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A field study to determine the prevalence, dairy herd management systems, and fresh cow clinical conditions associated with ketosis in western European dairy herds

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ABSTRACT

The aim of this study was to determine the prevalence, major management systems, and fresh cow clinical conditions associated with ketosis in western European dairy herds. A total of 131 dairies were enrolled in Germany, France, Italy, the Netherlands, and the United Kingdom during 2011 to 2012. A milk-based test for ketones (Keto-Test; Sanwa Kagaku Kenkyusho Co. Ltd., Nagoya, Japan; distributed by Elanco Animal Health, Antwerp, Belgium) was used for screening cows between d 7 and 21 after calving and ketosis was defined as a Keto-Test ≥100 μmol/L. Study cows were observed for clinical disease up to 35 d postcalving. Multivariate analysis (generalized estimating equation logistic regression) was performed to determine country, farm, management, feed, and cow factors associated with ketosis and to determine associations between ketosis and fresh cow diseases. Thirty-nine percent of the cows were classified as having ketosis. The herd average of ketosis was 43% in Germany, 53% in France, 31% in Italy, 46% in the Netherlands, and 31% in the United Kingdom. Of the 131 farms, 112 (85%) had 25% or more of their fresh cows resulting as positive for ketosis. Clinical ketosis was not reported in most farms and the highest level of clinical ketosis reported was 23%. The risks of ketosis were significantly lower in Italy and the United Kingdom compared with France, the Netherlands, and Germany. Larger herd size was associated with a decreased risk of ketosis. The farms that fed partially mixed rations had 1.5 times higher odds of ketosis than those that fed total mixed rations. Cows that calved in April to June had the highest odds of ketosis, with about twice as high odds compared with cows that calved in July to September. The cows that calved in January to March tended to have 1.5 times higher risk of ketosis compared with cows that calved in July to September. The odds of ketosis in parity 2 and parity 3 to 7 was significantly higher (1.5 and 2.8 times higher, respectively) than the odds of ketosis in parity 1. The odds of ketosis was significantly smaller in parity 2 compared with parity 3 to 7. Ketosis was associated with significantly higher odds of all common fresh cow conditions: metritis, mastitis, displaced abomasum, clinical ketosis, lameness, and gastrointestinal disorders. Odds of ketosis in cows having had twins or dystocia were not increased, whereas higher odds of ketosis were observed in cows with milk fever or retained placenta.

Key words: ketosis, postpartum disease, prevalence, milk ketone

INTRODUCTION

Ketosis in dairy cows, also referred to as subclinical ketosis was described already in the 1950s (Holmes, 1950). It has become a very common metabolic disorder in modern dairy production as productivity increases (Andersson, 1988; Duffield, 2000). Ketosis has an economic impact on the herd, involving decreased milk production, increased incidence and duration of fresh cow diseases, increased time to conception, and an increased risk of culling (McLaren et al., 2006; Ospina et al., 2010a; Chapinal et al., 2012; Dubuc et al., 2012; Roberts et al., 2012). Extreme cases of acute clinical ketosis are routinely recognized and diagnosed in cows by farmers and veterinarians in the periparturient period. The observed clinical signs for these cases may include extreme loss of body condition, nervous signs, and decreased feed intake and milk yield (Baird, 1982). However, the signs of ketosis are often subtle and missed by farmers; subsequently, the true incidence of ketosis may be underdiagnosed.

Ketosis can be diagnosed by measuring ketone bodies present in blood, urine, or milk. The Keto-Test (Ketolac test strip; Sanwa Kagaku Kenkyusho Co. Ltd., Nagoya, Japan; distributed by Elanco Animal Health, Antwerp, Belgium) is a cowside milk test to semiquantitatively

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measure BHBA in the milk and can be used for screening cows for ketosis (Geishauser et al., 1998, 2000). When using milk at a cutoff point of 100 μmol/L (corresponding to a serum range of 1,000 to 1,400 μmol/L), the sensitivity of the test has been estimated at 83% and the specificity at 82% (Oetzel, 2004).

The prevalence of ketosis in European Union dairy cows and in the most common management systems in the postcalving transition period has, until recently, been largely unexplored, with reports indicating that it is highly prevalent and entails high production costs (McKay, 2012). A recent study in May 2011 to October 2012 in 10 European countries indicated that the prevalence of ketosis, defined as serum BHBA concentration ≥1,200 to 1,400 μmol/L in cows within 2 to 15 DIM was 21.8%, ranging from 11.2 to 36.6% (Suthar et al., 2013). The aim of this field study was to determine the prevalence, major management systems, and fresh cow clinical conditions associated with ketosis in western European dairy herds.

MATERIALS AND METHODS

This study was a longitudinal survey including 4,709 fresh cows in 131 herds in 5 European countries tested between July 2011 and October 2012. The farms were a convenience sample selected by participating veterinarians from 39 veterinary practice districts in Germany, France, the Netherlands, Italy, and the United Kingdom. The farms selected were considered as normal herds (i.e., with no bias toward herds at risk from ketosis and with no routine ketosis prevention additive being used in the herd). All calving cows in the selected herds were included and enrolled for a period of 1 to 2 mo, depending on calving rate and herd size, with the aim of having at least 12 cows with complete information per farm (Oetzel, 2003). The minimum herd size for enrollment was set at 60 cows to achieve the minimum number of cows within the sampling time frame of the study.

Farm information included name and address of dairy, lactating herd size, average yearly milk production, and breed. Information on management, housing, and feeding systems was also collected. The cow information included test date, calving date, parity, and 1 ketosis milk testing at d 7 to 21 postcalving, with observations for clinical disease performed by the farm staff at d 0 to 35 postcalving. Disease diagnosis was according to clinical symptoms and definitions that were provided to the farmer and the participating veterinarians on each study farm. The disease conditions were classified as abortion, dystocia, twins, retained placenta (**RP**), milk fever, metritis, mastitis, clinical ketosis, displaced abomasum (**DA**), lameness, gastrointestinal disorder, or any other condition (Table 1). Milk from cows showing clinical disease tested for ketosis on the day of diagnosis of the condition.

A milk BHBA test strip (Keto-Test) was used by the participating veterinarians for screening a milk sample from cows. The strip was dipped into the milk sample for 3 s, read after 1 min, and recorded according to the color scale provided with the test. The color scale shows 6 colors corresponding to nominal levels of 0, 50, 100, 200, 500, and 1,000 μmol of BHBA/L of milk. A

Table 1. Clinical disease definitions in a study of ketosis in European dairy cows

Diagnosis	Definition
Twins	Production of more than 1 calf
Dystocia	Assistance with parturition due to difficulties with calving
Abortion	Birth of a calf before 270 d of gestation
Retained placenta	Placenta present more than 24 h after calving
Milk fever	Cow requires treatment with calcium by subcutaneous or intravenous injection due to clinical signs of milk fever, including down and unable to rise; muscular weakness, including S-bend in neck; cold extremities; dry nose; or constipation. (Cow is not regarded as having milk fever if a calcium treatment is given only because of age or other risk factor, or as a preventive.)
Metritis	Purulent and smelly uterine discharge with temperature ≥39.5°C (103.5°F)
Mastitis	Change in the appearance of the milk or udder indicative of infection
Displaced abomasum	Presence of a gas-filled abomasum on the left or upper right flank, giving a characteristic "ping" sound on percussion or splashing on ballottement
Lameness	Locomotion score of 2 or more (scale of 0–3); cow is noticeably lame on 1 or more limbs, and the affected leg(s) can be identified
Gastrointestinal disorder	Change in fecal consistency from that typical for herd, or individual, possibly combined with changed rumen activity (reduced cudding an abnormal rumen activity)
Clinical ketosis	Decrease in milk yield (perceived or recorded milk yield decrease ≥10% with no signs of estrus; udder not full before milking), reduced feed intake and (or) appetite (cow not feeding vigorously, standing back from feed trough; decrease/refusal in concentrate intake), low rumen fill, reduced activity or demeanor (dullness, listlessness), excessive loss of body condition (loss of BCS compared with immediate postcalving BCS of 1 unit or more; dull coat, indicative of weight loss), constipation/reduced fecal output or hard/dry feces, ketone odor in breath/milk, nervous signs (weakness, mania, apparent blindness, pica)