UNIVERSITI PUTRA MALAYSIA

EXPERIMENTAL TRIAL ON EFFICACY OF CLOXACILLIN AS DRY COW THERAPY AND 0.5% IODINE AS PREMILKING AND POSTMILKING TEAT DIPPING TO REDUCE BOVINE MASTITIS

RABINDRA THAKUR

FPV 2004 3
EXPERIMENTAL TRIAL ON EFFICACY OF CLOXACILLIN AS DRY COW THERAPY AND 0.5% IODINE AS PREMILKING AND POSTMILKING TEAT DIPPING TO REDUCE BOVINE MASTITIS

By

RABINDRA THAKUR

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Veterinary Science

March 2004
DEDICATION

This Thesis is dedicated to my

- late grand father Sri Ram Swarup Thakur, late grand mother, Ram Shakhi,
- father Sri Bibhishan Thakur, mother Ram Snehi
- wife, Veena and children Piyush, Pallavi, Paritosh, Shreya and Utkarsh,
- father-in-law, Prof. Arun Kumar Arun, mother-in-law, Ram Rati,
- brother, Dhirendra, sister, Rekha, sister in law Mamta and brother in law Sri Arun Kumar Sinha and Sri Santosh Kumar

for their full support and encouragement
EXPERIMENTAL TRIAL ON EFFICACY OF CLOXACILLIN AS DRY COW THERAPY AND 0.5% IODINE AS PREMILKING AND POSTMILKING TEAT DIPPING TO REDUCE BOVINE MASTITIS

By

RABINDRA THAKUR

March 2004

Chairman: Siti Zubaidah Ramanoon

Faculty: Veterinary Medicine

The efficacy of dry cow therapy, pre and postmilking teat dipping for bovine mastitis was studied. A total of 54 Holstein-Friesian late pregnant dairy cows on one farm in their third to tenth lactation were selected. Animals were randomly allocated to treatment and untreated control groups. At drying off, treatment group received 500mg cloxacillin as dry cow therapy (DCT), intramammarily. Iodine 0.5% as teat dip was applied at pre and postmilking. The DCT cured infected quarter, significantly (P<0.05) for Any organisms (Gram-negative and Gram-positive) and Staphylococcus aureus. Prevention of mastitis using DCT was not significant (P>0.05).

Self cure rates at cow level was 16%-50% and at quarter level was 16%-65% for Any organism, S. aureus, coagulase-negative staphylococcus and Other organism (Other than S. aureus and CNS), respectively. New infection rates at cow level were 0%-75% and at quarter level was 18%-32%. Teat dipping did not significantly prevent new cases of mastitis (P>0.05). The California mastitis test (CMT) positive was
significantly reduced (P<0.05) in treated quarters. The mean colony forming unit (cfu) log_{10} was 2.88 ± 0.32 (mean ± standard error of the mean) in first month after calving, significantly lower (P<0.05) in comparison to dry off and control group (5.76 ± 0.24 and 5.63 ± 0.37), respectively. The percent efficacy of the DCT was 48.8%. In conclusion, DCT significantly cured infected quarters and teat dipping did not prevent new cases of mastitis.

Keywords: Cow, mastitis, dry cow therapy, teat dip.
Abstrak tesis yang dikemukakan kepada senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains Veterinar

EKSPERIMENT PERCUBAAN UNTUK MENGUJI KEMUJARABAN CLOXACILLIN SEBAGAI TERAPI PENERINGAN LEMBU DAN PENGGUNAAN 0.5% IODIN SEBAGAI CELUPAN PUTING SUSU SEBELUM DAN SELEPAS PERAHAN SUSU UNTUK MENGURANGKAN MASTITIS LEMBU

Oleh

RABINDRA THAKUR

Mac 2004

Pengerusi: Siti Zubaidah Ramanoon

Fakulti: Perubatan Veterinar

Satu kajian ke atas mastitis lembu telah dijalankan untuk menguji kemujaraban terapi pengeriningan lembu dan celupan puting susu sebelum dan selepas pemerahan susu. Sebanyak 54 ekor lembu tenusu Holstein–Friesian, bunting berat, dalam laktasi ketiga hingga sepuluh, telah dipilih daripada sebuah ladang. Lembu tenusu dibahagikan secara rawak kepada kumpulan rawatan dan kawalan. Pada masa pengeriningan, kumpulan rawatan diberi cloxacillin 500mg secara intramamari. Puting susu dicelup dengan 0.5% Iodin sebelum dan selepas pemerahan susu. Terapi pengeriningan lembu terbukti dapat menyembuhkan jangkitan suku ambing susu untuk kategori sebarang organisma (Gram-negatif dan Gram-positif) dan Staphylococcus aureus. Pencegahan mastitis dengan menggunakan terapi pengeriningan lembu didapati tidak bekesan (P>0.05).
Kadar penyembuhan sendiri dalam lembu ialah 16%-50% dan sukuan ialah 16%-65% bagi sebarang organisma, S. aureus, koagulasi-negatif *staphylococcus* dan Organisma lain. Kadar jangkitan baru dalam lembu ialah 0%-75% dan dalam sukuan ialah 18%-32%. Celupan puting susu tidak dapat mencegah jangkitan baru mastitis dengan berkesan (P>0.05). Ujian California mastitis positif didapati berkurangan dengan berkesan (P<0.05) dalam sukuan yang dirawat. Purata unit pembentukan koloni (cfu) log₁₀ ialah 2.88± 0.32 (purata ± sisihan piawai purata) dalam bulan pertama selepas beranak adalah masing –masing kurang (P<0.05) berbanding semasa tempoh kering dan kumpulan kawalan (5.76 ± 0.24 dan 5.63 ± 0.37). Peratus kemujaraban bagi terapi pengeringan lembu adalah 48.8%. Kesimpulannya, terapi pengeringan lembu adalah berkesan menyembuhkan jangkitan sukuan ambing susu dan celupan puting susu tidak dapat mencegah jangkitan baru mastitis.

Kata kunci: Lembu, mastitis, terapi pengeringan lembu, celupan puting susu.
ACKNOWLEDGEMENTS

I would like to extend great appreciation to my supervisor Dr. Siti Zubaidah Ramanoon for her guidance in the completion of this thesis, words of comfort and suggestions during my depression time and for her friendship. I would like to thank my supervisory committee, Dr. Nadzri Salim and Assoc. Prof Dr. Abdul Rahim Mutalib for their expertise, time to time suggestions and contribution in this work. Also, big thank you to my external and internal examiners, and the chairman of the examination committee.

I would like to thank Dr. Ahmad Mohd Salleh (Director of Kluang Animal Institute, IHK), Dr. Ahmad Shukeri Bin Abdullah (Head of Large Ruminant Division, IHK), Mr. Maliki Bin Haroon (Assistant Veterinary Officer, IHK), Mr. Siva Rajasingam (Senior Veterinary Assistant) and other staff of IHK who have helped me in sampling work, providing data of the animals and the farm, arrangement of lodging and their friendship.

Thanks to all the staff of bacteriology laboratory, Dr. Zunita Zakaria, Dr. Siti Khairani Bejo, Mr. Hajaraih Salamat, Mr. Jefri, Mr. Zainudin, Miss Latifah, Atie, Ana Maria, Sit Mei Lin and Maureen. Also thanks to Fauzi, Mr. Krishnan Mariappan for the technical assistance in information technology, Mr. Amir Hussain Mohd Ishak and Mrs. Noraini Kassim for material collection from the library.

My best compliment to my sponsor EC Project/HMGN, Agriculture Ministry and Livestock Department. Also, to Mr. K. N. Singh, Mr. N. P. Choudhary and all staff
of District Livestock Services office of Mahottary who have helped me a lot during my presence and absence. Also thanks to Dr. K. S. Bisht, Dr. P. R. Bhusal, Dr. B. R. Thapa and Mrs Dr. Karuna Sharma for the friendship and moral support.

I would also like to thank my family, father and mother, father and mother in-law, brother, brother-in-law and all staff of Daffodils Public School for moral support.

Finally, I would like to thank my son Piyush, Paritosh and daughter Pallavi for their patience in two years of my absence. This acknowledgement is not complete without thanking my wife Dr. Veena for her suggestion, encouragement, and support to me, children and all family members.
I certify that an Examination Committee met on 16th March 2004 to conduct the final examination of Rabindra Thakur on his Master of Veterinary Science thesis entitled “Experimental trial on efficacy of cloxacillin as dry cow therapy and 0.5% iodine as premilking and postmilking teat dipping to reduce bovine mastitis” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

**Abdul Wahid Haron, Ph.D**  
Chairman  
Asso. Professor  
Faculty of Veterinary Medicine  
Universiti Putra Malaysia  
(Chairman)

**Dato Mohamed. Shariff Mohamed Din, Ph.D**  
Professor  
Faculty of Veterinary Medicine  
Universiti Putra Malaysia  
(Member)

**Abdul Aziz Saharee, Ph.D**  
Professor  
Faculty of Veterinary Medicine  
Universiti Putra Malaysia  
(Member)

**Abdul Aziz Jamaluddin, Ph.D**  
Deputy Director General  
Department of Veterinary Services  
Malaysia  
(Independent Examiner)

**GULAM RUSUL RAHMAT ALI, Ph.D.**  
Professor/Deputy Dean  
School of Graduate Studies  
Universiti Putra Malaysia  

Date:
This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Veterinary Science. The members of the Supervisory Committee are as follows:

**Siti Zubaidah Ramanoon**
Lecturer  
Faculty of Veterinary Medicine  
Universiti Putra Malaysia  
(Chairman)

**Nadzri Salim**
Lecturer  
Faculty of Veterinary Medicine  
Universiti Putra Malaysia  
(Member)

**Abdul Rahim Mutalib, Ph.D.**  
Associate Professor  
Faculty of Veterinary Medicine  
Universiti Putra Malaysia  
(Member)

---

**AINI IDERIS, Ph.D.**  
Professor/Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date:
DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

______________________________
Rabindra Thakur

Date:
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter/Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEDICATION</td>
<td>ii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>vii</td>
</tr>
<tr>
<td>APPROVAL</td>
<td>ix</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xvi</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>xvii</td>
</tr>
</tbody>
</table>

## CHAPTER

### 1 INTRODUCTION

1.1

### 2 LITERATURE REVIEW

2.1 Introduction
2.1

2.2 Aetiologic agent
2.2

2.2.1 Contagious pathogen
2.2

2.2.2 Environmental pathogen
2.2

2.3 Diagnosis of Bovine Mastitis
2.3

2.3.1 Physical examination of udder
2.3

2.3.2 Foremilk stripping
2.4

2.3.3 pH of foremilk with indicator dyes
2.4

2.3.4 Test of milk chlorides
2.5

2.3.5 The Catalase test
2.5

2.3.6 The Whiteside test
2.5

2.3.7 The Brabant mastitis test
2.6

2.3.8 The Wisconsin mastitis test
2.6

2.3.9 Indicator paper test
2.6

2.3.10 Hymast diagnostic kit
2.7

2.3.11 Modified model somatic cell count
2.7

2.3.12 California mastitis test
2.8

2.3.13 Electrical conductivity
2.9

2.3.14 Enzyme linked immunosorbent assay test
2.10

2.3.15 N-acetyl-β-D-glucosaminadase test
2.10

2.4 Risk Factors for Intramammary Infections
2.12

2.4.1 Age and parity
2.12

2.4.2 Stage of lactation
2.12

2.4.3 Milking characteristics
2.12

2.4.4 Morphology of udder and teat
2.13

2.4.5 Physical condition of teat
2.13

2.4.6 Nutritional status
2.13

2.4.7 Other concurrent diseases
2.14

2.4.8 Immunological function of mammary gland
2.14
3  Efficacy of Cloxacillin, 500mg as Dry Cow Therapy in Bovine Mastitis

3.1  Introduction

3.2  Materials and methods

3.2.1  Farm and animals

3.2.2  Preparation of udder and teats

3.2.3  Procedure for collection of milk samples

3.2.4  Procedure for California mastitis test

3.2.5  Procedure for bacterial colony forming unit counts

3.2.6  Bacteriological culture

3.2.7  Biochemical test

3.2.8  The API 20 Strep System

3.2.9  The API Staph

3.2.10  Statistical analysis

3.3  Result

3.3.1  Milk bacteriological culture

3.3.2  Efficacy of dry cow therapy with cloxacillin 500mg

3.4  Discussion

4  Efficacy of 0.5% Iodine as Pre and Postmilking Teat Dipping in Bovine Mastitis

4.1  Introduction

4.2  Materials and methods
4.2.1 Farm and animals
4.2.2 Preparation of udder and teats
4.2.3 Procedure for premilking teat dipping
4.2.4 Procedure for postmilking teat dipping
4.2.5 Procedure for collection of milk samples
4.2.6 Statistical analysis

4.3 Result
4.3.1 Analysis of the intramammary infection after calving
4.3.2 Organism present in the milk bacteriological culture at 1st to 5th month after calving in treatment and control groups
4.3.3 Evaluation of prevention of new intramammary infection at first to fifth month after calving
4.3.4 New infections rates
4.3.5 California mastitis test results of quarters at 1st to 5th month after calving
4.3.6 CMT result compared with bacteriological culture at 1st to 5th month after calving
4.3.7 Colony forming unit

4.4 Discussion

5 GENERAL DISCUSSION
6 CONCLUSION

REFERENCES
APPENDIX
BIODATA OF THE AUTHOR
<table>
<thead>
<tr>
<th>Table</th>
<th>List of Tables</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Prevalence of contagious and environmental organism</td>
<td>2.3</td>
</tr>
<tr>
<td>2.2</td>
<td>Tests used for the diagnosis of bovine mastitis and the sensitivity and specificity of the test</td>
<td>2.11</td>
</tr>
<tr>
<td>2.3</td>
<td>Malaysian studies on prevalence and aetiologic agents of subclinical mastitis in dairy cows and quarters</td>
<td>2.31</td>
</tr>
<tr>
<td>3.1</td>
<td>Number of lactation and number of animals for sampling</td>
<td>3.4</td>
</tr>
<tr>
<td>3.2</td>
<td>Interpretation of CMT reaction score</td>
<td>3.8</td>
</tr>
<tr>
<td>3.3</td>
<td>Characteristics of different organisms on bacteriological culture</td>
<td>3.10</td>
</tr>
<tr>
<td>3.4</td>
<td>Biochemical tests and description for various organisms</td>
<td>3.12</td>
</tr>
<tr>
<td>3.5</td>
<td>Distribution of milk culture from cows and quarters at dry off and first month after calving for treatment and control groups</td>
<td>3.27</td>
</tr>
<tr>
<td>3.6</td>
<td>Organism present at dry off and first month after calving in frequencies and percentage at cow and quarter levels</td>
<td>3.28</td>
</tr>
<tr>
<td>3.7</td>
<td>Bacteriological isolates from the quarter milk bacteriological culture of the treatment and control groups at the time of dry off and in the first month</td>
<td>3.29</td>
</tr>
<tr>
<td>3.8</td>
<td>Effect of dry cow therapy in curing IMI in cows and quarters (%) at first month after calving</td>
<td>3.30</td>
</tr>
<tr>
<td>3.9</td>
<td>Effect of dry cow therapy in the prevention of new intramammary infection at cow and quarter level at first month after calving</td>
<td>3.31</td>
</tr>
<tr>
<td>3.10</td>
<td>Self cure rate at cow and quarter level at first month after calving from the control group</td>
<td>3.32</td>
</tr>
</tbody>
</table>
3.11 New infection rates of the cows and quarters in frequencies and percentages at first month after calving
3.12 CMT results of quarters at dry off and first month after calving
3.13 CMT results compared with bacteriological cultures at first month after calving
3.14 Comparison of mean log_{10} colony forming unit in treatment and control group at dry off and first month after calving
4.1 Descriptive analysis of milk bacteriological culture from 1st to 5th month after calving in treatment and control groups
4.2 Organism present in milk bacteriological culture at 1st to 5th month after calving in treatment and control group
4.3 Effect of pre and postmilking teat dipping in the prevention of new IMI at cow level from 1st to 5th month after calving
4.4 Effect of pre and postmilking teat dipping in the prevention of new IMI at quarter level from 1st to 5th month after calving
4.5 New intramammary infection rates of cows and quarters from 1st to 5th month after calving
4.6 CMT results of quarters at 1st to 5th month after calving
4.7 CMT results compared with bacteriological culture at 1st to 5th month after calving
4.8 Sensitivity and specificity of CMT compared with milk bacteriological culture results
4.9 Comparison of mean log_{10} colony forming unit in treatment and control groups at 1st to 5th month after calving

xvi
<table>
<thead>
<tr>
<th>Figure</th>
<th>List of Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Percentage of quarters cured after dry cow therapy in treatment and control groups by organism category</td>
<td>A.8</td>
</tr>
<tr>
<td>3.2 Mean ± SEM of cfu log base10 in quarter milk sample before and after dry cow therapy for the treatment and control groups</td>
<td>A.8</td>
</tr>
<tr>
<td>4.1 Culture positive in percentage for treated and untreated control quarters from first to fifth month of teat dip</td>
<td>A.9</td>
</tr>
<tr>
<td>4.2 Result of cfu (Log base 10) after teat dipping during five months of sampling after calving</td>
<td>A.9</td>
</tr>
</tbody>
</table>
### LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADH</td>
<td>Arginine Di-Hydrolase</td>
</tr>
<tr>
<td>Any organism</td>
<td>All Gram-negative and Gram-positive organism</td>
</tr>
<tr>
<td>CFU</td>
<td>Colony forming unit</td>
</tr>
<tr>
<td>(\chi^2)</td>
<td>Chi-square test</td>
</tr>
<tr>
<td>CMT</td>
<td>California mastitis test</td>
</tr>
<tr>
<td>CIR</td>
<td>Cow infection rate</td>
</tr>
<tr>
<td>CNS</td>
<td>Coagulase-negative <em>staphylococcus</em></td>
</tr>
<tr>
<td>DCT</td>
<td>Dry cow therapy</td>
</tr>
<tr>
<td>ELISA</td>
<td>Enzyme linked immunosorbent assay</td>
</tr>
<tr>
<td>Epi Info</td>
<td>Epidemiology Information</td>
</tr>
<tr>
<td>FOECC</td>
<td>Fluoro-opto-electric-cell-counting</td>
</tr>
<tr>
<td>FET</td>
<td>Fisher exact test</td>
</tr>
<tr>
<td>IMI</td>
<td>Intramammary infection</td>
</tr>
<tr>
<td>IPT</td>
<td>Indicator paper test</td>
</tr>
<tr>
<td>MDG</td>
<td>Methyl- alpha- D- Glucopyranoside</td>
</tr>
<tr>
<td>NAGase</td>
<td>N- acetyl- β-D-glucosaminadase</td>
</tr>
<tr>
<td>NaOH</td>
<td>Sodium hydroxide</td>
</tr>
<tr>
<td>NMC</td>
<td>National Mastitis Council</td>
</tr>
<tr>
<td>Other organism</td>
<td>Organism other than <em>S. aureus</em> and CNS</td>
</tr>
<tr>
<td>QIR</td>
<td>Quarter infection rate</td>
</tr>
<tr>
<td>SA</td>
<td><em>Staphylococcus aureus</em></td>
</tr>
<tr>
<td>SCC</td>
<td>Somatic cell count</td>
</tr>
<tr>
<td>SCM</td>
<td>Subclinical Mastitis</td>
</tr>
<tr>
<td>SE</td>
<td>Standard error</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical package for social services</td>
</tr>
<tr>
<td>URE</td>
<td>Urease</td>
</tr>
<tr>
<td>VP</td>
<td>Voges-proskauer</td>
</tr>
<tr>
<td>WMT</td>
<td>Wisconsin mastitis test</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

Bovine mastitis is generally characterized by inflammation of the parenchyma of the mammary gland in the presence of significantly increased leukocyte content in milk (Radostits et al., 2000). Causes of mastitis may be by physical, chemical, managerial, mycotic and primarily bacteriological and pathological changes in the glandular tissue. The most important changes in the milk include discoloration, pus, the presence of clots, abnormal secretion in the gland and presence of a large numbers of leukocytes. There is swelling, heat, pain, fever, marked depression, rapid weak pulse, sunken eyes, weakness and complete anorexia (Radostits et al., 2000).

Many infective agents cause intramammary infections (IMI). The common microorganisms are *Streptococcus agalactiae, Staphylococcus aureus* and *Escherichia coli* (http://www.nmconline.org). Risk factors for mastitis are infected quarters, teat injury, efficiency of milking personnel, milking speed and hygiene in the milk parlor. Susceptibility of the cow to mastitis was found to be related to stage of lactation, early (50 days) post calving (Sargeant et al., 1998), age of cow, lactation number (more than four lactations) (Emanuelson and Funke, 1991), level of inherited resistance, teat shape, anatomy of teat canal, teat lesions (especially the orifice), distance from ground to teat, immunological factors including leukocyte and status of each mammary gland including prior infection (Radostits et al., 2000).
The risk of IMI is increased with high milking rate and large teat canal diameter. It is also associated with increased somatic cell count (SCC) (Slettbakk et al., 1995), lack of vitamin E, A and selenium (Jukola et al., 1996; Weiss et al., 1997).

The economic losses from mastitis occur in the form of reduced milk production and quality, shortened reproductive life, premature culling of the affected animals, and veterinary costs for treatment. It has been estimated that mastitis results in severe economic losses of around US$182 per cow annually. The total annual losses due to mastitis in U.S.A. are about US$2 billion (Miller et al., 1993). A single infected gland results in a loss of 770 kg of milk per cow (McDonald, 1979).

The widespread use of mastitis control measures such as: (1) milking machine maintenance, (2) teat dipping, (3) early treatment of clinical cases, (4) dry cow therapy, (5) culling of cows with chronic mastitis (http://www.nmconline.org) has led to considerable progress in controlling mastitis caused by contagious pathogens such as *S. agalactiae* and *S. aureus*. Nevertheless, environmental mastitis has become a major problem in many well-managed dairy farms (Oliver and Mitchell, 1984; Smith et al., 1985a; Oliver, 1988; Booth, 1988; Todhunter et al., 1995; Milne et al., 2002).

Milking machine has direct contact with teat and it transports milk from teat to processing plant. The milking machine can influence new IMI from one animal to the other. It is crucial to understand the basic components, functions, and operation of the milking equipment, maintenance and importance of good milking technique (Spencer, 1989).
Premilking udder preparation and teat sanitation is necessary to reduce the microbial population and minimize new IMI. It may be performed by washing and drying with a single service paper towel. Predipping and udder preparation have a significant effect on milk bacterial counts, and on the incidence of mastitis (Ruegg and Dohoo, 1997). Predipping controls the growth of environmental mastitis. Postmilking teat dipping immediately after every milking with a germicidal solution reduce (contagious pathogen) the incidence of new udder infections by 50-90% (Boddie and Nickerson, 1997).

Early treatment of the clinical cases alleviates clinical signs, achieves a bacteriological cure and restores the cow’s production. In addition, it also limits the spread of infection, eradicate a specific pathogen, and increases herd production (Radostits et al., 2000).

Dry cow therapy (DCT) eliminates the existing infections by 70-98%. Cure rate varies according to organism for coagulase-negative *staphylococcus* (CNS) over 95% (Davidson et al., 1994) and *S. aureus* 85.2% (Pankey et al., 1982a). Prolong use of DCT eliminates *S. agalactiae* by 90-100%. Dry cow therapy reduces the incidence of new IMI by 50-75% (Williamson et al., 1995). The cure rate of *S. aureus* IMI varies from 40 to 83% (Rindsig et al., 1978; Ziv et al., 1981).

Culling of chronically infected cow can help to eliminate the existing IMIs. Animals which are infected with *S. aureus* may have fibrosis in the mammary epithelium and the infection persists for long time. These animals are poorly responding to antimicrobial therapy. Sometimes 4-5 cases of clinical mastitis occur in current
lactation. Therefore, chronically infected animals should be culled (Stott and Kennedy, 1993).

Conventional method for bacteriological isolation and identification is used worldwide. California mastitis test is an indirect test which is a rapid and practical test to determine approximate somatic cell concentration in milk (Miller and Kearns, 1967). It is also in use since a long time for mastitis diagnosis. It has been considered as a reference method in mastitis diagnosis.

Among the environmental pathogens, *Streptococcus uberis*, *Streptococcus dysgalactiae*, and *Enterobacteriae* spp. are the most prevalent, infecting mammary glands as favourable conditions arise (Smith *et al.*, 1985b; Oliver, 1988; Todhunter *et al.*, 1995; Milne *et al.*, 2002).

The prevalence of IMI from pathogens is about 50% of cows and quarter infection rate of about 25% (Fox *et al.*, 1995). The prevalence of infection in dairy heifers of breeding age and in pregnant dairy heifers varies widely from 30-50% (Fox *et al.*, 1995) and 18% of quarters (Pankey *et al.*, 1991) to as high as 97% of heifers and 75% of quarters (Nickerson *et al.*, 1995). The average annual incidence of mammary infection of clinical quarter cases per 100 cows at risk per year including the dry period in individual herds ranges from 10-12% (Miltenburg *et al.*, 1986) but higher values, ranging from 16-65% in some herds (Firat, 1993; Bartlette *et al.*, 1992b).

Studies on the effect of premilking, postmilking teat dipping and DCT have not been reported in Malaysia. Evaluation of DCT, pre and postmilking teat dipping by
comparing colony forming unit in treatment and control group has also not been performed. Therefore, this study evaluates the efficacy of DCT, pre and postmilking teat dipping in bovine mastitis.

This study aims to determine the efficacy of Noroclox ® (Cloxacillin 500mg, Norbrook Laboratories Limited U.K.) as a DCT in eliminating existing IMI and preventing new IMI and to determine the efficacy of 0.5% iodine as a pre and postmilking teat dip in bovine mastitis.
CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Mastitis is the most common disease affecting dairy cows worldwide. Fifty percent of the cows may be infected in one or more quarters (Ziv, 1992). It affects milk production, loss of glandular secretory tissue, systemic illness, and cause death. Mastitis has many effects on raw milk components, milk product quality and yield. There is a decrease in the production of lactose, fat, nonfat milk solids, and casein. Whey proteins, sodium, chloride, pH, and free fatty acids are increased. Total protein may remain stable as increases in albumin and immunoglobulins offset the decrease in casein. Inflammatory cells (somatic cells) are increased.

Mastitis has 38% morbidity (Sischo, 1990). On an annual basis, three of every 10 dairy cows have clinical inflammation of the mammary gland. Seven percent are culled and 1% dies as a consequence of the disease.

Mastitis may result from the introduction of microorganisms through the teat sphincter. The clinical course of the disease varies with the ability of bacteria to colonize and thrive in the mammary gland secretions, their inherent virulence, and the type of magnitude, and duration of the host response to the bacterial invasion. The inflammation of the mammary gland is indicated by clinical signs (Radostits et al., 2000).