



Factors related to the level of occurrence of bovine abortion in Chilean dairy herds

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ABSTRACT

The objectives of this study were (1) to estimate the frequency and dynamics of bovine abortion syndrome; (2) to identify groups of cows affected by abortion; and (3) to assess the characteristics of herd management and lactation associated with abortion rates. The study was performed using farmers' historical records for 77 dairy herds in the south of Chile (Bio-Bio, Los Lagos and Los Ríos Regions) collected between 2001 and 2005. These records included 44,959 lactations from 20,977 cows. In addition, farm management practices were assessed through a questionnaire involving 127 herds. The herds were selected according to the farmers' willingness to participate and the existence of high-quality electronic records assessed by the practitioners advising the farms. The frequency distribution of observed, inferred and general abortions was estimated by the incidence rate (IR). A hierarchical logistic regression analysis with random intercept was performed to assess the association between herd management and lactation characteristics and the occurrence of abortion. An IR of 1.74 per 100 cow-months at risk was estimated. General abortions were highest in first-parity cows (IR: 1.85 per 100 cow-months at risk). Abortion cases inferred from individual records were most frequent in the first trimester of gestation and decreased over time, whereas observed abortions increased in accordance with gestation time. The period of highest risk for abortion was around 82 days of gestation. Management practices such as a tap drinking system for cows, a closed herd, vaccination against leptospirosis, exclusive use of pasture for cows, animal density, the time that a calf stays with its dam and breed type were associated with the risk of abortion.

The results of this study demonstrate that there is a large underestimation of abortion rates when only farmers' abortion records are analysed, and there are several factors associated with the risk of abortion.

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1. Introduction

The primary reason for preventing bovine abortion or its sequelae is to reduce the impact on a herd's reproduc-

tive performance by taking appropriate control measures. Bovine abortion is a limiting factor for the dairy business because it decreases milk production and the potential number of replacements for the herd, increases feeding and medical treatment costs, increases the number of artificial inseminations required to obtain a calf and increases culling rates (Thurmond and Picanso, 1990). For example, in Chilean dairy herds, it is estimated that losses are as great as US \$143.32 for lactations in which an abortion occurs (Gädicke et al., 2010).

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Several determinants are associated with abortion in cattle; some are specific infectious agents (*Brucella Abortus*, *Leptospira* spp., BVDV, etc.), whereas others are related to the characteristics of the cow, such as age, breed and milk production level. Other determinants include the presence of an additional *corpus luteum*, prior abortion, retained placenta or metritis in the early postpartum period (Gröhn et al., 1990; Markusfeld-Nir, 1997; Duchens et al., 2008). Moreover, nutritional supplementation and other aspects of feeding, such as energy or protein levels in the diet (Forar et al., 1996; López-Gatius et al., 2008; Szenci, 2008), are noted as putative causes. Finally, environmental determinants, such as management practices and climatic factors (Labèrnia et al., 1996), are also associated with bovine abortion syndrome (BAS) (Gädick and Monti, 2008). However, management practices have not received much attention in the literature (Forar et al., 1995; Szenci, 2008). Although a multiple-cause origin is recognised, few studies on abortion approach the problem independently of these causes (Thurmond et al., 1990, 1994, 2005; Rafati et al., 2010). Most studies are related to infectious causes or specific agents and are based on intensive indoor dairy production systems. Fewer studies (Atkinson et al., 2000; Campero et al., 2003; Moore et al., 2009) focus on extensive or free-grazing production systems, which represent a large proportion of dairy farming around the world (FAO, 2010). Accurate estimation of the frequency of occurrence is crucial for monitoring herd performance. Therefore, the frequency distribution of BAS incidence and an estimation of the risk factors under Chilean production conditions may contribute to current knowledge and aid in the design of more realistic and efficient control programmes in extensive production systems. The objectives of this study were as follows: first, to estimate the frequency and dynamics of BAS; second, to identify which cows are likely to abort; and, finally, to assess the characteristics of herd management and lactation associated with abortion rates.

2. Material and methods

2.1. Herds and management

The study used a retrospective design. The area under study is located between 36°00' and 44°04' South and 71°00' West and the Pacific Ocean (Instituto Geográfico Militar, 2008). This area supports almost 60% of the total cattle population of the country (Velis et al., 2006). In terms of herd size, the herds selected represent typical medium to large dairies in the centre of southern Chile.

In southern Chile, as in many developing countries, milk production is based on perennial pastures because costs are lower compared with indoor concentrate-based feeding. Pasture is a major component of the diet for dairy cows, and supplementation with cereal grains is often used to increase milk production. Dairy cows are usually fed concentrate twice daily during milking, and they receive a new pasture lot after each milking (Pulido et al., 2009). In this study, dairy herds consisted of Holstein (57.1%) and Black-Pied X Holstein cattle (23.8%). In 93.7% of the farms, all replacements were bred from their own herd. The feeding system was grazing pasture year round and

was supplemented with silage (89.7% of the farms), concentrates (88.9% of the farms) and hay (62.2% of the farms). In addition, most farmers offered year-round mineral supplements to heifers and cows (85.8% of the farms), and cows were divided into production groups (59.8% of the farms). Reproductive management was AI and breeding, year round (all herds), with visual heat detection without the use of aiding devices (95% of the farms). A bull was used on oestrus cows (35.4% of the farms) (after 3 AI, on average). Prostaglandin treatment was applied by farmers (83.5%) to control the reproductive cycle but was not used for all animals; 27.5% of farmers used GnRH treatment.

Ninety-four percent of the farms applied vaccines against brucellosis; 84.2% applied vaccines against leptospirosis (*Leptospira interrogans* serovar Hardjo-bovis and *L. interrogans* serovar Pomona); 48.8% applied vaccines against infectious bovine rhinotracheitis (IBR); and 40.9% applied vaccines against bovine viral diarrhoea virus (BVDV). Most of the farms were certified by the official animal health service (SAG) as free of infection for brucellosis (96.8%) and tuberculosis (79.5%), but the majority of farms only applied control measures for leptospirosis (68.5%).

2.2. Data collection

Herds were selected by convenience based on farmers' willingness to cooperate with the project and by the presence of high-quality electronic records (assessed by the farm advisor). Initially, 127 herds participated and included the requested information. Reproductive information was collected by veterinarians during routine herd health visits (at least once monthly). All cows that calved from 1 January 2000 to 6 months before the date of administration of the questionnaire on each farm were included. The cows had been observed for at least 6 months. Pregnancy diagnosis was performed by transrectal palpation between 35 and 60 days after AI. The reproductive records of the farms included the AI date. Cows that were served with clean-up bulls were removed from the dataset. The herds that were included in the study could be characterised as having both high management standards and high yielding cows (305-day production yield of 7979 lt).

At all farms, a personal interview was conducted and a questionnaire was administered by four interviewers who were trained by the senior author. The questionnaire (5 pages with 18 topics, mostly open questions) was previously validated with 10 farmers and practitioners, and information was obtained about herd management practices relating to replacements, feeding systems, breeding and reproductive management and biosafety measures on farms (A copy of the questionnaire is available upon request from the corresponding author).

2.3. Dataset descriptions

Records obtained from the 127 herds were assessed for consistency and accuracy, validity and recording year. Analysis was performed based on two reduced but consistent datasets that aimed to pursue different goals because not all farms have the same level of information. The first dataset (dataset A) consisted of farmers' historical records

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