

**EFFECTS OF SOMATIC CELL COUNTS IN COW MILK ON  
THE PHYSICAL AND CHEMICAL PROPERTIES OF  
YOGHURT**



**BY**

**THUSHANTHINI SHANTHAIYA**



FAG444  
  
Project Report  
Library - EUSL

**444**

**FACULTY OF AGRICULTURE**

**EASTERN UNIVERSITY**

**SRI LANKA**

**2016**

**PROCESSED**  
Main Library, EUSL

## ABSTRACT

Somatic cells are important components found naturally in milk. Somatic cell count (SCC) is used as an indicator of milk and dairy product quality. Yoghurt is a fermented dairy product obtained by lactic acid fermentation of milk. This study was conducted to evaluate the influence of SCC on the physicochemical properties, microbial counts, and sensory qualities of yoghurt made from cow milk. Milk was divided into four groups according to the range of SCC (P1:  $3.6 \times 10^5$  cells/ml; P2:  $4.5 \times 10^5$  cells/ml; P3:  $5.4 \times 10^5$  cells/ml; P4:  $7.2 \times 10^5$  cells/ml). The yoghurts made from different range of SCC milk were analyzed for chemical parameters (pH, titratable acidity, fat, protein, total sugar, reducing sugar, ash content, and dry matter), physical parameter (syneresis), sensory qualities and microbial population on weeks first, second, third and fourth weeks after production.

There were no significant differences ( $p>0.05$ ) in ash, dry matter, titratable acidity, pH, total sugar, reducing sugar and fat contents among the SCC ranges of milk. But, the total protein content of yoghurt was increased with increasing milk SCC. High content of total protein ( $3.62 \pm 0.01\%$ ) was observed in  $7.2 \times 10^5$  cells/ml SCC range of milk. At day one, yoghurt made from milk with  $3.6 \times 10^5$  cells/ml SCC shown high value of dry matter, fat, reducing sugar, total sugar and pH as ( $18.7 \pm 0.1\%$ ), ( $2.77 \pm 0.12\%$ ), ( $2.85 \pm 0.09\%$ ), ( $2.85 \pm 0.09\%$ ), ( $15.64 \pm 0.04\%$ ) and ( $4.49 \pm 0.01$ ), respectively. Yoghurt made with  $7.2 \times 10^5$  cells/ml SCC range shown high ash, total protein and titratable acidity as ( $1.05 \pm 0.03\%$ ), ( $3.91 \pm 0.6\%$ ) and ( $0.86 \pm 0.02\%$ ), respectively.

During the storage period, ash, dry matter, pH, and titratable acidity, total sugar, reducing sugar, fat, and protein ( $p < 0.05$ ) were significantly differed with SCC range of yoghurt. Yoghurt made with  $3.6 \times 10^5$  cells/ml SCC range shown high value of fat, reducing sugar, total sugar and pH ( $2.7 \pm 0.1\%$ ), ( $2.71 \pm 0.14\%$ ), ( $12.63 \pm 0.03\%$ ) and ( $4.43 \pm 0.01$ ), respectively during first week of storage. Yoghurt made with  $7.2 \times 10^5$  cells/ml SCC range shown high value of total protein and titratable acidity as ( $3.7 \pm 0.1\%$ ) and ( $1.18 \pm 0.03\%$ ), respectively during fourth week of storage. Syneresis of yoghurt was increased with increasing SCC range. Syneresis was high ( $44.32 \pm 0.08\%$ ) in yoghurt made with  $7.2 \times 10^5$  cells/ml SCC range after two hours of analysis.

There is a significant difference ( $p < 0.05$ ) was observed between SCC range and sensory attributes (texture, taste, colour, flavour and overall acceptability) of yoghurt evaluated during four weeks of storage period. All sensory attributes of yoghurt decreased with increasing SCC range during storage period. Bacterial colony count of yoghurt increased with increasing SCC range. The maximum amount of bacteria  $1.4 \times 10^6 \pm 0.67 \times 10^6$  CFU was observed on  $7.2 \times 10^5$  cells/ml SCC range of yoghurt at 2 weeks of storage. The overall results indicate that higher milk SCC ( $7.2 \times 10^5$  cells/ml) has a negative effect on the physical, chemical and organoleptic quality of yoghurt than low SCC milk ( $3.6 \times 10^5$  cells/ml).



# TABLE OF CONTENTS

ABSTRACT .....	i
ACKNOWLEDGEMENT .....	iii
LIST OF TABLES .....	viii
LIST OF FIGURES .....	ix
LIST OF ABBREVIATIONS .....	x
CHAPTER 1 .....	1
INTRODUCTION.....	1
CHAPTER 2 .....	4
LITERATURE REVIEW .....	4
2. 1 Somatic cells .....	4
2.1. 1 Definition of somatic cell.....	5
2.1. 2 Somatic cell count.....	5
2.1. 3 Importance of somatic cell counting.....	6
2. 2 Milk.....	7
2. 2. 1 Milk structure.....	7
2. 2. 2 Composition of milk .....	8
2. 2. 2.1 Water .....	9
2. 2. 2.2 Lactose.....	10
2. 2. 2.3 Fat .....	10
2. 2. 2.4 Protein.....	11
2. 2. 2.5 Enzymes.....	13
2. 2. 2.6 Vitamins.....	13
2. 2. 2.7 Minerals .....	14
2. 2. 3 Milk quality.....	14
2.2.3.1 Importance of somatic cell counting effect the milk quality .....	15
2. 2. 4 Health benefits of milk.....	15
2. 3 Milk processing.....	16

2.4	Milk products .....	16
2.4.1	Concentrated dairy products .....	17
2.4.2	Dried dairy products .....	17
2.4.3	Fermented milk products .....	17
2.5	Yoghurt .....	18
2.5.1	History of yoghurt.....	18
2.5.2	Nutritional value of yoghurt.....	18
2.5.3	Health benefits of yoghurt .....	19
2.5.4	Types of yoghurt.....	20
2.5.4.1	Stirred yoghurt.....	20
2.5.4.2	Set yoghurt.....	21
2.5.5	Ingredients.....	21
2.5.5.1	Milk .....	21
2.5.5.2	Stabilizers .....	22
2.5.5.3	Sweetening agent.....	22
2.5.5.4	Flavouring agents .....	22
2.5.5.5	Colouring agents.....	23
2.5.5.6	Starter culture .....	23
2.5.6	Basic principle of yoghurt.....	24
2.5.7	Quality of yoghurt.....	24
2.5.7.1	Somatic cell counting influence the yoghurt quality .....	25
2.6	Microbial activity .....	25
2.7	Sensory evaluation .....	26
2.7.1	Hedonic scale .....	27
<b>CHAPTER 3 .....</b>		<b>28</b>
<b>MATERIALS AND METHODS .....</b>		<b>28</b>
3.1	Laboratory study .....	28
3.2	Collection of milk samples .....	28
3.3	Counting of somatic cells in different samples.....	28

3.4	Yoghurt preparation .....	29
3.4.1	Mother culture preparation .....	29
3.4.2	Sub culture preparation for starter culture .....	30
3.4.3	Procedure of yoghurt preparation .....	30
3.5	Nutritional analysis of yoghurt .....	30
3.5.1	Determination of ash content .....	30
3.5.2	Determination of dry matter content .....	30
3.5.3	Determination of fat content .....	31
3.5.4	Determination of protein content .....	31
3.5.5	Determination of total sugar .....	31
3.5.6	Determination of reducing sugar .....	32
3.5.7	Determination of titratable acidity .....	33
3.5.8	Determination of pH .....	34
3.6	Syneresis analysis .....	34
3.7	Sensory analysis .....	34
3.8	Microbial analysis .....	35
3.8.1	Sheep blood agar media preparation .....	35
3.8.2	Inoculation of yoghurt sample .....	35
3.8.3	Preparation of smear .....	36
3.8.4	Grams stain technique .....	36
3.9	Statistical analysis .....	37
<b>CHAPTER 4 .....</b>		<b>38</b>
<b>RESULTS AND DISCUSSION .....</b>		<b>38</b>
4.1	Somatic cells range in fresh milk .....	38
4.2	Physical and chemical compositions of fresh milk .....	39
4.3	Physical and chemical properties of yoghurts at day one .....	40
4.3.1	Dry matter .....	40
4.3.2	Ash .....	42
4.3.3	Fat .....	42



4.3.4	Total protein.....	42
4.3.5	Reducing sugar.....	43
4.3.6	Total sugar .....	43
4.3.7	Titrateable acidity .....	44
4.3.8	pH.....	44
4.4	Syneresis analysis .....	45
4.5	Changes in quality characteristics of yoghurt during storage period.....	46
4.5.1	Dry matter .....	46
4.5.2	Ash content .....	47
4.5.3	Fat content.....	48
4.5.4	Total protein.....	49
4.5.5	Reducing sugar.....	50
4.5.6	Total sugar .....	52
4.5.7	pH.....	53
4.5.8	Titrateable acidity .....	55
4.6	Microbial analysis.....	56
4.7	Changes in sensory attributes of yoghurt during storage.....	57
4.7.1	Sensory evaluation at week 1.....	58
4.7.2	Sensory evaluation at week 2.....	59
4.7.3	Sensory evaluation at week 3.....	60
4.7.4	Sensory evaluation at week 4.....	61
4.7.5	Changes in sensory attributes during storage period .....	63
<b>CHAPTER 5</b>	.....	<b>65</b>
<b>CONCLUSION</b>	.....	<b>65</b>
<b>SUGGESTIONS FOR FUTURE RESEARCH</b>	.....	<b>66</b>
<b>REFERENCES</b>	.....	<b>67</b>
<b>APPENDIX</b>	.....	<b>86</b>