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# Occurrence of abomasal displacement in dairy cows from High-yielding dairy farms of Paraná State, Southern Brazil

# Ocorrência do deslocamento de abomaso em vacas leiteiras de alta produção de fazendas do Estado do Paraná, Sul do Brasil

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## Highlights

Abomasal displacement is frequent in high yielding dairy herds around the world.
The disease occurs frequently in the transition period.
The left displacement represents 90% of the cases.

## Abstract

The present study aimed to verify the occurrence of displacement of the abomasum (DA) in dairy herds from a high-yielding dairy region of Southern Brazil. Data on breed, age, lactation number, days after calving, breeding system, number of animals, and number of lactating cows in the herd were obtained from 135 cases of DA. A total of 39 herds, and 6,454 cows, including 2,987 lactating cows from the municipality of Palmeira, Paraná State, were included in this study. The overall prevalence of DA was 2.09%, and occurrence of DA during lactation was 4.42%. Left displacement was more prevalent, with 94.07% of the cases. The mean number of lactations and age of the cows were 2.5±1.16 lactations and 50.9±18.5 months, respectively. DA occurred predominantly in the semi-intensive breeding system (68.1% of cases), during the first 4 weeks postpartum (84.4% of cases), in Black and White Holstein-Friesian cows (94.07% of cases), and during the winter (31.1% of cases). Cows with DA in high-yielding dairy farms in Southern Brazil were similar to cows from herds of high-milk-yielding regions of North America and Europe. Multiparous Black and White Holstein-Friesian cows showed the highest prevalence of DA during the transition period, mostly on the left side.

**Key words:** Dairy cow. Displaced abomasum. Transition period.

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## Resumo

O presente estudo objetivou verificar a ocorrência do deslocamento de abomaso (DA) em rebanhos leiteiros de uma bacia leiteira de alta produção, na região sul do Brasil. Dados sobre raça, idade, números de lactação, número de dias após o parto, sistema de criação, número total de animais e de vacas em lactação foram obtidos de 135 casos de DA. Trinta e nove rebanhos, 6.454 vacas, sendo 2.987 vacas em lactação da cidade de Palmeira, Estado do Paraná, foram incluídos neste estudo. A frequência de DA foi de 2,09%, sendo que em vacas lactantes esta frequência foi de 4,42%. O deslocamento à esquerda foi o mais prevalente, com 94,07% dos casos. O número médio de lactações e a idade das vacas acometidas por DA foram 2,5±1,16 lactações e 50,9±18,5 meses, respectivamente. O DA ocorreu predominantemente em animais criados no sistema semi-intensivo (68,1% dos casos), durante as primeiras quatro semanas pós-parto (84,4% dos casos), em vacas Holandesa branco e preta (94,07% dos casos) e durante o inverno (31,1% dos casos). As vacas com DA em rebanhos leiteiros de alta produção do Sul do Brasil apresentaram similaridades com vacas de rebanhos de alta produção localizados em outros países da América do Norte e Europa. Vacas multíparas, Holandesa Preto e Branca e durante o período de transição tiveram a maior ocorrência de DA, sendo a maioria para o lado esquerdo.

**Palavras-chave:** Deslocamento de abomaso. Período de transição. Vacas leiteiras.

## Introduction

Both left and right displacements of the abomasum (DAs) are common and economically significant diseases in dairy cows (LeBlanc et al., 2005). Since the first reports of the disease in the 1950s, the incidence of this condition has increased continuously (Doll et al., 2009). The first reports of DA in Brazil were in the 1970s and 1980s, and DA is common in high-yielding herds from different Brazilian States, such as Rio Grande do Sul (Cardoso, 2007) and Pernambuco (Câmara et al., 2010).

DA mostly affects high-yielding Holstein dairy cows during the transition period (2 weeks prepartum and 4 weeks postpartum) (Fiore et al., 2018). Risk factors include concomitant diseases (retained fetal membranes, metritis, ketosis, and musculoskeletal disorders) (Tschoner et al., 2022), genetics (Doll et al., 2009), and metabolic disorders (hypocalcemia, negative energy balance, and metabolic alkalosis) (Van Winden & Kuiper, 2003a). The impact of DA on herds includes reduced milk yield, reduction in milk protein and fat, costs of treatment, increased risk of culling, and increased gap from calving to the first service (Fiore et al., 2018; Melendez et al., 2017).

Left DA, which is the most common position for a displaced abomasum, accounts for up to 90% of the reported cases (Shaver, 1997), although Câmara et al. (2010) showed a higher incidence of right DA (85.7%). The incidence of DA varies between countries and herds in the same country. In North America, the incidence ranges between 3% and 5% (Doll et al., 2009) , whereas in Germany, it is up to 5.6% (Freick et al., 2013). However, there have been no studies on the prevalence of DA in Brazilian dairy herds (Cardoso, 2007).

This study aimed to describe the occurrence and characteristics of DA in dairy cows from a high-yielding dairy region of Southern Brazil.

## Material and Methods

This was an observational retrospective study, wherein data regarding breed, age of cow, lactation number, days after calving, breeding system, number of animals in the herd, and number of lactating cows were obtained from cows with a displaced abomasum. The cows belonged to 39 high-yielding dairy farms (higher than 8,500 kg/milk/305 days/per cow) in Palmeira (25º25'46 S, 50º00'23 W), Paraná State, Southern Brazil, where a humid subtropical climate is predominant. A total of 6,454 animals, including 2,987 lactating dairy cows, were enrolled in this study. The herds were selected based on the presence of cows with a displaced abomasum and were classified according to the housing system as pasture-based (n=2), semi-intensively managed (n=32), and intensively managed (n=5).

In the intensively managed system, the cows were housed in a free stall or compost bar and fed twice a day with corn silage, concentrate, and hay (coastcross or oat hay) or total mixed ration (TMR). In the semi-intensive housing system, the cows grazed during the day and were housed in a free stall at night, where they were fed corn silage and concentrate. In the pasture-based system, the cows were fed only grass.

The dairy breeds enrolled in this study were Holstein-Friesian, Red-Friesian, Jersey, Jersey crossbreeds, and Jersey-Holstein-Friesian crossbreeds. The diagnosis of DA was based on the historical decrease in milk yield and auscultation with percussion and succussion of the left or right paralumbar fossa. DA was diagnosed by three qualified bovine practitioners.

Data were obtained from July 2012 to June 2015 (a total of 36 months) and inserted into an Excel spreadsheet (Microsoft Corporation). A descriptive statistical model was used to illustrate the variables, showing the data distribution using the absolute frequencies of the major indicators.

## Results and Discussion

To our knowledge, this is the first study on the occurrence of DA in Brazilian dairy herds housed in different breeding systems. Paraná State is the second largest milk-producing state in Brazil, and the dairy farms in Palmeira are well technified with high-yielding dairy cows.

A total of 135 cows presented with DA during this study; left DA occurred in 127 (94.07%) cases, and right DA occurred in 8 cases (5.93%). The herds had a mean number of 380 cows (min, 23; max, 1,320; median, 210), with a mean number of 161 cows in lactation (min, 15; max, 600; median, 82.5) (Table 1). The overall prevalence of DA was 2.09%, and the incidence of DA during lactation was 4.42%. The mean number of lactation of cows with DA was 2.5±1.16 (Figure 1), and the mean age was 50.9±18.5 months, ranging from 22 to 120 months (Table 1). DA occurred predominantly in cows housed in the semi-intensive system (92 cases, 68.1%), followed by the intensively managed system (41 cases, 30.3%) and pasture-based system (2 cases, 1.4%).

**Table 1**
**Mean ± standard deviation (SD), median, maximum, minimum and interquartile of age from 135 cows with displaced abomasum, the number of cows in milk and the total number of cows per farm**

| | mean±SD | maximum | minimum | median | 1st quartile | 3rd quartile |
|---|---|---|---|---|---|---|
| Age (months) | 50.9±18.6 | 120 | 22 | 48 | 36 | 60 |
| Cows in milk | 161±162 | 600 | 15 | 87.5 | 60 | 152.5 |
| Number of cows per farm | 381±421 | 1320 | 23 | 210 | 124.5 | 350 |

Nutritional intake has been implicated as the major cause of DA. Reduced roughage fed near calving is associated with a displaced abomasum because it decreases ruminal filling and enables the abomasum to displace to the left (Cameron et al., 1998). Ruminal fill is also implicated as a cause of hypomotility in the abomasum (Van Winden & Kuiper, 2003a). Diets with high concentrate and low fiber have been implicated as risk factors for DA (Shaver, 1997; Caixeta et al., 2018). TMRs can contribute to DA when they are unbalanced, with a high proportion of corn silage and inadequate physical structure (Shaver, 1997). The cows in the intensively managed and semi-intensive systems were predominantly fed diets based on corn silage and concentrate or TMR, which may justify the higher cases of DA in these breeding systems. The semi-intensive system was overrepresented (82% of the farms), and it could support the highest prevalence of DA in this housing system. The risk of DA was 13 times higher in intensively managed housed cows than in grazing herds because of restricted mobility and reduced ingestion of fiber (Witkowska & Ponieważ, 2022)

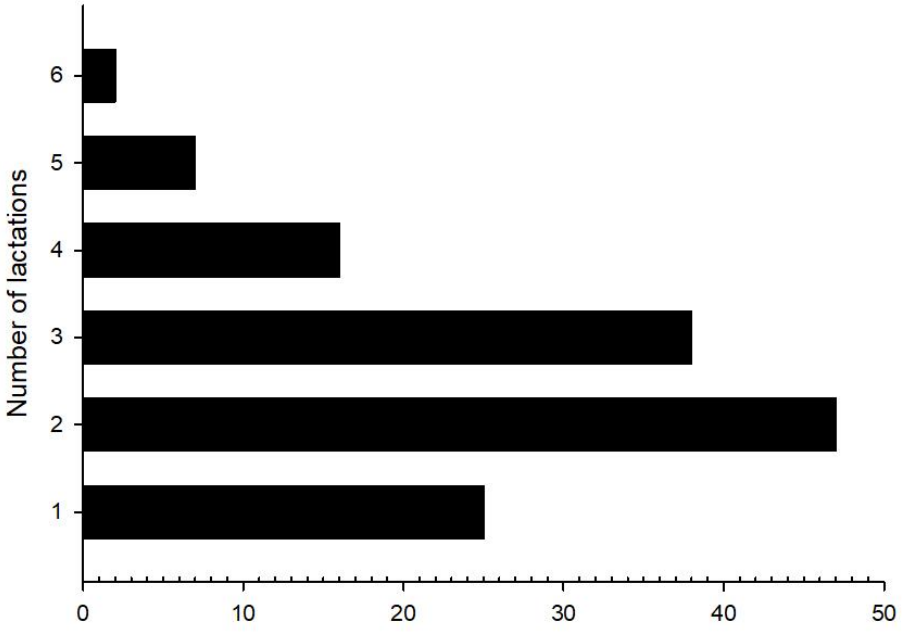


**Figure 1.** Distribution of 135 cases of abomasal displacement as defined by lactation number.

Seventy-one cases (52.5%) of DA occurred in the first 2 weeks postpartum, and 114 cases (84.4%) occurred in the first month postpartum (Table 2). The majority of DAs occurred in Black and White Holstein-Friesian cows (127 cases, 94.07%). The other breeds with DA cases were Jersey cows (three cases, 2.2%), Red and White Holstein-Friesian cows (two cases, 1.48%), and crossbreeds (Jersey-Holstein-Friesian crosses; three cases, 2.2%). The dairy herds from Palmeira are predominantly composed of Holstein-Friesian cows. DA occurs mostly in typical dairy breeds, including Holstein-Friesian, Jersey, Brown Swiss, and crossbred cows (Jubb et al., 1991; Constable et al., 1992; Van Winden et al., 2003b). Genetic selection for high milk yield also selects traits for framed body and tall stature, which may increase the risk of DA (Van Winden et al., 2003b).

DA occurs predominantly during the transition period (from 2 weeks prepartum to 4 weeks postpartum) (Constable et al., 1992; Sexton et al., 2007; Freick et al., 2013). This period is related to changes in feed and hormonal profile, elevated metabolic stress, and concomitant diseases, such as hypocalcemia, metritis, and ketosis (Doll et al., 2009; LeBlanc et al., 2005). In our study, 84.44% of the cases occurred during the transition period, which is expected in high-yielding dairy farms. Holstein-Friesian cattle are the predominant dairy breeds in dairy farms in Paraná State, which explains the higher prevalence in this breed. Furthermore, the Holstein-Friesian breed is more predisposed to DA owing to body features, such as tall stature and body depth (Doll et al., 2009). Only 50%-70% of right DAs are diagnosed during the transition period, whereas the rest can occur independently of the stage of gestation or lactation (Dirksen, 2006). In our study, 21 cases of DA occurred after the transition period (15.5%).

**Table 2**
**Cases of displaced abomasum of 135 dairy cows according to days in milk and according to housing system**

| Days in milk | Number of cases | | | |
|---|---|---|---|---|
| | Pasture-based | Semi-intensive | Intensively managed | total |
| <15 | 1 | 46 | 24 | 71 |
| 15-30 | 1 | 31 | 11 | 43 |
| >30 | 0 | 12 | 6 | 18 |
| Dry cow | 0 | 3 | 0 | 3 |
| Total | 2 | 92 | 41 | 135 |

Most of the cases in this study occurred in winter (42 cases), followed by spring (35 cases), autumn (33 cases), and summer (25 cases). The month with the highest number of cases was July, with 27 cases (Figure 2), whereas in January, only two cases of DA occurred. The incidence of DA is seasonal and generally occurs in winter and early spring (Constable et al., 1992; Cameron et al., 1998) because of a higher calving frequency, lower quality of the stored roughage, and increased energy requirements of cows (Constable et al., 1992; Cameron et al., 1998; Van Winden et al., 2003b). Despite the observation of more cases in winter and fewer cases in summer, this study did not show a seasonal occurrence of DA, with similar numbers of cases throughout the year, as described in another study (Freick et al., 2013). Despite the cold temperatures during the winter, the quality of roughages remains high because winter forages are cultivated on dairy farms from Palmeira, preserving the feed quality. On the other hand, cows managed intensively were fed the same food throughout the year. The increased number of DA during the winter occurred probably because of the higher calving rate during this time of year.

The lactation incidence of DA found in this study was 4.42%, similar to studies in North America (LeBlanc et al., 2005) but less than that in Germany (Freick et al., 2013). Recently, Daros et al. (2017) found a DA incidence of 1.4% in dairy cows from Southern Brazil; however, these cattle were managed exclusively on pasture. The incidence of DA has been increasing over the last years, probably because of intensive management systems and diets with higher feed intake (Van Winden & Kuiper, 2003a; LeBlanc et al., 2005; Doll et al., 2009).

Left DA is predominant in studies worldwide, and the proportion of left DA in this study was similar to that in studies from North America and Germany (LeBlanc et al., 2005; Freick et al., 2013). In Brazil, Câmara et al. (2010) found a higher proportion of right DA, with 83.3% of cases; however, this study was carried out at a veterinary hospital, where emergency cases, such as right DA, were predominant.

The occurrence of DA was higher in multiparous cows, with two (47 cases) and three (38 cases) lactations, similar to studies from Brazil (Cardoso, 2007) and Germany (Freick et al., 2013). In contrast, some studies have shown a high prevalence of DA in cows with one or two lactations (Sexton et al., 2007; Cameron et al., 1998). According to Constable et al. (1992), older cows have a higher risk of DA because the occurrence of metabolic, reproductive, and musculoskeletal diseases is also higher in this cattle category. On the other hand, heifers have more DA because of their poor adaptation to new nutritional management (Jubb et al., 1991). Additionally, older cows may have undergone surgical treatment when heifers or an increased culling rate reduces the number of older cows, thereby increasing the occurrence of DA in heifers.

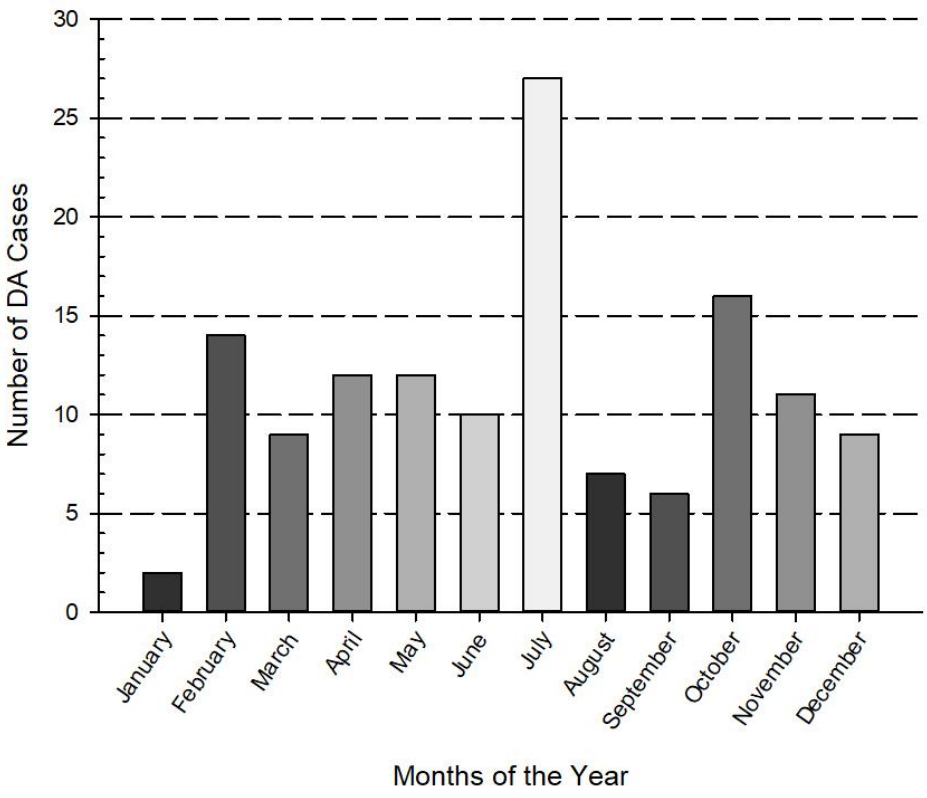


**Figure 2.** Number of displaced abomasum (DA) by month of the year (from July 2013 to June 2015).

## Conclusions

In conclusion, cows with DA in high-yielding dairy farms in Southern Brazil are similar to cows from herds of high-milk-yielding regions of North America and Europe. Multiparous Holstein-Friesian cows during the transition period in an intensively managed housing system feeding diets with high concentrate showed a higher incidence of DA. As expected, the left side was the most prevalent DA category. Data on concomitant diseases and blood concentrations of non-esterified fatty acids, ß-hydroxybutyrate, and calcium must be included in future research better characterization of predisposition factors of DA in high-milk-yielding dairy herds from Brazil. This characterization can identify which variables demand greater attention to reduce losses for milk farmers.

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