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EFFECTS OF LEFT DISPLACED ABOMASUM, KETOSIS AND DIGESTIVE DISORDERS ON MILK YIELD IN DAIRY COWS

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Summary

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The objectives of the current study were to investigate left displaced abomasum (LDA), ketosis and digestive disorders (DD) incidence in a private dairy herd and the effect of these diseases on daily average of weekly milk yield (DMY) and lactation milk yield. Dataset used for analyses comprised 1293 lactation data from 859 Holstein cows. The datasets for LDA, ketosis and DD were analysed separately. Mixed model procedures were used to analyse the DMY. In terms of LDA and ketosis the difference between parity 1 and parity ≥2 was not statistically significant, whereas, the difference was significant for DD. It was observed that 68% of LDA cases and 62% of ketosis cases were in first two weeks of lactation. All LDA cases were in the first eight weeks of lactation and all ketosis cases (other than one case) were in the first ten weeks of lactation. Digestive disorder cases were seen in all periods of lactation. Milk losses were observed two weeks before the diagnosis of LDA and one week before the diagnosis of ketosis and DD. It was determined that the highest milk loss in all three diseases was in diagnose week and the milk losses in diagnose week were 8.1 kg/day in LDA, 6.21 kg/day in ketosis and 2.86 kg/day in DD. For all three diseases, decreases in lactation milk yield of ill cows were observed when compared to healthy cows, however, these differences were not statistically significant. The lactation milk yield losses in LDA, ketosis and DD cows were 184.3 kg, 285.6 kg and 52.4 kg, respectively.

Key words: dairy cows, disease, incidence, lactation, milk loss

INTRODUCTION

Left displaced abomasum (LDA) and ketosis are important diseases of dairy cows that usually occur at the time of calving or early in lactation, respectively. Digestive disorders (DD), however, can occur at any time during the lactation.

LDA is a condition in which the abomasum is enlarged with fluid or gas, or both that is mechanically trapped in the left side of abdominal cavity (Coppock, 1974). Ketosis is a disorder mainly attributed to a decrease in energy absorption from the feed regime. DD consists of digestive diseases (except LDA) like diarrhoea, enteritis and rumen bloat whatever the causes of the diseases are (Lawson *et al.,* 2004).

Illness incidence of dairy herds reported in the literature varied between 1.2–5.5% for LDA, 3.3–41.9% for ketosis (Fourichon *et al.,* 1999) and 2.8–39.6% for DD (Bareille *et al.,* 2003; Fourichon *et al.,* 2001; Lawson *et al.,* 2004).

It is very important to determine the effects of disease periods on milk yield as some diseases may cause significant milk

losses in a short time (Gröhn *et al.,* 1999). In the literature, some estimates of short-term losses from diseases are based on monthly recordings of test day milk yield in commercial dairy herds. Monthly measurements may not be frequent enough to permit detection of very short-term milk losses or properly estimates of milk yield in early lactation. In order to estimate the real milk yield losses correctly, milk yields before the disease of the cows should be known (Østergaard & Gröhn, 1999; Fourichon *et al.,* 1999).

The objectives of the current study were to investigate LDA, ketosis and DD incidence in a private dairy herd and the effect of these diseases on daily average of weekly milk yield (DMY) and lactation milk yield (LMY).

MATERIALS AND METHODS

This study was carried out in a private farm in Turkey. The cows were housed in semi-open free-stall barns and were milked three times daily in milking parlour. The data on daily milk yield were transferred to computer automatically by using Afimilk Meters (S.A.E. Afikim, Israel). The data on diagnosis and treatment practices of illness were transferred to computer manually.

For the nutrition of the cows, a ration containing 17% crude protein and 139 MJ NE_L was used. In the ration, silage (corn and wheat) and hay (barley and wheat) were used as roughage, corn, barley, wheat, wheat bran, soy bean meal and molasses were given as concentrates and feedstuffs like vitamins and salt were also added.

The animal material of this study was composed of Holstein cows, which were milked between 2000 and 2003. Only cows with no diseases and cows with LDA, ketosis and DD were included in the analyses. Finally, edited dataset used for analyses comprised 1293 lactation data from 859 Holstein cows.

The traits analysed were the DMY and LMY. In the study, lactation milk yield was taken for 44 weeks. In order to calculate the DMY of a cow, its weekly milk production was divided to seven. In the calculation of LMY of cows, which were milked for 285– 305 days, linear extrapolation was applied to estimate the 305-day lactation milk yield. On the other hand, when the lactation of a cow was longer than 305 days, only 305 days milk yield was used in the analyses.

Diagnoses were made by veterinarians according to clinical methods under normal field conditions. Clinical signs of ketosis were confirmed by Rothera's test on milk or urine samples. Clinical signs of LDA were confirmed by tympanitic sounds, which are audible with percussion and auscultation. The therapy of illnesses was performed by veterinarians of the farm according to the structure of the illnesses. Treatment of ketosis was done by giving intramuscular corticosteroid and intravenous glucose. The first illness records of cows, which had an illness treatment for more than once, were taken into consideration. In the study, milk production weeks were separated into nine categories according to the periods in which illness was observed. These categories were:

1. Cows, which never had illness (healthy cows),
2. Second week before the diagnosis of illness,
3. First week before the diagnosis of illness,
4. The week, in which the diagnosis of illness was made,
5. First week after the diagnosis of illness,

6. Second week after the diagnosis of illness,
7. Third week after the diagnosis of illness,
8. Fourth week after the diagnosis of illness,
9. Five weeks after the diagnosis of illness.

To compare illness incidences of parity groups, chi-square test was used. The datasets for LDA, ketosis and DD were analysed separately. Mixed model procedures were used to analyse the DMY.

To compare the LMY of ill and healthy cows for entire dataset, least-squares analysis, which included the fixed effects of parity (1, 2, 3), illness (LDA, ketosis and DD) and the random effect of cow, was applied. SPSS 11.5 program package was used for the statistical analyses (Anonymous, 2004).

RESULTS

The incidences of LDA, ketosis and DD in the herd were summarized in Table 1. At least one of the three disorders was recorded for 30.6% of the cows and for 24.8% of lactations. In terms of LDA and ketosis the difference between parity 1 and parity ≥2 was not statistically significant whereas the difference was significant for DD.

It was observed that 68% of LDA cases and 62% of ketosis cases were in first two weeks of lactation, all LDA cases were in first eight weeks of lactation and all ketosis cases (other than one case) were in the first ten weeks of lactation. Digestive disorder cases were seen in all periods of lactation. The distribution about this was presented in Fig. 1.

The DMY of the ill cows in the diagnosis week, in the pre- and after diagnosis weeks were given in comparison with the DMY of healthy cows in Table 2. Significant milk losses were observed two weeks before the diagnosis of LDA and one week before the diagnosis of ketosis and DD. The losses continued until the fifth week after the diagnosis of LDA and ketosis and until the second week after the diagnosis of DD. In all these three diseases the highest losses were in diagnosis weeks. When compared to the weeks in which the milk production returned to normal level, it was seen that the loss in diagnosis week was 8.1 kg/day in LDA, 6.21 kg/day in ketosis and 2.86 kg/day in DD.

The lactation milk yields of healthy cows were compared to the lactation milk

Table 1. Lactation incidence rate of left displaced abomasum (LDA), ketosis and digestive disorders (DD) (%)

	Disease		
	LDA	Ketosis	DD
Parity 1	3.56	7.44	9.45[b]
Parity ≥2	2.20	6.32	19.85[a]
All parity	3.13	7.08	13.12

[a, b]: The differences between the means of groups carrying various letters in the same column are significant ($P < 0.05$).

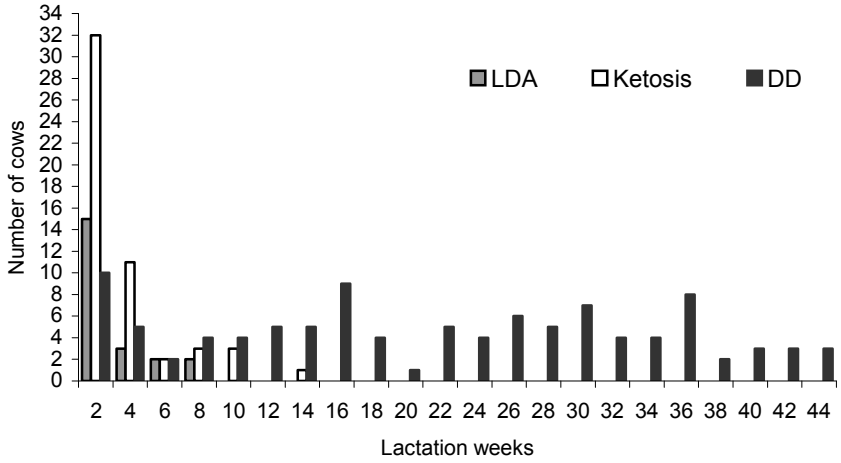

Fig. 1. Numbers of left displaced abomasum (LDA), ketosis and digestive disorders (DD) by lactation weeks (total number of cows = 859).

Table 2. Least-squares means (LSM) and standard errors (SE) of the daily averages of weekly milk yields (DMY) by disease category (kg)

Disease category	Left displaced abomasum (LDA) (n=22)		Ketosis (n=52)		Digestive disorders (DD) (n=103)	
	LSM	SE	LSM	SE	LSM	SE
2 weeks before	27.68 ^{bc}	1.164	29.75 ^{ab}	0.693	31.46 ^{a}	0.332
1 weeks before	26.55 ^{bc}	0.797	28.14 ^{c}	0.469	29.58 ^{c}	0.318
Diagnose week	22.58 ^{d}	0.690	24.22 ^{e}	0.452	27.47 ^{d}	0.317
1 week after	23.23 ^{d}	0.690	24.81 ^{e}	0.452	30.03 ^{c}	0.317
2 weeks after	25.25 ^{c}	0.690	26.49 ^{d}	0.452	30.33 ^{bc}	0.320
3 weeks after	26.71 ^{bc}	0.690	27.79 ^{c}	0.452	30.21 ^{bc}	0.321
4 weeks after	27.98 ^{b}	0.690	28.29 ^{bc}	0.452	30.32 ^{bc}	0.324
≥5 weeks after	30.68 ^{a}	0.284	30.43 ^{a}	0.183	29.84 ^{c}	0.133
Healthy cows	30.68 ^{a}	0.042	30.63 ^{a}	0.041	30.69 ^{b}	0.043

$^{a, b, c, d, e}$: The differences between the means of groups carrying various letters in the same column are significant ($P < 0.05$).

yields of LDA, ketosis and DD cows and the results were presented in Table 3. In all the three diseases, decreases in lactation milk yields of ill cows were observed when compared to the healthy cows but these differences were not statistically significant. The lactation milk losses in LDA, ketosis and DD cows were 184.3 kg, 285.6 kg and 52.4 kg, respectively.

Table 3. Lactation milk yields (LMY) of ill cows and healthy cows (kg)

	n	LSM*	SE
Healthy cows	682	9400.5	65.82
Left displaced abomasum	22	9216.2	464.89
Ketosis	52	9114.9	281.37
Digestive disorders	103	9348.1	174.72

* Differences not significant (P > 0.05).

DISCUSSION

The lactation incidence rates of the current study are in general agreement with the results of other studies for LDA (Gröhn *et al.,* 2004, Gulay *et al.,* 2005) and ketosis (Østergaard & Gröhn, 2000; Hardeng & Edge, 2001). Some authors reported higher incidences for ketosis (Deluyker *et al.,* 1991; Gröhn *et al.,* 1999; Bareille *et al.,* 2003) and DD (Bareille *et al.,* 2003). There are also reports for lower incidences of LDA (Østergaard & Gröhn 1999; Østergaard & Gröhn 2000; Fourichon *et al.,* 2001), ketosis (Lucey *et al.,* 1986; Rowlands & Lucey, 1986; Emanuelson *et al.,* 1993; Rajala-Schultz *et al.,* 1999; Fourichon *et al.,* 2001; Lawson *et al.,* 2004; Gulay *et al.,* 2005) and DD (Fourichon *et al.,* 2001; Lawson *et al.,* 2004).

The lactation incidences for LDA reported by Østergaard & Gröhn (1999) were 0.6% for parity 1 and 1.2% for parity≥2. In the study of Gröhn *et al.* (2004) the lactation incidences for DD in two different farms were 1.3% and 2.7% for parity 1 and 1.9% and 3.7% for parity ≥2. Although the LDA incidence increased by parity in other studies, in the present study the LDA incidence decreased when parity increased. The results of present study for ketosis were different than the results of Østergaard & Gröhn (1999) who found that the incidence of ketosis increased by parity (2% for parity 1 and 10% for parity ≥2) and were similar to one of the two farms in Gröhn *et al.* (2004)'s study (24.9% for parity 1 and 20.9% for parity ≥2) by means of the decrease in the incidence of ketosis when parity increased. In the study of Bareille *et al.* (2003) in which they investigated diarrhoea cases separately from digestive disorders, for parity 1, 2 and 3 the incidences of diarrhoea were 32.2%, 47.3% and 41.6%, respectively and the incidence of other digestive disorders were 22.9%, 31.1% and 28.9%, respectively. Contrasting to the study of Bareille *et al.* (2003), lower incidences of DD were found in the current study. However, unlike LDA and ketosis, the incidence of DD increased significantly by parity. The reason for the increase in DD incidence by parity might be the rise on the side of concentrated feed in the concentrated feed/roughage percentage according to the increase in milk yield.

The prevalence of LDA and ketosis cases only in the beginning periods of lactation and DD cases in all the periods of lactation was in accordance with the results of other studies (Deluyker *et al.,* 1991; Detilleux *et al.,* 1997; Gröhn *et al.,* 1999; Østergaard & Gröhn, 1999; Raiz-

man & Santos, 2002; Bareille *et al.,* 2003).

Reported milk production losses caused by LDA vary among studies. Similar to the results in the present investigation, in most of studies the losses begin before the diagnosis and return to normal after a while. Detilleux *et al.* (1997) reported that the LDA cows yielded 557 kg (6.1% of 305-day milk yield) less milk than healthy cows from the beginning of lactation until the 60th day after the diagnosis, 30% of the losses were before the diagnosis and the milk yield returned to normal 20–45 days after diagnosis. Deluyker *et al.* (1991) found that LDA caused a total loss of 402 kg (8.8% of cumulative yield to 119 day of lactation) in the first 49 days of lactation and the losses of milk yield were not significant after the 120th day of lactation. Geishauser *et al.* (1998) reported a loss of 316 kg of milk over lactation. Fourichon *et al.* (1999) reported average losses varying from 400 to 800 kg in their review article. The difference between the 305-day milk yield of LDA cows with healthy cows was not significant and this result was similar to Gröhn *et al.* (1995)'s study but different than the other studies. When the milk yields of LDA cows in diagnosis week and in their healthy periods were compared, the milk loss in the current study is in the limits of the loss reported by Raizman & Santos (2002) and van Winden *et al.* (2003).

The estimates of the present study agree with the findings of Lucey *et al.* (1986) and Rajala-Schultz *et al.* (1999), who reported that milk yield declined for 2 to 4 weeks before the diagnosis of ketosis. Fourichon *et al.* (1999) reported that reduction in milk yield on the day of diagnosis reached 4–10 kg/day for clinical ketosis. Over short-term periods, losses following clinical cases averaged 3–6 kg/day. Duration of losses was short (17–28 days) in the studies of Lucey *et al.* (1986) and Detilleux *et al.* (1994), but lasted more than 50 days in the studies of Deluyker *et al.* (1991) and Lean *et al.* (1994).

The results of the present study are in agreement with the results of Gröhn *et al.* (1995), who found no significant association between previous milk yield and risk of ketosis, after adjusting for parity, season and herd. However, in other studies using 305-d milk yield, Rowlands & Lucey (1986), Rajala-Schultz *et al.* (1999) and Detilleux *et al.* (1994) reported that cows with ketosis yielded more milk over the entire lactation than the healthy ones; Dohoo & Martin (1984), reported a case of ketosis appeared to increase yield by approximately 2.5%. The results of some researchers (Rowlands & Lucey, 1986; Gröhn *et al.,* 1999) for the loss caused by ketosis were similar to the results of the present study and some others' (Lucey *et al.,* 1986; Rajala-Schultz *et al.,* 1999; Detilleux *et al.,* 1994; Bareille *et al.,* 2003) were lower.

In terms of the effects of DD on milk yield, only Bareille *et al.* (2003) reported the total loss caused by diarrhoea and other digestive disorders as 35.6 kg and 46.1 kg, respectively. These results are in agreement with the results of current study.

CONCLUSIONS

The diseases investigated in the current study caused milk yield losses in the diagnosis week and in some weeks before and after the diagnosis, however, when the 305-day milk yields were taken into consideration, the losses caused by the diseases were not statistically significant.

The milk losses occurring before the diagnosis of LDA, ketosis and DD showed the necessity of the care given to the diagnostic methods. Moreover, for the early diagnosis, the decrease in the milk yield in cows should be carefully observed. The dairy farms should pay attention to the feeding and management of cows according to the periods and parity of lactations.

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