sup> stated that the septicaemia neonatorum was found in calves because of the contamination of the barns in the region and the presence of many cattle from all age groups in the same barn.

Feeding a calf with sufficient amount of colostrum is very important for health and vitality. However, it was determined that only 68.5% of the enterprises in the region gave calves colostrum within the first 6 h after birth. The low rate is due to the fact that many farmers in the locality think that colostrum causes enteritis in calves. However, postpartum period is the most common case of the calf with pathogenic microorganisms, and immune substances from the mother can only be transferred via colostrum<sup>[14]</sup>. In addition, the colostrum protects the offspring from diseases which they may encounter within the first 3-4 months of their lives<sup>[15]</sup>. From this point of view, it can be said that producers do not have enough knowledge about the importance of colostrum.

In this study, data were collected on 0-180 day old diseased and dead calves in the region. As a matter of fact, studies on diseased animals such as cattle and sheep reported that the highest amount of disease in the entire age group was observed in the 0-6 month period<sup>[14,16]</sup>. For the cattle brought to the clinic of Kafkas University Veterinary Faculty,

the rate of calves was determined as 56.30%<sup>[17]</sup>. This situation was attributed to an inadequate immune system against bacterial, viral and parasitic infections in calves<sup>[18]</sup>.

In this study, it was determined that average 13 cattle and 10 calves per enterprise. Approximately 30% of 1061 calves in 2016 year and 25% of 1140 calves in 2017 year were found to be diseased. This rate was found to be close to the morbidity rates between 20-30% in other studies<sup>[19,20]</sup>. But this rate found to be lower than the other study conducted by Erdogan et al.<sup>[21]</sup> (51.1%, 36.3%) in 2001 and 2002 in the province of Kars. This situation has been interpreted as increasing the knowledge of livestock enterprises about maintenance and feeding.

In some studies, conducted in developed countries, it is considered that average of 2-12% of calf mortality is acceptable in an enterprise<sup>[2,19,20]</sup>. In the studies conducted, the general mortality rate in calves was determined as Sivula et al.<sup>[19]</sup> 11.8%, and Wells et al.<sup>[20]</sup> 6.3%. In Turkey, the neonatal calf mortalities are reported to be 15-20% in public enterprises. However, in the present study, the calf mortality ratio was calculated as 5.52%. It was found that a significant portion of these mortalities is due to inadequate and incorrect nutrition methods, but with a good husbandry-nutrition method, the mortality rate can be reduced by 3-5%<sup>[3,15,22]</sup>. Similar to the findings of this study, conducted by Tokgöz et al.<sup>[23]</sup> found that the mortality rate in calves was 5.45%.

In this study, it was determined that enteritis cases were seen in at least 26% of the enterprises. Similar to the findings of this study, Erdogan et al.<sup>[21]</sup> found that the ratio of enteritis in neonatal calves was 28.8% and that of Cilil et al.<sup>[24]</sup> was 30.4%.

Among the causes of deaths, enteritis ranks first with a rate of 45.2%. It was determined that 72.7% of the deaths during the first week of birth were due to enteritis. In parallel with this finding, Cilil et al.<sup>[24]</sup> reported that enteritis in new-born calves was more common in the first week after birth in their study of the region. These diseases cause very important economic losses as new-born calves with enteritis and an ongoing disease lead to high mortality and growth retardation<sup>[5]</sup>.

In this study it was found that respiratory system diseases were the other most common disease in calves. Demir and Bozukluhan<sup>[9]</sup> reported that the frequency of diseases in their study conducted in Kars was 24.4% in calves and cows. Other studies also showed that respiratory system diseases are among the top 3 in terms of the frequency of occurrence in the region<sup>[17,25]</sup>. In this respect, respiratory diseases are of great importance in terms of aquaculture and they lead to significant economic losses<sup>[26]</sup>. As a matter of fact, the study by Demir and Bozukluhan<sup>[9]</sup> reported that the average economic loss due to respiratory tract diseases in the region was \$202 per calf.

In this study, mortalities due to respiratory system diseases in calves were observed from the first week following birth, but the highest mortality was found between 31-60 days (37%). As a matter of fact, in the study by Erdogan et al.<sup>[25]</sup>, it was reported that pneumonia cases appeared after the 4<sup>th</sup> week of birth. Although it is not seen in this study results, it has been reported that calf deaths or high-cost traumatic problems occur due to extraction force in dairy farms<sup>[27]</sup>.

In interviews with producers, it was found that calves also frequently had umbilical infections in dairy farms. In the study conducted by Celik<sup>[3]</sup>, reported that, in parallel with this study, umbilical lesions were seen in 5% to 15% of newborn calves. In this study, it is thought that this situation is related to the fact that the rate of navel cord cleaning performed immediately after birth is as low as 55.6%. According to these findings, birth hygiene and nutrition are not fulfilled adequately by producers<sup>[28]</sup>.

In the study conducted, mortalities due to navel infection in calves were found to be more frequent between the 21<sup>st</sup> and 60<sup>th</sup> days following birth. Belge et al.<sup>[28]</sup> reported that 76.8% of the total 112 calf lesions detected in the navel lesion occurred between 0 and 3 months.

In the interviews, it was determined that the enterprises spent an average of 103 TRY (\$29) per animal only as treatment, medicine and maintenance costs in 2016, which increased to 184 TRY (\$52) in 2017. If the calf smaller than 30 days dies, the cost estimate for this case is calculated as 3.978 TRY (\$1.119). This figure was found to be 4.395 TRY (\$1.235) in the 30-89-day calf and 5.420 TRY (\$1.524) in the 90-180-day calf.

In conclusion, calf diseases, which are one of the most important problems in animal production, cause inefficiency, development retardation, treatment costs and even deaths which, in return, cause significant economic losses in Turkey and around the world. The most important issue in livestock enterprises, as it is in every business, is to be able to produce high quality and healthy production at the maximum amount with a minimum cost. For the profitability and continuity of a dairy farming enterprises, calves need to be grown in a healthy way and at a low cost. In this way, calf mortalities can be reduced and dairy cattle farms can become more profitable.

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