



Association between disease occurrence and fertility of dairy cows in three geographic regions of Chile



P.J. Pinedo ^{a,b,*,1}, P. Melendez ^c, S. Paudyal ^d, R. Krauss ^e, F. Arias ^e, H. Lopez ^f,
A. Luco ^e, C.F. Vergara ^{e,f}

^a Texas A&M AgriLife Research, Amarillo, Texas, USA

^b Department of Veterinary Pathobiology, College of Veterinary Medicine and Biomedical Sciences, Texas A&M University System, College Station, Texas, USA

^c Department of Veterinary Medicine and Surgery, College of Veterinary Medicine, University of Missouri–Columbia, Missouri, USA

^d Department of Agricultural Sciences, West Texas A&M University, Canyon, Texas, USA

^e ABS Chile Ltd., Santiago, Chile

^f ABS Global Inc., DeForest, Wisconsin, USA

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ABSTRACT

The objective was to analyze the association between disease occurrence during early lactation and reproductive performance and survival of dairy cows in high-producing herds, under different management practices in three geographic regions of Chile. Data included 30,757 lactation records of cows calving from January 2013 to June 2014 in three different locations: Central (C) area ($n = 6198$ cows in eight herds), Central-South (CS) area ($n = 17,234$ cows in 12 herds), and South (S) area ($n = 7325$ cows in six herds). Data were analyzed using logistic regression and ANOVA, considering cow as the experimental unit. Covariables offered to the models included parity number, season of calving, cow and herd relative milk yield, geographic location, and management system. Average milk yield (305 ME) per cow were 12,091, 11,783, and 6852 kg for C, CS, and S regions, respectively. Time from calving to first service and time to conception were consistently greater for cows with at least one disease event within 50 days in milk (DIM), for cows that were reported lame, or for cows that had mastitis or metritis. The odds (95% confidence interval) of pregnancy at 150 DIM (P150) and the odds of survival until 150 DIM (S150) for cows that had at least one disease event within 50 DIM were 0.84 (0.79–0.91) times the odds of pregnancy and 0.25 (0.22–0.28) times the odds of survival for healthy cows. The odds of P150 for cows located in the C and CS areas were 1.56 (1.36–1.80) and 1.16 (1.04–1.30) times the odds of P150 for cows in the S area. The odds of S150 for cows located in the C and CS areas were 0.48 (0.37–0.62) and 0.54 (0.42–0.67) times the odds of S150 for cows in the S area. These data suggested that cow health status and geographic location are significantly associated with reproductive performance and survival in this population of Chilean dairy cows.

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1. Introduction

The transition period is a critical time for cow health and survival and for the profitability of the lactation. Significant

endocrine changes occur with calving [1], and high-producing dairy cows require severe metabolic adjustments to allow nutrient partitioning to support milk synthesis. The abrupt increase in nutrient requirements that occurs at the onset of lactation, when feed intake is usually depressed, causes extensive mobilization of body fat and results in a shift from a positive energy balance to a negative one. These events are concurrent with substantial immune suppression [2–4], resulting in suboptimal health

* Corresponding author. Tel.: 1 970 491 8300; fax: 1 970 491 5326.

E-mail address: pablo.pinedo@colostate.edu (P.J. Pinedo).

¹ Present address: Department of Animal Sciences, Colorado State University, Fort Collins, Colorado, USA.

and performance in the affected cows. Notably, about 30% to 50% of high-producing cows may be affected by some disease around parturition and 75% of health disorders will occur in the first 30 DIM [5–7], which is also a critical time for survival with close to 8% of cows leaving the herd during the first 2 months of lactation [8,9].

Reproductive efficiency has a major impact on the profitability of dairy farms. Improvement in reproductive performance of dairy cattle depends on factors associated with resumption of ovarian function, estrus expression, and establishment and maintenance of pregnancy [10]. The effect of disease on reproductive performance has been well characterized; factors such as extensive loss of body condition and postpartum health problems have been implicated with impaired resumption of postpartum ovulation, compromised fertilization and pre- and peri-implantation conceptus development, altered conceptus gene expression, increased pregnancy loss, and ultimately reduced pregnancy per insemination [10–13]. Contrasting with the availability of studies on disease prevalence during the transition period and their effects on reproductive performance in North America [14], there is a paucity of information on this topic from dairy farms in other countries, where similar genetics are used in a variety of environments and management systems.

Chile has a dairy cattle population of 480,000 lactating cows [15], with the Holstein breed being the most common because genetics from Canada and the United States have been introduced gradually during the last 30 years [16,17]. Chilean dairy farms are represented by two typical groups: The small family agriculturist group, holding 50% of the country's livestock and characterized by a low-technology level and extensive management and the commercial group, characterized by more advanced technology and intensive management [18]. Only, 18% of Chilean producers contribute 86.4% of the industrial volume of milk [15]; 70% of Chilean dairy cattle is distributed in the South (S) area of the country being managed under grazing conditions and the remaining 30% is distributed in the Central (C) and Central-South (CS) areas being managed under confinement conditions [15].

The prevalence of clinical and subclinical diseases in Chilean dairy herds and their impact on reproductive outcomes have not been extensively characterized, but, as reported by some authors, it may be expected that disease occurrence varies depending on production level and whether the cows are under confinement or grazing conditions [14,19]. We hypothesize that the occurrence of clinical and subclinical diseases in dairy farms located in multiple geographic areas of Chile differs from values observed in high-producing dairy cows in North America and that diseases compromise reproductive performance and survival of this population of cows.

Therefore, the objective of this study was to analyze the association between disease occurrence during early lactation and reproductive performance and survival of dairy cows in high-producing herds under different management practices in three geographic regions of Chile.

2. Materials and methods

2.1. Study population

The present study analyzed lactation records from cows maintained in high-producing herds in three regions of Chile (Fig. 1). A convenience sample of farms was selected from the technical service platform offered by ABS Global to dairy producers in Chile. Herds were visited monthly by one of the authors in a routine fashion to collect and record data. Data from cows calving between January 2013 and June 2014 were included in the analysis, resulting in a total of 30,757 complete lactation records. This time frame was defined to include the most recent lactation of the participant cows and to provide enough time for reproductive outcomes to be completed (breedings and diagnosis of pregnancy). Data were provided by 26 herds, ranging from 126 to 9803 cows, located in the C area ($n = 6198$ cows in eight herds), CS area ($n = 17,234$ cows in 12 herds), and S area ($n = 7325$ cows in six herds). Housing systems consisted of open dry lot ($n = 3881$ cows in six herds), freestall ($n = 21,421$ cows in 12 herds), grazing ($n = 1211$ cows in three herds), and freestall/grazing ($n = 4244$ cows in five herds). Reproductive programs in the participant farms were on the basis of insemination from visual estrus detection, with varying levels of application of estrus or ovulation synchronization procedures and timed artificial insemination.

Information was extracted from on-farm software (DairyComp 305; Valley Agricultural Software, Tulare, CA, USA) and consisted of calving date, parity, health events and date, reproductive information (date of breedings and diagnosis of pregnancy), 305-day mature equivalent (305 ME) milk yield, herd code, and recorded culling date or death. Lactation records with missing calving date were removed from the data set.

2.2. Geographic regions

The C area of Chile is an agricultural region located between 32.0°S and 35.3°S latitude and 71.1°W and 71.5°W longitude. It has a Mediterranean-type climate, with a minimum and maximum ambient temperature of 3 °C and 32 °C, respectively, and a mean rainfall of 400 mm/y (0 mm in January and 80 mm in July). The S area holds the largest concentration of the country's dairy cattle. It extends from about 39°S to about 42°S and has a temperate oceanic climate. The summer months of January and February are the driest, with a monthly average precipitation of 67 mm. The winter months average 410.6 mm of rainfall. Annual rainfall ranges from 1500 to 2500 mm. Temperatures in the area are moderate. The CS area represents a transition zone between central and south Chile [20].

2.3. Events of interest and independent variables

Outcome variables were calving to first service interval (days), defined as the number of days between parturition and the subsequent first breeding; calving to conception interval (days), defined as the number of days between parturition and the breeding that resulted in a pregnancy;

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