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The influence of the rearing period on intramammary infections in Swiss dairy heifers: A cross-sectional study

M.J. Bludau[a], A. Maeschli[a], F. Leiber[a], P. Klocke[a,1], J.A. Berezowski[c], M. Bodmer[b,*,2], B. Vidondo[c,2]

[a] Department of Livestock Science, Research Institute of Organic Agriculture (FiBL), Ackerstrasse 113, 5070 Frick, Switzerland
[b] Clinic for Ruminants, University of Bern, Bremgartenstrasse 109a, 3012 Bern, Switzerland
[c] Veterinary Public Health Institute, University of Bern, Schwarzenburgstrasse 155, 3097 Liebefeld, Switzerland

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ABSTRACT

Healthy replacement heifers are one of the foundations of a healthy dairy herd. Farm management and rearing systems in Switzerland provide a wide variety of factors that could potentially be associated with intramammary infections (IMI) in early lactating dairy heifers. In this study, IMI with minor mastitis pathogens such as coagulase-negative staphylococci (CNS), contagious pathogens, and environmental major pathogens were identified. Fifty-four dairy farms were enrolled in the study. A questionnaire was used to collect herd level data on housing, management and welfare of young stock during farm visits and interviews with the farmers. Cow-level data such as breed, age at first calving, udder condition and swelling, and calving ease were also recorded. Data was also collected about young stock that spent a period of at least 3 months on an external rearing farm or on a seasonal alpine farm. At the quarter level, teat conditions such as teat lesions, teat dysfunction, presence of a papilloma and teat length were recorded. Within 24 h after parturition, samples of colostral milk from 1564 quarters (391 heifers) were collected aseptically for bacterial culture. Positive bacteriological culture results were found in 49% of quarter samples. Potential risk factors for IMI were identified at the quarter, animal and herd level using multivariable and multilevel logistic regression analysis. At the herd level tie-stalls, and at cow-level the breed category "Brown cattle" were risk factors for IMI caused by contagious major pathogens such as *Staphylococcus aureus* (*S. aureus*). At the quarter-level, teat swelling and teat lesions were highly associated with IMI caused by environmental major pathogens. At the herd level heifer rearing at external farms was associated with less IMI caused by major environmental pathogens. Keeping pregnant heifers in a separate group was negatively associated with IMI caused by CNS. The odds of IMI with coagulase-negative staphylococci increased if weaning age was less than 4 months and if concentrates were fed to calves younger than 2 weeks. This study identified herd, cow- and quarter-level risk factors that may be important for IMI prevention in the future.

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1. Introduction

It is well accepted that good udder health is crucial for the economic success of a dairy farm. However, farmers often pay less attention to the rearing of young stock than to the management of adult cows, even though it has been shown that adequate management of young stock can avoid future udder health problems (Le Cozler et al., 2008). Recent studies distinguish between clinical and subclinical heifer mastitis, depending on the presence or absence of inflammatory signs in the mammary gland (Piepers et al., 2010). Heifer mastitis is a disease which may be increasing in importance in different parts of the world. In New Zealand, 21.5% of quarters of heifers had a positive bacterial culture result (Compton et al., 2007) and in a Belgium study 25% of quarters of early postpartum heifers were culture positive (Piepers et al., 2010). Although CNS is the most frequently isolated pathogen in heifers (Fox, 2009; Piepers et al., 2011) CNS is traditionally categorized as minor pathogen and only in rare cases results in clinical mastitis in heifers (Lam et al., 1997). Piepers et al. (2011) reported that CNS infection in heifers in early lactation was very common (72% of tested quarters

* Corresponding author.
E-mail address: michele.bodmer@vetsuisse.unibe.ch (M. Bodmer).
[1] Present address: bovicare GmbH, Hermannswerder, Haus 14, 14473 Potsdam, Germany.
[2] These authors contributed equally.

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Table 1A
Description of herd level risk factors potentially related to intramammary infections in Swiss dairy heifers.

Independent variable	Categories	Definition of categories
Variables at herd level (demographic data)		
Herd size	12–24 dairy cows	Tercile 1
	24–33 dairy cows	Tercile 2
	34–115 dairy cows	Tercile 3
Geographical region of the dairy farm (Cadastral zones[1])	Lowland zone	Territorial division of agricultural area with different climate, infrastructure and surface structure
	Mountain zone I	
	Mountain zone II	
	Mountain zones III and IV	
Average milk production in year 2012	5500–7000 kg	Tercile 1
	7000–7800 kg	Tercile 2
	7800–10,000 kg	Tercile 3
Yield corrected herd somatic cell count CHSCC1	<100,000 (cells/mL)	Average in the year 2012
	≥100,000 (cells/mL)	
Yield corrected herd somatic cell count CHSCC2	<200,000 (cells/mL)	Average in the year 2012
	≥200,000 (cells/mL)	
Housing system (Dairy cows)	Loose housing	
	Tie-stall barn	
Housing young stock		
Housing of calves	Crate	
	Igloo	
	Group pen	
Housing of young cattle	Tie-stall barn	
	Deep straw grouped	Deep straw bedded group pens without cubicles
	Free-stall with cubicles	Free-stall with cubicles
	Tie-stall barn	Tie-stall barn
Alpine rearing	Yes/No	Communal alpine pasturing during summer
External rearing	Yes/No	Raising in specialized farms with animals of other farms
Feeding of rearing cattle		
Period of milk feedin	<4 months	Tercile 1
	4 months	Tercile 2
	>4 months	Tercile 3
Amount of whole milk fed	L//day	Range: 5–8 l/day
Quality of whole milk fed	Milk with antibiotic residues	
	High SCC milk	
	Bulk tank milk	
Feeding of minerals to calves	Yes/No	
Calf age at the start of additional feeding	Directly after birth	Tercile 1
	After 1 week	Tercile 2
	After 2 weeks	Tercile 3
Feeding concentrates for calves	Yes/No	
Type of roughage for cattle	Only hay	
	Second cut hay	
	Corn Silage	
Feeding concentrates to heifers	Grass silage	
Feeding of minerals to heifers	Yes/No	
Grazing regimen	Yes/No	
	<6 months	Tercile 1
	6–7 months	Tercile 2
	>7 months	Tercile 3
Heifer management		
Preconditions for the first insemination	Age	
	Weight	
	Development	
	Season	
Desired calving age of heifers	24–26 months	
	27–29 months	
	≥30 months	
Adaption time in the productive herd	<2 weeks	Tercile 1
	2–3 weeks	Tercile 2
	>3 weeks	Tercile 3
Heifers housed with dry cows	Yes/No	

infected) and was associated with fewer cases of clinical mastitis (CM) throughout the following lactation compared to non-infected herd mates. In Piepers' study the occurrence of IMI caused by contagious pathogens such as *S. aureus* and *Streptococcus agalactiae (S. agalactiae)*, and environmental pathogens such as *Streptococcus uberis (S. uberis), Streptococcus dysgalactiae (S. dysgalactiae)* and *Escherichia coli* (*E. coli*) were less prevalent in early lactation heifers.

Several studies have identified potential risk factors for heifer mastitis (De Vliegher et al., 2004; Svensson et al., 2006; Piepers et al., 2011; De Vliegher et al., 2012; Krömker et al., 2012; Archer et al., 2013; Bludau et al., 2014; Abb-Schwedler et al., 2014). It is reported to be a multifactorial disease influenced by climate, season, geographical location and genetic background. In particular management factors such as social stress, type of housing sys-

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