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Dairy Management Practices Associated with Incidence Rate of Clinical Mastitis in Low Somatic Cell Score Herds in France

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ABSTRACT

An epidemiological prospective study was carried out in French dairy herds with Holstein, Montbéliarde, or Normande cows and with low herd somatic cell scores. The objective was to identify dairy management practices associated with herd incidence rate of clinical mastitis. The studied herds were selected on a national basis, clinical cases were recorded through a standardized system, and a stable dairy management system existed. In the surveyed herds, mean milk yield was 7420 kg/cow per yr and mean milk somatic cell score was 2.04 (132,000 cells/mL). Overdispersion Poisson models were performed to investigate risk factors for mastitis incidence rate. From the final model, the herds with the following characteristics had lower incidence rates of clinical mastitis: 1) culling of cows with more than 3 cases of clinical mastitis within a lactation; 2) more than 2 person-years assigned to dairy herd management; 3) balanced concentrate in the cow basal diet. Moreover, herds with the following characteristics had higher incidence rates of clinical mastitis: 1) milking cows loose-housed in a straw yard; 2) no mastitis therapy performed when a single clot was observed in the milk; 3) clusters rinsed using water or soapy water after milking a cow with high somatic cell count; 4) 305-d milk yield >7435 kg; 5) herd located in the South region; 6) herd located in the North region; 7) cows with at least 1 nonfunctional quarter; and 8) premilking holding area with a slippery surface. The underlying mechanisms of some highlighted risk factors, such as milk production level and dietary management practices, should be investigated more thoroughly through international collaboration.
(**Key words:** clinical mastitis, somatic cell score, dairy management)

Abbreviation key: 36-mo SCS = mean SCS for the 36 mo preceding the beginning of the survey, **CM** = clinical mastitis, **IRCM** = incidence rate of clinical mastitis, **ZMP** = Zero Mastitis Objective program.

INTRODUCTION

Mastitis is a 2-faceted health problem including subclinical and clinical udder infections. To control IMI status and decrease mastitis (which has negative consequences on animal welfare and economic impact from control costs, penalties, and production losses), 2 main indicators are used in observational and intervention studies: milk SCC and incidence rate of clinical mastitis (**IRCM**; IDF, 1997). To minimize the occurrence and consequences of herd IMI, a target could be a bulk SCC below 200,000 cells with an IRCM of less than 20% (Pyörälä, 2003; Schukken et al., 2003).

The very few studies conducted to highlight management factors associated with IRCM in low SCC herds (Schukken et al., 1990; Peeler et al., 2000) indicated a large IRCM variation in this ideal epidemiological situation. A simultaneous evaluation of the risk factors associated with a low SCC and those associated with a lower or higher IRCM is necessary (Barkema et al., 1998), particularly because SCC levels, contrary to IRCM, have fallen over the last 20 yr (Ely et al., 2003; Schukken et al., 2003), whereas the importance of environmental vs. contagious pathogens has increased (Peeler et al., 2003). Nevertheless, if low SCC herds are considered to have higher levels of environmental mastitis (Peeler et al., 2000), clinical mastitis (**CM**) caused by *Staphylococcus aureus* has been observed more frequently in herds with a bulk milk cell count lower than 150,000 cells/mL (Elbers et al., 1998).

The main herd risk factors associated with IRCM in low SCC herds (Schukken et al., 1990; Peeler et al., 2000) were: 1) management variables that increased the exposure to environmental pathogens (straw yard housing, poor free stall cleanliness, drinking water from sources other than public water, leaking milk outside the parlor, cleaning the calving area less than once a month, scraping the gathering yard less than twice a day); 2) variables associated with bacterial challenge or host resistance (high percentage of cows leaking milk, postmilking teat disinfection, high frequency of free

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stall disinfection); 3) practices that could be linked to mastitis problems in the herd (wearing of rubber gloves by the dairyman during milking, changing teat liners more frequently); 4) increased detection and reporting of cases of mastitis (stripping foremilk before attaching the clusters); 5) general management practices (long dry period, high replacement rate); 6) genetic and udder conformation dependent traits (breed, milk yield level); and 7) dietary components (sugar beet pulp in the ration). Nevertheless, it is not always easy to clarify whether a factor is cause or effect: for example, farmers may change liners more frequently because of mastitis, or frequent liner changes may potentially damage the teat (Peeler et al., 2000). Moreover, a herd risk factor associated with IRCM could be due to several reasons: a high culling rate could be an indication of one or more of the following: the relevant herd was not stable; the herd size was increasing; there was increased culling for some reason, including mastitis; or that the introduction of cows into an established herd increased the risk of mastitis (Peeler et al., 2000).

Some studies suggested that low SCC was associated with high IRCM (Elbers et al., 1998; Beaudeau et al., 2002; Green et al., 2004), whereas other works did not reveal any interrelationship (Barkema et al., 1998; Beaudeau et al., 1998). These controversial results could depend on: 1) the situation of the herds in terms of prevailing pathogens (Barkema et al., 1998; Peeler et al., 2003); 2) the accuracy of CM evaluation including the epidemiological unit (Gasqui and Barnouin, 2003; Peeler et al., 2003), SCC measurement level (from most to least accurate: quarter, cow, bulk), and length of the period taken to observe CM cases after SCC measurement (Beaudeau et al., 2002); 3) the stability of management practices in the herds; 4) the fact that the farmers who are better at diagnosing CM might divert more high SCC milk (Elbers et al., 1998); 5) the observed (negative) association between milk yield level and SCC (Barkema et al., 1998), and (positive association) between milk yield level and CM risk (Schukken et al., 1990; Chassagne et al., 1998).

The purpose of the present epidemiological study was to identify, from a large set of potentially relevant variables, dairy herd management practices and characteristics associated with IRCM in French herds with low SCS fulfilling the following criteria: 1) selected on a national basis from DHIA database; 2) experienced a low SCS over a long period; 3) recorded CM cases through a standardized system, which included individual forms collected monthly; and 4) had a stable dairy management system.

MATERIALS AND METHODS

General Program

Data were collected from the Zero Mastitis Objective Program (**ZMP**), a national mastitis control program carried out in France from February 1999 to July 2001 (Barnouin et al., 2004). The objectives of the ZMP were to display, through several complementary epidemiological studies conducted at herd level, dairy management practices characterizing farms with a high degree of udder health control.

Herd Selection

The general herd selection procedure of ZMP has been described previously (Barnouin et al., 2004). The surveyed herds were located in 48 French departments, had at least 20 cows of which 90% were Holstein, Montbéliarde, or Normande breeds, and did not practice vaccination against mastitis. The herd sample was constituted from the National DHIA database according to the herd's previous 36-mo history of somatic cell score (**36-mo SCS**), because SCS (SCS = $\log_2$[SCC/100,000] + 3) is, contrary to bulk SCC, a criterion not biased by milk discarding. Herd 36-mo SCS was the arithmetic mean of all monthly cow SCS values determined in a herd during the 36 mo preceding ZMP. All the selected herds of the present study had 36-mo SCS that were among the lowest 5% of SCS for herds within breed, as breed is a key SCS variation factor (Rupp et al., 2000). Consequently, 36-mo SCS was ≤1.99 (125,000 cells/mL) for Montbéliarde herds, ≤2.38 for Holstein herds (185,000 cells/mL), and ≤2.76 (230,000 cells/mL) for Normande herds. Three hundred fifty-seven herds were enrolled, representing 15% of the total number of herds in the National DHIA database that had 36-mo SCS in the lowest 5%. The study did not involve any payment to the selected farmers. Two farmers quit the survey before starting. Five herds were removed because of bovine spongiform encephalopathy. Thirty farmers quit ZMP before it ended for different reasons (DHIA resignation, health problems, lack of time, unknown reasons) or were discarded for incomplete data concerning mastitis recording or questionnaires. Moreover, 23 herds were removed because the farmers did not state the start and end dates of their mastitis recording. In the end, 297 herds were studied, representing 83.2% of the herds initially enrolled.

Clinical Mastitis

Clinical mastitis was identified by the farmers based on clinical signs including udder inflammation or abnormal milk, with or without general clinical signs. Farmers were instructed how to fill out a specific record form and required to describe all the observed CM cases from February 1, 1999 to July 31, 2001. Data included: CM case definition, cow identification, date of CM occurrence, clinical description, affected quarters, and treat-