

**IMPROVEMENT OF LOW FAT CHEESE
PROPERTIES USING LACTIC ACID
BACTERIAL CULTURE**

By

RASHA ABD EL SALAM GHOBASHY

B.Sc. Agric. Sc. (Dairy Sci. & Tech.), Fac. of Agric., Ain Shams Univ., 2004

M.Sc. Agric. Sc. (Dairy Sci. & Tech.), Fac. of Agric., Ain Shams Univ., 2010

**A Thesis Submitted in Partial Fulfillment
Of
the Requirements for the Degree of**

**DOCTOR OF PHILOSOPHY
in
Agriculture Sciences
(Dairy Science and Technology)**

**Department of Food Science
Faculty of Agriculture
Ain Shams University**

2020

ABSTRACT

Rasha Abd El-Salam Ghobashy, Improvement of low fat cheese properties using lactic acid bacterial cultures. Unpublished Ph.D. Thesis, Food Sci. Dept., Fac. Agric., Ain Shams Univ., Cairo, Egypt 2020.

During the last decade, feeding on low-fat and non-fat soft cheese products has become more important for human health and trend. Low-fat cheese is restricted to fat content equal or less than 3 g per 100-g serving. In general, full-fat soft cheese contains about 40- 45% fat in dry matter but not more than 60%.

Traditional soft cheese were manufactured using standardized buffalo's milk contained 4.2%, 2.0%, 1.0% and 0.05% fat for control full fat, half-fat, low-fat and free-fat soft cheese, respectively. In addition, ultra-filtrated soft cheese were manufactured using standardized buffalo's milk retentate. Standardized full fat, half-fat, low and free-fat milk were divided into 8 portions. The first and second portions were used as control without starter culture, the third to the eighth portions were manufactured using different starter cultures as follows: A1= *Lactococcus lactis* subsp. *creamoris*, *Lactococcus lactis* subsp. *lactis*, *Streptococcus thermophiles*, *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Lactobacillus helveticus* (White Daily 82). A2= *Lactococcus lactis* subsp. *creamoris*, *Lactococcus lactis* subsp. *lactis*, *Streptococcus thermophiles* and *Lactobacillus delbrueckii* subsp. *bulgaricus* (White Daily 42). V1= *Lactococcus lactis* subsp. *creamoris*, *Lactococcus lactis* subsp. *lactis*, *Streptococcus thermophiles*, *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Lactobacillus helveticus* (White Daily 82) and *Streptococcus thermophiles*, *Lactobacillus delbrueckii* subsp. *bulgaricus* (YF-L811). V2= *Lactococcus lactis* subsp. *creamoris*, *Lactococcus lactis* subsp. *lactis*, *Streptococcus thermophiles*, *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Lactobacillus helveticus* (White Daily 82) and *Streptococcus thermophiles*, *Lactobacillus delbrueckii* subsp. *bulgaricus* (YC-X11). V3= *Lactococcus lactis* subsp. *creamoris*,

lactococcus lactis subsp. *lactis*, *streptococcus thermophiles* and *lactobacillus delbrueckii* subsp. *bulgaricus* (White Daily 42) and (*streptococcus thermophiles*, *lactobacillus delbrueckii* subsp. *bulgaricus* (YF-L811). V4= *Lactococcus lactis* subsp. *creamoris*, *lactococcus lactis* subsp. *lactis*, *streptococcus thermophiles* and *lactobacillus delbrueckii* subsp. *bulgaricus* (White Daily 42) and (*streptococcus thermophiles*, *lactobacillus delbrueckii* subsp. *bulgaricus* (YC-X11). Three replicates were traditionally manufactured and stored at $5 \pm 1^\circ\text{C}$.

Ultrafiltration was carried out using standardized buffalo's milk retentate concentration factor of ~ 3.5 and the average composition of the used retentate was: 38.23 % total solids, 15.44 total protein, 16.1% fat, 4.3%lactose and 2.4 ash for composition of full fat retentate. While, the average composition of low fat retentate 27.55 % total solids, 16.81 total protein, 3.5% fat, 4.76%lactose and 2.5 ash. The starter culture used was V1 (White Daily 82 and YF-L811) which gave the most acceptable traditional soft cheese properties. Three replicates of full, half, low and free fat soft cheese were manufactured using UF technique and the resultant soft cheese were stored at 22 and $5 \pm 1^\circ\text{C}$. Samples were analyzed within 0, 15, 30, 45, 60, 75, 90, 105, 120, 150, and 180 days of storage and examined for chemical, microbiological, rheological and organoleptic characteristics.

Results designated that, the use of exopolysaccharide producing strains in V1 mixture gave the highest soluble nitrogen / total nitrogen, soluble tyrosine and soluble tryptophan contents and the rate of accumulation of total volatile fatty acids than all other cheese treatments. In addition, the highest lactic acid bacterial counts were found in fresh V1 free fat soft cheese and V2. Lactic acid bacterial count gradually decreased within 120 days of storage. Yeast and mould counts were less than the standards within first 60 days of the storage period. Total viable bacterial counts slightly increased in all cheese samples as the storage period progressed. Hardness, cohesiveness, chewiness and adhesiveness properties were high in control full-fat as compared with all other free fat

cheese. Generally, production of free fat soft cheeses using acid producing and exopolysaccharide producing lactic acid bacteria as starter culture could be recommended to produce healthy and acceptable cheese.

Key words: Full fat, Low-fat, Free fat soft cheese; Exopolysaccharide producing lactic acid bacteria; Rheological properties and storage period.

LIST OF CONTENTS

No.		Page
	LIST OF TABLES	VI
	LIST OF FIGURES	XII
	LIST OF ABBREVIATIONS	XIII
I	Introduction	1
II	Review of Literature	4
2.1.	Low fat cheese	4
2.2.	The role of exopolysaccharide (EPS) producing lactic acid bacteria	4
2.3	The used of lactic acid bacteria in acceleration of cheese ripening	15
2.4.	General characteristics of low fat soft cheese	22
2.5.	Rheological and organoleptic properties of Low-Fat cheese	24
2.6.	Improving the characteristics of low-fat white soft cheese	25
2.7.	Use of ultrafiltration (UF) retentate for making soft cheese	29
III	Materials and Methods	34
3.1	Materials	34
3.1.1	Milk and retentate	34
3.1.2	Starter culture	35
3.1.3	Rennet	36
3.1.4	Sodium-chloride	36
3.1.5	Calcium chloride	36
3.2	Methods	36
1	Cheese manufacture	36
1.1.	Traditional soft cheese production	36
1.2	UF soft cheese production	36
2	Physiochemical Analysis	38

3	Microbiological Analyses	39
4	Rheological and properties	39
5	Sensory evaluation	41
6	Statistical Analysis	41
IV	Results and Discussion	42
Part I	Production and properties of Traditional soft cheese with EPS producing LAB	42
I	Production and properties of Full fat soft cheese with EPS producing LAB	42
1.1	Chemical analysis	42
1.1.1	Dry matter (DM %) and Fat/Dry matter (F/DM %) contents	42
1.1.2	Titrateable acidity (%) and pH value	43
1.1.3	Ash in dry mater (Ash/DM %) and salt in water phase (SWP %) contents	44
1.1.4	Total nitrogen in dry mater (TN/DM %) and soluble nitrogen in total nitrogen (SN/TN %) contents	47
1.1.5	Soluble Tyrosine (mg/100g) and Soluble tryptophan (mg/100g)	48
1.1.6	Total Volatile Fatty Acids (TVFA)	49
1.2	Microbiological Analyses	51
1.2.1	Total viable mesophilic bacterial count and Lactic acid bacterial count	51
1.2.2	Psychrophilic bacteria count	53
1.2.3	Yeast and mould counts	53
1.3	Rheological properties	54
1.3.1	Hardness	54
1.3.2	Cohesiveness	55
1.3.3	Gumminess	55
1.3.4	Springiness	57

1.3.5	Chewiness	57
1.3.6	Adhesiveness	57
1.4	Sensory evaluation	59
1.4.1	Flavor	59
1.4.2	Body & texture	59
1.4.3	Appearance	59
II	Production and properties of free fat soft cheese with EPS producing LAB	61
2.1	Chemical analysis	61
2.1.1	Dry matter (DM %) content	61
2.1.2	Titrateable acidity (%) and pH value	62
2.1.3	Ash in dry mater (%) and salt in water phase (%)	63
2.1.4	Total nitrogen in dry mater (%) and soluble nitrogen in total nitrogen (%)	66
2.1.5	Soluble Tyrosine (mg/100g) and Soluble tryptophan (mg/100g)	66
2.1.6	Total Volatile Fatty Acids (TVFA)	69
2.2	Microbiological Analyses	70
2.2.1	Total viable mesophilic bacterial count and Lactic acid bacterial count	70
2.2.2	Psychrophilic bacteria count	71
2.2.3	Yeast and mould counts	72
2.3	Rheological properties	73
2.3.1	Hardness	73
2.3.2	Cohesiveness	74
2.3.3	Gumminess	74
2.3.4	Springiness	76
2.3.5	Chewiness	76
2.3.6	Adhesiveness	77
2.4	Sensory evaluation	79
2.4.1	Flavor	79
2.4.2	Body & texture	80

2.4.3	Appearance	80
III	Production and properties of low and half fat soft cheese with EPS producing LAB.	82
3.1	Chemical analysis	82
3.1.1	Dry matter content (DM %)	82
3.1.2	Fat/Dry matter content (F/D %)	83
3.1.3	Titrateable acidity (%)	84
3.1.4	pH value	85
3.1.5	Ash in dry mater (Ash/DM %)	85
3.1.6	Salt in water phase (SWP %) content	87
3.1.7	Total nitrogen in dry mater (TN/DM %) content	88
3.1.8	Soluble nitrogen in total nitrogen (%)	89
3.1.9	Soluble Tyrosine (mg/100g)	90
3.1.10	Soluble tryptophan (mg/100g)	91
3.1.11	Total Volatile Fatty Acids (TVFA)	92
3.2	Microbiological Analyses	93
3.2.1	Total viable mesophilic bacterial count	93
3.2.2	Lactic acid bacterial count	94
3.2.3	Psychrophilic bacteria count	95
3.2.4	Yeast and mould counts	96
3.3	Rheological properties	97
3.3.1	Hardness (N)	97
3.3.2	Cohesiveness (ratio)	98
3.3.3	Gumminess (N)	99
3.3.4	Springiness (mm)	100
3.3.5	Chewiness (N.mm)	101
3.3.6	Adhesiveness (mj)	102
3.4	Sensory evaluation	103
3.4.1	Flavor (50 points)	103
3.4.2	Body & texture (40 points)	104
2.4.3	Appearance (10 points)	105

Part 2	Production and properties of UF low fat soft cheese with EPS producing LAB stored at 5±1°C and 22±1°C	107
2.1	Chemical analysis	107
2.1.1	Dry matter content (%)	107
2.1.2	Fat/Dry matter contents (F/DM %)	108
2.1.3	Titrateable acidity (%)	109
2.1.4	pH value	110
2.1.5	Ash in dry mater contents (%)	111
2.1.6	Salt in water phase contents (SWP %)	112
2.1.7	Total nitrogen in dry mater contents (TN/DM %)	112
2.1.8	Soluble nitrogen in total nitrogen contents (SN/TN %)	114
2.1.9	Soluble Tyrosine (mg/100g)	115
2.1.10	Soluble Tryptophan (mg/100g)	116
2.1.11	Total Volatile Fatty Acids (TVFA)	117
2.2	Microbiological Analyses	119
2.2.1	Total Viable Bacterial Count (TVBC)	119
2.2.2	Lactic Acid Bacteria Count (LABC)	119
2.2.3	Yeast and mold counts	122
2.3	Rheological properties	123
2.3.1	Hardness (N)	123
2.3.2	Cohesiveness (ratio)	124
2.3.3	Gumminess (N)	125
2.3.4	Springiness (mm)	126
2.3.5	Chewiness (N.mm)	127
2.3.6	Adhesiveness (mj)	127
2.4	Sensory evaluation	129
2.4.1	Flavor (50 points)	129
2.4.2	Body & texture (40 points)	130

2.4.3 Appearance (10 points)	131
V. Summary and Conclusion	133
VI. References	150
VII. Arabic Summary	

LIST OF TABLES

NO.		Page
1	Chemical composition of buffalos' milk used for manufacture	34
2	Chemical composition of retentate used for manufacture of UF low fat soft cheese with different starter cultures.	35
3	Textural profile parameters derived from two-bite compression	40
4	Dry matter (%) and Fat/ Dry matter contents (%) of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	43
5	Titrateable acidity (TA %) and pH value of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	45
6	Ash/DM (%) and S/WP (%) of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	46
7	TN/DM (%) and SN/TN (%) of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	48
8	Tyrosine (mg/100g) and Tryptophan (mg/100g) of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	49
9	TVFA (ml 0.1N NaOH/100g cheese) of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	50
10	Mesophilic bacterial and Lactic Acid Bacteria (LAB) counts of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	52
11	Psychrophilic of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	54
12	Yeast & Mould counts of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	54
13	Hardness (N), Cohesiveness (ratio) and Gumminess (N) of full fat soft cheese along the storage period for 120	56

VIII

NO.		Page
	days at 5±1°C.	
14	Springiness (mm), Chewiness (N.mm) and Adhesiveness (mj) of full fat soft cheese along the storage period for 120 days at 5±1°C	58
15	Flavor (50 points), Body & Texture (40 points) and appearance (10 points) of full fat soft cheese along the storage period for 120 days at 5±1°C.	60
16	Dry matter (%) content of free fat soft cheese along the storage period for 120 days at 5±1°C.	61
17	Titratable acidity (%TA) and pH values of free fat soft cheese along the storage period for 120 days at 5±1°C.	63
18	Ash/DM content (%) and SWP (%) of free fat soft cheese along the storage period for 120 days at 5±1°C.	65
19	TN/DM (%) and SN/TN (%) contents of free fat soft cheese along the storage period for 120 days at 5±1°C.	67
20	Soluble tryptophan (mg/ 100 g) and Tyrosine (mg/100g) of free fat soft cheese along the storage period for 120 days at 5±1°C.	68
21	TVFA (ml 0.1N NaOH/100g) cheese of free fat soft cheese along the storage period for 120 days at 5±1°C.	69
22	Mesophilic bacterial and Lactic Acid Bacteria (LAB) counts of free fat soft cheese along the storage period for 120 days at 5±1°C.	71
23	Psychrophilic bacteria count of free fat soft cheese along the storage period for 120 days at 5±1°C.	72
24	Yeast and mould count of free fat soft cheese along the storage period for 120 days at 5±1°C.	73
25	Hardness (N), Cohesiveness (ratio) and Gumminess (N) of free fat soft cheese along the storage period for 120 days at 5±1°C.	75
26	Springiness (mm), Chewiness (N.mm) and	78

	Adhesiveness (mj) of free fat soft cheese along storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	
27	Sensory evaluation of free fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	81
28	Dry matter (%) of low and half-fat soft cheese along storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	83
29	Fat/Dry matter contents (%) of low and half-fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	84
30	Titrateable acidity (TA%) and pH value of full-fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	85
31	pH value of low and half-fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	86
32	Ash/DM (%) of low and half-fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	87
33	SWP (%) of low and half-fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	88
34	TN/DM contents (%) of low and half-fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	89
35	SN/TN contents (%) of low and half-fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	90
36	Tyrosine (mg/100g) content of low and half-fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	91
37	Tryptophan (mg/100g) content of low and half-fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	92
38	TVFA (ml 0.1N NaOH/100g cheese) content of low and half-fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	93
39	Mesophilic bacterial count of low and half-fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	94
40	Lactic Acid Bacteria (LAB) counts of low and half-fat soft cheese along the storage period for 120 days at	95

	5±1°C.	
41	Psychrophilic of low and half-fat soft cheese along the storage period for 120 days at 5±1°C.	96
42	Yeast & Mould of low and half-fat soft cheese along the storage period for 120 days at 5±1°C.	97
43	Hardness (N) of low and half-fat soft cheese along the storage period for 120 days at 5±1°C.	98
44	Cohesiveness (ratio) of low and half-fat soft cheese along the storage period for 120 days at 5±1°C.	99
45	Gumminess (N) of low and half-fat soft cheese along the storage period for 120 days at 5±1°C.	100
46	Springiness (mm) of low and half-fat soft cheese along the storage period for 120 days at 5±1°C	101
47	Chewiness (N.mm) of low and half-fat soft cheese along the storage period for 120 days at 5±1°C.	102
48	Adhesiveness of low and half-fat soft cheese along the storage period for 120 days at 5±1°C.	103
49	Flavor (50 points) of low and half-fat soft cheese along the storage period for 120 days at 5±1°C.	104
50	Body & Texture (40 points) of low and half-fat soft cheese along the storage period for 120 days at 5±1°C.	105
51	Appearance (10 points) of low and half-fat soft cheese along the storage period for 120 days at 5±1°C.	106
52	Dry matter (%) content of UF low fat soft cheese with EPS producing LAB stored at 5±1°C and 22±1°C for 180 days.	108
53	Fat /DM contents (%) of UF low fat soft cheese with EPS producing LAB stored at 5±1°C and 22±1°C for 180 days.	109
54	Titrateable acidity (TA %) of UF low fat soft cheese with EPS producing LAB stored at 5±1°C and 22±1°C for 180 days.	110

55	pH value of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	111
56	Ash/DM contents (%) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	112
57	S/WP contents (%) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	113
58	TN/DM contents (%) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	114
59	SN/TN contents (%) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	115
60	Tyrosine (mg/100g) content of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	116
61	Tryptophan (mg/100g) content of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	118
62	TVFA (ml 0.1N NaOH/100g cheese) content of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	118
63	Total viable mesophilic bacterial count (TVBC cfu/g cheese) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	120
64	Lactic acid bacteria count (TVBC cfu/g cheese) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	121
65	Yeast & Mould counts (\log_{10} cfu g^{-1}) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$	123

	and $22\pm 1^{\circ}\text{C}$ for 180 days.	
66	Hardness (N) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	124
67	Cohesiveness (ratio) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	125
68	Gumminess (N) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	126
69	Springiness (mm) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	127
70	Chewiness (N.mm) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	128
71	Adhesiveness (mj) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	129
72	Flavor (50 points) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	130
73	Body & texture (40 points) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	131
74	Appearance (10 points) of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	132

LIST OF FIGURES

NO		Page
1	Traditional soft cheese manufacture	37
2	Ultra filtrated soft cheese production	38
3	Ash/DM (%) and SWP (%) contents of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	46
4	TVFA (ml 0.1N NaOH/100g cheese) of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	51
5	Mesophilic bacteria and Lactic Acid Bacterial (LAB) counts of full fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	52
6	Titratable acidity (TA %) and pH value of free fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	64
7	TVFA (ml 0.1N NaOH/100g cheese) of free fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	70
8	Hardness (N), Cohesiveness (ratio) and Gumminess (N) of free fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	76
9	Springiness (mm), Chewiness (N.mm) and Adhesiveness (mj) of free fat soft cheese along the storage period for 120 days at $5\pm 1^{\circ}\text{C}$.	79
10	Total viable bacterial count of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	121
11	Lactic acid bacterial count of UF low fat soft cheese with EPS producing LAB stored at $5\pm 1^{\circ}\text{C}$ and $22\pm 1^{\circ}\text{C}$ for 180 days.	122