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TO STUDY THE ASSOCIATION BETWEEN SCC AND  
BACTERIA NUMBERS, AND MILK COMPOSITION IN FARM  
BULK MILK SUPPLIED TO TUI MILK PRODUCTS COMPANY  
FOR 1992/93 SEASON.

**A thesis presented in partial fulfilment of the requirements  
for the degree of Master of Agricultural Science in Animal  
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## ABSTRACT

The association between bulk milk SCC and bacteria numbers and milk composition were studied using data containing test records of 1200 farms which supplied bulk milk to TUI Milk Company Limited, for 1992/93 season. Three data sets were created, (1) data set A (N = 4623) with all measurements recorded for each herd for the same milk sample; (2) data B (N = 30 120) with all measurements of BMSCC and milk composition recorded for each herd within a 10 day period but not necessarily on the same sample of bulk milk; and (3) data set C (N = 33 800) with all measurements of bulk milk bacteria numbers and milk composition recorded for each herd within a 10 day period but not necessarily on the same sample of bulk milk. Correlation was used to determine the association between bulk milk SCC and bacteria numbers and milk composition. Multiple regression analysis was also carried to determine the association between bacteria numbers (dependent variable) and SCC and milk composition for early lactation and whole lactation. The results showed the overall average of the mean BMSCC of 280 000 cells/ml of all the farms studied. Approximately 85 % of the farms supplied bulk milk with SCC <250 000 cells/ml, while 1 % of the farms supplied bulk milk with SCC >500 000 cells/ml. Both bulk milk SCC and bacteria numbers were higher in early and late parts of lactation. Highly significant but low positive correlations occurred between the mean bulk milk SCC and bacteria number in early ( $r = 0.24$ ;  $r^2 = 0.06$ ;  $P < 0.001$ ) and whole lactation ( $r = 0.15$ ;  $r^2 = 0.02$ ;  $P < 0.001$ ). Thus 2 to 6 % of the variation observed in bacteria count was accounted for by variation in bulk milk SCC. The mean fat %, protein % and total solids % increased from mid-lactation to the end of lactation. In contrast, the mean lactose % showed a decrease as the lactation progressed. On the average for the whole lactation, low positive correlations occurred between the mean bulk milk SCC and fat % ( $r = 0.18$ ), protein % ( $r = 0.26$ ) and total solids % ( $r = 0.15$ ). However, a moderate but highly significant negative correlation occurred between bulk milk SCC and lactose % ( $r = -0.43$ ;  $P < 0.001$ ).

In conclusion the overall low average BMSCC suggests that good quality bulk milk was supplied to the company, which also meets the EC standards. Significant low correlation between BMSCC and bacteria numbers suggests that mastitis bacteria were only a small but significant contributor to the high bacteria count in the bulk milk particularly in early lactation, with dirty milking machines or poor cooling being the most likely major contributor. Finally, lactose % was more sensitive to mastitis effective than fat %, protein % and total solids % in the bulk milk.

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## TABLE OF CONTENTS

	PAGE
TITLE PAGE	i
ABSTRACT	ii
ACKNOWLEDGMENTS	iv
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES	x
CHAPTER ONE INTRODUCTION	1
CHAPTER TWO REVIEW OF LITERATURE	3
2.0 Definition of mastitis	3
2.1 Forms of mastitis	3
2.1.1 Clinical mastitis	3
2.1.2 Subclinical mastitis	4
2.2 Causes of Mastitis	5
2.3 Methods of diagnosis of bovine mastitis	6
2.4 Origin and functions of somatic cells in milk	7
2.4.1 Use of SCC as a diagnostic test for subclinical mastitis	8
2.5 Relations between SCC and subclinical mastitis	9
2.5.1 Relations between SCC and subclinical mastitis of individual cows	9
2.5.2 Relations between bulk milk cell counts and subclinical mastitis	11
2.6 Seasonal trend of SCC in herds	13
2.7 Bacteria count in bulk milk	15
2.7.1 Relation between bacteria count in bulk milk and the prevalence of mastitis	17
2.7.2 Relation between bacteria and bulk milk SCC	17
2.8 Effects of subclinical mastitis on the farmer	18

2.8.1	Reduction in milk yield	18
2.8.2	Effect of subclinical mastitis on milk composition	21
2.8.2.1	Total solids and solid-not-fat percentages	21
2.8.2.2	Fat concentration	22
2.8.2.3	Milk protein concentration	23
2.8.2.4	Lactose concentration	24
2.8.2.5	Concentration of minerals or ions	25
2.8.3	Economic loss due to mastitis	26
2.9	Effects of mastitis on the manufacturer of dairy products	28
2.9.1	Whole milk quality	28
2.9.2	Reconstituted milk	29
2.9.3	Butter	29
2.9.4	Cultured dairy products	30
CHAPTER THREE		
3.0	Material and methods	32
3.1	Statistical analysis	32
CHAPTER FOUR		
4.0	RESULTS	34
4.1	Mean values for BMSCC and bacteria numbers in the farm bulk milk in each of lactation	34
4.2	Mean values for bulk milk fat, protein, lactose and total solids concentrations in month of lactation	35
4.3	Distribution of farms according to their lactation average mean BMSCC values	36
4.4	Relations between BMSCC and bacteria numbers and milk composition for the whole of lactation	37
4.5	Relations between BMSCC and bacteria numbers and milk composition for each month of lactation	38
4.6	Relations between mean bulk milk bacteria numbers	40

	and milk composition for the whole lactation	
4.7	Relations between mean bulk milk bacteria numbers and milk composition for each month of lactation	41
4.8	Prediction of the effect of BMSCC, fat %, protein % and lactose % on bacteria count	43
CHAPTER FIVE		
5.0	DISCUSSION	48
5.1	Mean values for BMSCC and bacteria numbers in farm bulk milk in each month of lactation	48
5.2	Mean values for the bulk milk fat %, protein % lactose % and total solids % in each month of lactation	45
5.3	Distribution of farms in relation to their average mean BMSCC values	46
5.4	Relations between BMSCC, bacteria numbers and milk composition for the whole lactation	47
5.5	Relations between mean bulk milk bacteria numbers and milk composition for the whole lactation	48
5.6	Relations between BMSCC and bacteria numbers and milk composition for each month of lactation	49
5.7	Relations between the mean bulk milk bacteria numbers and milk composition for each month of lactation	50
CHAPTER SIX	SUMMARY AND CONCLUSION	51
REFERENCES		53

## LIST OF TABLES

<b>Table</b>		<b>Page</b>
2.1	Average values of SCC in composite milk samples from uninfected cows	10
2.2	The relationship between herd milk and percentage of cows in herds infected with mastitis	11
2.3	Tui milk Products Company Grading system according to BMSCC	13
2.4	The relationship between BMSCC for a herd and the average milk production per cow in the herd	20
2.5	Estimated cost of mastitis to the average new Zealand herd	27
4.1	Seasonal distribution of the mean bulk BMSCC and bacteria numbers	35
4.2	The distribution of the mean bulk milk fat %, protein %, lactose % and total solids	36
4.3	The ditribution of farms according to their average mean bulk milk SCC	37
4.4	The correlation coefficients between mean BMSCC and bacteria numbers and milk composition	38
4.5	The correlation coefficients for each month between BMSCC and bacteria numbers,fat %, protein %, lactose % and total solids	39
4.6	Correlation coefficients between the mean bacteria numbers and milk composition for data sets A and C	40

- |     |  |    |
|-----|--|----|
| 4.7 | Correlation coefficients between bacteria numbers and fat %, protein %, lactose % and total solids % in each month | 42 |
| 4.8 | Prediction of the effect of BMSCC, fat %, protein % and lactose % on bacteria count                                | 43 |

**TABLE OF FIGURES**

Figure	Page
2.1 The seasonal trend of BMSCC in New Zealand dairy herds from 1991/92 to 1994/95	14
4.1 The seasonal distribution of the mean BMSCC and bacteria numbers	35
4.2 The seasonal distribution of mean bulk milk fat % protein % and lactose %	35

## CHAPTER ONE

### INTRODUCTION

Universally there is an increasing demand for high quality milk, free from cellular contamination or with low cell count. This is attributed to (a) public health concern that a sample of milk contaminated with somatic cells carries with it images of diseased udders and (b) in part due to lower product yields and inflated processing cost to the manufacturer. Despite the fact that it is not likely that mastitis pathogens will have survived pasteurisation, there is a public feeling that milk should be clean at the source -farm level. In recent times, the demands of buyers have increased, which include specified somatic cell counts. For example, the European Economic Community (EEC) somatic cell counts standards for raw cows milk for the manufacture of milk based products have been set at < 500,000 cells/ml since the beginning of 1994 (Frank, 1994). Thus all countries wishing to export dairy milk products to the community will have to show that their standards measure up to those required within the EC. This is a challenge to which the New Zealand dairy industry attaches utmost importance since about 85 % of its total milk products is exported (NZDB, 1994). It is therefore imperative that New Zealand dairy farmers supply the dairy factories with raw milk of high quality with low somatic cell counts for the manufacture of finest milk products to meet the high standard requirements of the export market (SAMM Plan, 1995).

Primarily, milk Somatic Cell Counts (SCC) are being used in the diagnosis of subclinical forms of bovine mastitis, which is part of a greater disease complex -mastitis as a whole (IDF, 1975; Fetrow, 1984; Bramley, 1991). An infection of mastitis in the bovine udder is associated with a commensurate increase in somatic cells to fight the causative pathogens (Schalm, 1977; Bramley, 1992). Bovine mastitis and somatic cell counts (SCC) have therefore been associated with decreased milk yield (Janzen, 1970; Hoare, 1982; Deluyker et al, 1993) and changes in milk composition (Wheelock et al., 1966; Janzen, 1970; Schalm

et al., 1971; Kitchen et al., 1981; Munro et al., 1984), which in turn constitute an economic loss to the dairy farmer (Boothe, 1989; Harmon, 1993; Holdaway, 1993). Mastitis costs about \$14,000 annually due to on farm increased costs and decreased milk sold in the average New Zealand herd (Holdaway, 1993). In addition problems with manufacturing properties and product defects have been observed for most dairy products made from mastitic milk (Mitchell et al., 1985). Regular monitoring of the number of somatic cells in farm bulk milk at both farm and factory levels has therefore become a regular practice in the New Zealand dairy industry. Bulk milk somatic cell count (BMSCC) is increasingly becoming a key parameter in determining raw milk quality (Frank, 1994). It is now being used by some manufacturing companies as one of the measurement factors for milk payments to farmers in New Zealand. Furthermore BMSCC has permitted the adoption of regulatory programmes such as the 5-Point Plan worldwide (Bramley, 1992) and the SAMM Plan in New Zealand (The SAMM Plan, 1995) to identify mastitis status in a herd and its control. In addition, it is possible for mastitis causing organisms to increase the bacterial count of the farm bulk milk to such an extent that the count exceeds the dairy company's bacterial standards for finest milk. This may attract a penalty in monetary terms by the dairy companies.

The objectives of this work were to:

- study the association between SCC and bacteria quality and milk composition - fat, protein and lactose concentrations in farm bulk milk supplied to the Tui Milk Products Company for 1992/93 season; and
- assess the importance of mastitis in the herd as a cause of failure by the herd's milk to meet the bacterial quality standards.