In vitro and *in vivo* studies on treatment and prevention of bovine mastitis

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Abstract

Mastitis prevalence on dairy farms depends on the number of infected cows and the duration of each intramammary infection. Strategies aiming to influence these factors are the subject of research presented in this thesis.

Decreasing the duration of infection can be achieved by successfully treating infected quarters. Treatment of mastitis can occur during lactation or in the dry period. Treatment success is influenced by the concentration of antimicrobial achieved at the site of infection and the length of time it is present. The concentration of antimicrobial should exceed the relevant minimal inhibitory concentration. The susceptibility of mastitis-causing organisms varies among geographical areas and over time. New Zealand's susceptibility data demonstrated a high susceptibility to penicillin. A formulation containing this antimicrobial was administered to healthy lactating cows milked once or twice daily. The concentrations of penicillin in milk were above the minimal inhibitory concentrations for the entire inter-dosing interval. Doubling the number of treatments or milking once-a-day resulted in a significantly increased time above the minimal inhibitory concentrations.

The number of new infections is greatest during the early dry period in mature cows and in the pre-calving period in both heifers and mature cows. Pre-partum administration of delayed release antimicrobial formulations in heifers decreased the incidence of clinical mastitis and resulted in better reproductive performance, but not in increased milk production, when compared to control heifers. More effective prevention of new infections within the dry period was achieved by administering a novel teat sealant to mature cows when compared to a commercial teat sealant and untreated controls.

Strategies for shortening the duration of intramammary infections and decreasing the number of affected cows at the start of lactation investigated in this thesis should reduce the prevalence of mastitis on dairy farms in New Zealand.

KEY WORDS: Aetiology, Antibiotic, Antimicrobial, Challenge, Dry period, Experimental challenge, Heifers, Individual Cow Somatic Cell Count, Internal teat sealant, Mastitis, Milking frequency, Penicillin G, Reproductive performance, *Staphylococcus aureus, Streptococcus uberis*, *Streptococcus dysgalactiae,* Susceptibility, Time Above the Minimal Inhibitory Concentrations, Udder, Withholding Period.

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Table of Contents

List of Equations

List of Figures

List of Tables

List of abbreviations

Abbreviation	Meaning
ACVM	Agricultural Compounds and Veterinary Medicines Group (part of MAF New Zealand)
ATS	Anti-Infective-Containing Internal Teat Sealant
BAGG	Buffered Azide Glucose Glycerol broth
BMSCC	Bulk Milk Somatic Cell Count
CAMP	Christie–Atkins–Munch-Petersen test
CI	Confidence Interval
CLSI	Clinical and Laboratory Standards Institute
CMT	California Mastitis Test
CNS	Coagulase-Negative Staphylococci
DCT	Dry Cow Therapy
EMEA	European Medicines Agency
EUCAST	European Committee on Antimicrobial Susceptibility Testing
I	Intermediate Susceptibility
ICSCC	Individual Cow Somatic Cell Count
IU	International Units
kg	Kilogramme
L	Litre
LF	Left Front
Ltd	Limited
µg	Microgram
mg	Milligram
mL	Millilitre
MIC	Minimal Inhibitory Concentration

List of Abbreviations continued

MRL	Maximum Residue Levels
MRSA	Methicillin-Resistant *Staphylococcus aureus*
NIRD	National Institute for Research in Dairying
OAD	Once-a-Day
PBP	Penicillin Binding Protein
PFGE	Pulse Field Gel Electrophoresis
R	Resistant
RR	Rear Right
S	Susceptible
SAMM	Seasonal Approach to Managing Mastitis
SAS	Statistical Analysis System
SCC	Somatic Cell Count
SCS	Somatic Cell Score
T>MIC	Time above the Minimal Inhibitory Concentrations
TD	Twice daily
WHP	Withholding period