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MODIFICATION OF THE TRADITIONAL METHOD OF MAKING RAS CHEESE, AND ITS EFFECT ON THE PROPERTIES AND QUALITY OF THE RESULTANT LOW-FAT RAS CHEESE

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ABSTRACT

Low-fat Ras cheese (LFC) was made from cow's milk of 1.5±0.1% fat with some modifications in the traditional method of cheese-making, including washing the curd by warm water (35C^{o}/5min.) or rinsing it for 5min. in the same whey (after adding 0.1 or 0.2% wt/wt sodium citrate). Full-fat cheese (FFC) being made from cow's milk of 3 ± 0.1% fat, and low-fat cheese (without any modifications) were also made for comparison . The resultant cheeses were ripened at 8 ± 2C^{o} and relative humidity of 85% for 3 months. Cheese samples were analyzed when fresh and after 15,30,60 and 90 days of ripening for chemical, microbiological, rheological and sensory properties. Results indicated that as the fat content of cheese decreased, the moisture, salt and protein contents increased, whereas, the acidity, fat and protein indices decreased along the ripening period. Washing the curd by warm water decreased greatly the acidity of the resultant cheese, and this decrease consequently affected greatly the rheological and sensory properties of the resultant cheese. Microbiological properties of treated or not treated LF-cheeses were found to be lower than full-fat cheese (control), during ripening. Texture profiles of cheese showed that the LF-cheese (either treated or not) had inferior properties compared with FF-cheese, and the previous modifications of cheese-making had no effect on these properties. Sensory evaluations revealed that FF-cheese characterized with the highest properties among all treatments followed, by LF-cheese (without any modifications), sodium citrate treatments and curd washing treatments. Generally, it is worth to note that these modifications did not improve the rheological and sensory properties of the LF-cheese along the ripening period.

Keywords: Ras cheese, low fat cheese, ripening.

INTRODUCTION

Ras (Kafalotyri) cheese is the most popular hard-cheese in Egypt. It is made with full cream milk and ripened throughout two to three months. During the past 10 to 15 years, the American Heart Association, and other Health Organizations have called for a reduction in total dietary fat to 30% of calories for most people (AHA, 1986; DHHS, 1988). They have also recommended that no more than 10% of total calories should come from saturated fats. High intake of total dietary fat is associated with an increased risk of obesity, some type of cancers, gallbladder disease, high blood cholesterol and coronary heart disease.

Removal of fat from cheese results in undesirable texture and appearance, altered rheoloical parameters, Lack of flavour, poor keeping quality and poor meltability and stretching property (Rodriguez, 1998; Sipahioglu *et al*., 1999 and Koca and Metin, 2004*)*. Low-fat cheeses are usually characterized by rubbery body and lack of flavor (Mistry, 2001).

Several attempts have been tried to improve the texture and flavror of low-fat cheese by increasing its moisture content (Le Roux and Abbot, 1962*)*; incorporation of whey protein (Marshall, 1982 and Fox, 1987*)*; adding denatured whey protein (Walker, 1970); using of different types of starter cultures and non starter bacteria, or by altering the manufacturing protocol (Johnson *et al*., 1998); the use of accelerating ripening agents (Rodriguez, 1998); and by using of fat replacers or producing exopolysaccharides bacteria (Zalazar, 1998).

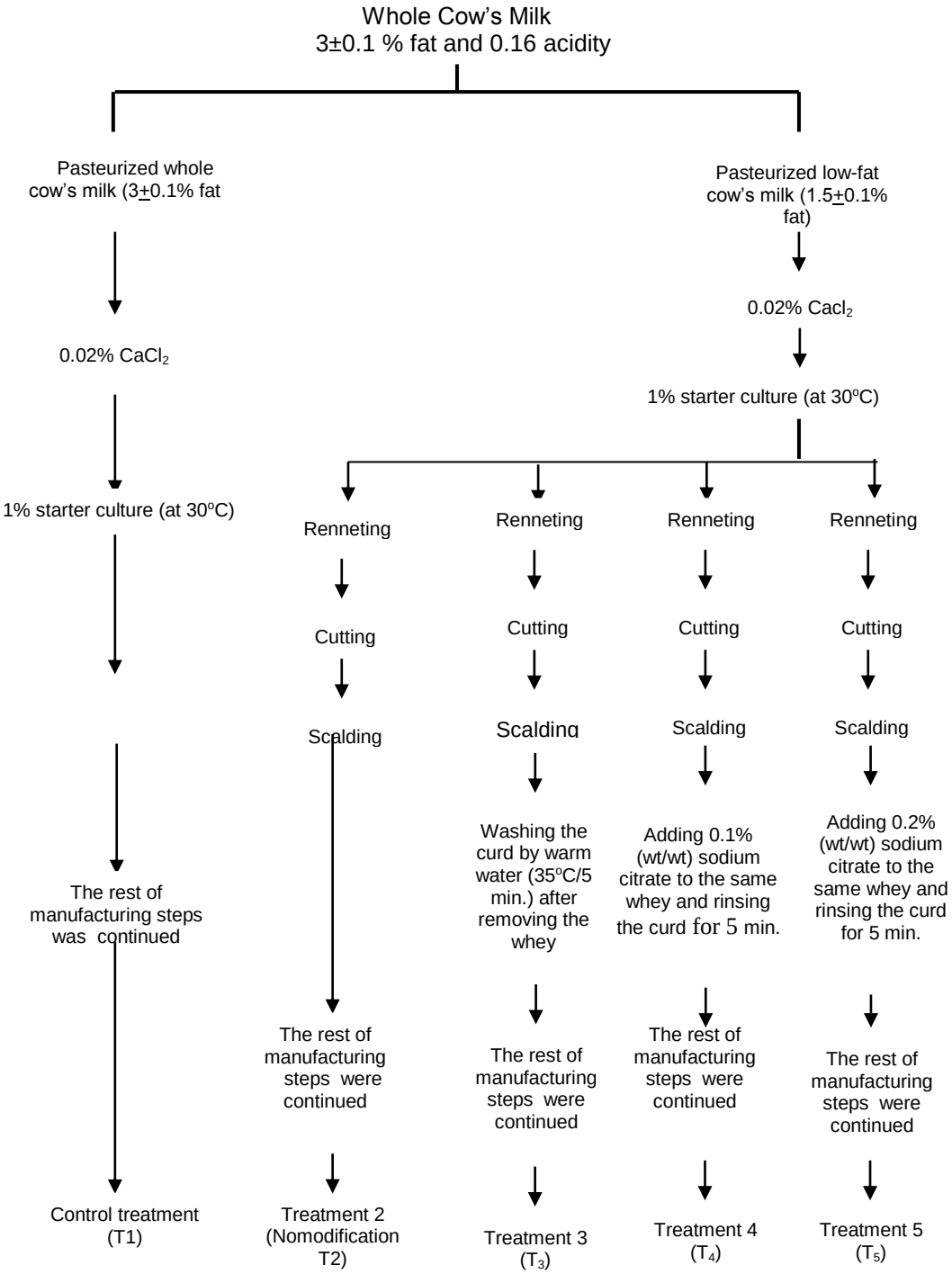
The present study aims to improve the organoleptic (body & texture) and rheological properties of low-fat Ras cheese by modifying some steps of cheese making procedure to overcome the former defects of low-fat cheese mentioned before. The resultant cheese were analyzed for chemical, microbiological, rheological and sensory properties during ripening.

Materials And Methods

Cow's milk was obtained from the herd belonging to EL-Gemmeza station, Animal Production Research Institute, Ministry of Agriculture, Egypt. The average chemical composition of milk was 0.16% aciity, pH value 6.6, fat 3±0.2% and total solids content 11.6 ± 0.2%.

Pure culture of *Lactococcus lactis subsp. lactis, Lactobacillus delbrueckii subsp. bulgaricus,* were obtained from Ch.Hansens Laboratories, Denmark. The organisms were activated separately in sterilized reconstituted skim milk at the optimum temperature of each for 16-18hr. Powder calf rennet was obtained from Ch. Hansen's Laboratories, Denmark. All chemicals used in this study were of analytical grade, and supplied by BDH, Sigma and Prolabo Chemical Companies.

Cheese was made from pasteurized cow's milk (72c^{o}/15sec.) of 3 ± 0.1% fat content according to the method explained by Abdel Tawab (1963). This study was carried out for 3 replicates. The plan of this study was shown in diagram Fig. (1).


Whole Cow's Milk
3±0.1 % fat and 0.16 acidity
Pasteurized whole cow's milk (3±0.1% fat
Pasteurized low-fat cow's milk (1.5±0.1% fat)
0.02% Cacl2
0.02% CaCl2
1% starter culture (at 30°C)
1% starter culture (at 30°C)
Renneting
Renneting
Renneting
Renneting
Cutting
Cutting
Cutting
Cutting
Scalding
Scalding
Scalding
Scalding
Washing the curd by warm water (35°C/5 min.) after removing the whey
Adding 0.1% (wt/wt) sodium citrate to the same whey and rinsing the curd for 5 min.
Adding 0.2% (wt/wt) sodium citrate to the same whey and rinsing the curd for 5 min.
The rest of manufacturing steps was continued
The rest of manufacturing steps were continued
The rest of manufacturing steps were continued
The rest of manufacturing steps were continued
The rest of manufacturing steps were continued
Control treatment (T1)
Treatment 2 (Nomodification T2)
Treatment 3 (T3)
Treatment 4 (T4)
Treatment 5 (T5)

Samples were taken from the fresh cheese and after 15,30,60 and 90 days of ripening for chemical, bacteriological, rheological and sensory properties. Samples were chemically analyzed for, moisture, fat, acidity, pH, salt, proteolysis as described by ling (1963). Total volatile fatty acids were determined by Kosikowski (1982). Samples were microbiologically examined for the total viable and lactic acid bacteria according to APHA (1992), proteolytic bacterial count (Sharaf, 1970); Lipolytic bacterial count (Davis, 1955). Texture profiles were measured by an Instron universal machine (model 1195, Instron corporation, canton, M.A., USA) by the method of Yang and Toranto (1983). Sensory properties were estimated according to Abdel Fattah (1966).

RESULTS AND DISCUSSION

Data in Table (1) show that reducing the fat content of cheese milk by approximately 50% resulted in an apparent increase in the moisture content of the resultant low-fat cheese (LF) T2, compared to full-fat (FF) control cheese (T1). The moisture content of control cheese when fresh and after 90 days of ripening were 33.39 and 29.89%, and the corresponding values of LF-cheese were 38.19 and 32.41%, in the same order. This increase in moisture content of LF-cheese was observed previously by Marshall (1982) and Storry *et al*. (1983), who reported that increasing fat content might increase the number of interstices within the network which are occupied by fat globules, thus leading to an increased impedance of whey drainage. Results in Table (1) also indicated that the acidity of LF-cheese (T2) decreased (being 1.50 and 2.20, when fresh and after 90 days of ripening), compared with control cheese (1.75 and 2.35%), respectively, owing to the reduction of fat content. pH values behaved in a reverse trend to titratable acidity (TA) along the ripening period. Fat and fat in the dry matter (F/DM) were found greatly higher in control cheese (T1) than LF-cheese (T2), during ripening (Table,1). Differences in salt and salt in moisture phase (S/M) were relatively lower in control cheese than in LF-cheese. Variations in the moisture and fat contents were presumably responsible for that.

Washing the curd by warm water (T3) decreased greatly the TA of the resultant fresh cheese (being 1.15%), compared to T2 (1.50%) and FF-control cheese (1.75%). This might be due to the replacement of whey medium surrounding the curd (rich medium) by water (poor nutrient medium), which consequently affected the activity of lactic acid bacteria and the rate of acid production. Contrarily, sodium citrate treatments (T4 and T5) had no obvious effects on the TA of the resultant cheese, when fresh and during ripening. Pastorino *et al*. (2003) noticed the same effect of sodium citrate on Ras cheese. Results, also showed that washing the curd either with warm water or sodium citrate had no pronounced effect on the moisture, fat and salt contents of the resultant cheeses, during ripening, compared with LF-cheese (T2). Results of moisture content of water washed curd were in agreement with Pastorino *et al*. (2003),which confirmed the effect of sodium citrate rinsed curd of cheese.

Table (1): Chemical composition of low-fat Ras cheese (LFC) in relation to some modifications in cheese-making procedure.

Ripening Period (day)	Treatments	Moisture (%)	Acidity (%)	pH Value	Fat (%)	Fat/DM (%)	Salt (%)	Salt/ moisture
Fresh		33.39	1.75	5.60	31	46.54	4.15	12.43
15	T1	32.34	1.95	5.55	32	47.29	4.20	12.99
30	(control)	32.08	2.05	5.51	33	48.59	4.33	13.50
60	1	31.0	2.25	5.47	34	49.28	4.54	14.65
90		29.89	2.35	5.41	35	49.92	4.72	15.79
Fresh		38.19	1.50	5.78	19.5	31.55	4.32	11.31
15	T2	35.05	1.75	5.77	21.5	33.10	4.53	12.41
30	(control)	32.89	1.85	5.74	23.5	35.02	4.50	13.68
60	2	32.50	1.95	5.71	24.0	35.56	4.63	14.25
90		32.41	2.20	5.67	24.0	36.32	4.80	14.81
Fresh		37.93	1.15	5.56	17.0	27.39	4.43	11.68
15		35.50	1.25	6.53	18.0	27.91	4.47	12.59
30	T3	33.68	1.45	6.44	20.5	30.91	4.56	13.54
60		32.45	1.55	6.38	22	32.57	4.66	14.36
90		31.75	1.70	6.31	23	33.70	4.84	15.24
Fresh		37.33	1.55	6.86	18	28.95	4.38	11.58
15		34.61	1.65	5.74	19.5	29.82	4.43	12.80
30	T4	32.96	1.75	5.69	22.5	33.56	4.60	13.96
60		32.32	1.95	5.67	23.0	33.95	4.76	14.76
90		30.56	2.10	5.61	24.0	34.56	5.00	16.36
Fresh		36.67	1.55	5.84	17.5	27.63	4.40	12.00
15		33.70	1.65	5.72	19.0	28.66	4.47	13.26
30	T5	32.58	1.85	5.69	21.0	31.15	4.65	14.27
60		31.36	2.05	5.64	22.5	32.72	4.81	15.34
90		30.55	2.20	5.59	23.0	33.10	5.10	16.69

T1: control treatment (From 3% fat milk)
T2: low-fat cheese, control, 2 (1.5% fat milk)
T3: LFC + washing the curd by warm water (35c^{o}/5min.)
T4: LFC + rinsing the curd in the same whey after adding 0.1% sodium citrate.
T5: LFC + rinsing the curd in the same whey after adding 0.2% sodium citrate.
DM: Dry matter

Concerning the rate of proteolysis and lipolysis (Table, 2 and Fig. 2), it was noticed that reducing the fat content of cheese milk led to a delay in the rate of proteolysis (SN/TN and NPN/TN) during cheese ripening. This reduction in the ripening indices of proteolysis occurred although the total protein contents of the same cheeses were increased. Guinee *et al*., (2007) found that reducing the fat level from 174 to 139g/kg Cheddar-type cheese resulted in a decrease in pH (4.6) and in the contents of soluble N/total nitrogen %, and an increase in the contents of moisture, protein and intact protein. Fenelon and Guinee (2000)came to the same conclusion. Washing the curd by warm water (T3) was found to have no apparent effect on the total protein, SN/TN and NPN/TN contents of the resultant cheeses during ripening. These proteolytic indices were found to be the lowest, when

compared with the rest LF-cheese treatments. similar results were also reported by Jovanovic *et al*. (2004).

Table (2) :Proteolysis and lipolysis of low-fat Ras cheese during ripening as affected by some modifications in the procedure of cheese making.

Ripening Period (day)	Treatments	Protein (%)	SN/TN (%)	NPN/TN (%)	Total volatile* fatty acids (%)
Fresh		18.69	7.41	4.07	7.80
15	T1	20.35	8.37	4.80	10.30
30	(control)	22.33	10.43	5.24	13.20
60	1	23.80	14.48	5.66	16.68
90		25.52	17.25	6.31	18.26
Fresh		20.22	6.22	3.57	5.86
15	T2	22.71	7.47	4.50	7.22
30	(control)	23.61	9.75	4.67	9.15
60	2	25.65	12.90	5.05	12.36
90		27.43	16.0	5.63	14.17
Fresh		19.40	6.02	3.17	5.43
15		21.25	7.0	3.93	6.36
30	T3	23.22	9.38	4.25	8.86
60		25.96	12.45	4.72	11.29
90		26.03	15.16	5.07	12.70
Fresh		19.97	6.12	3.36	6.66
15		21.56	7.34	4.40	8.32
30	T4	23.48	9.55	4.56	10.33
60		25.40	12.75	5.10	13.33
90		27.12	15.07	5.52	14.83
Fresh		19.78	6.10	3.26	6.23
15		22.52	7.24	4.31	8.0
30	T5	24.24	9.60	4.62	9.62
60		25.26	12.63	4.92	13.26
90		26.92	15.50	5.43	14.26

*** ml 0.1 N NaoH/100g cheese.**

Rinsing the curd with sodium citrate (T4 and T5) had a slight effect on the rate of proteolysis of the resultant cheeses, compared with LF-cheese treatment (T2) and control one (T1) along the ripening period. These results were opposite to those found by in karish cheese.

Table (2) show that there was a negative relationship between the fat content of cheese and the total volatile fatty acids (TVFA) of Ras cheese, and of course a positive correlation with the ripening period.

Ohren & Tucky (1969) reported that F/DM content in the cheese of more than 50% is required for the development of true Cheddar flavor. Similarly washing the curd by warm water slightly decreased the values of TVFA, compared with LF-cheese (T2) during ripening. The TVFA content of the sodium citrate treated curds (T4 & T5) were slightly higher than the other LF-cheeses (T2 and T3) along the ripening period. This increase was

probably due to the emulsifying and promoting effect of sodium citrate on the growth and activity of lipolytic bacteria, and was subsequently reflected on the liberation of free volatile fatty acids during ripening . As the ripening period advanced the acidity, salt, fat, proteolysis and lipolysis indices gradually increased till the end of the ripening period, while, the values of moisture contents decreased. These results are in agreement with those found by Fenelon & Guinee (2000) and Shehata *et al*. (2004).

Data in Table (3) show that the reduction of fat content in LF-cheese led to proportional reduction in all populations of bacterial counts (total viable (Tc), lactic acid bacteria (LAB); proteolytic (PB) and lipolytic (LB) bacteria) in the resultant cheeses. Laloy *et al*. (1996) found similar observations. Washing the curd by warm water (T3) or rinsing it in the same whey with sodium citrate was found to have a slight effect on the former population counts during ripening. Variations in the chemical composition among all treatments presumably play an important role in that.

Table (3): Microbiological profile of Low-fat Ras cheese, during 90 days of ripening.

	Ripening Period (day)	Treatments				
		T1 Control	T2	T3	T4	T5
Total bacterial count (CFU × 10^7/g)	Fresh	9.2	7.6	7.1	6.7	6.1
	15	14.8	13.5	12.5	12.9	11.7
	30	10.4	8.8	7	7.3	6.5
	60	7.8	6.4	6.1	5.7	5.5
	90	6.4	4.9	4.4	4.6	4.2
Lactic acid bacterial count (CFU × 10^7/g)	Fresh	8.4	5.7	5.2	5.3	4.7
	15	13.1	11.5	11.5	11.3	10.5
	30	8.9	7.1	6.6	6.5	5.9
	60	6.7	5.5	5.0	5.1	4.7
	90	5.8	4.1	3.3	3.9	3.5
Proteolytic bacteria (CFU × 10^3/g)	Fresh	38	16	13	11	17
	15	36	25	21	22	16
	30	53	40	32	34	27
	60	78	65	57	58	49
	90	138	97	82	90	76
Lipolytic bacteria (CFU × 10^3/g)	Fresh	26	2.0	1.3	1.4	1.2
	15	30	9.0	3.0	6.0	4.1
	30	36	15	5.0	13	6.0
	60	47	26	18	22	15
	90	72	48	39	42	34

With the progress of ripening period, TC and LAB counts increased gradually up to 15 days of ripening, then decreased thenafter till the end of the ripening period. The same trend of decrease was noticed previously by Uperti *et al*., (2006). Proteolytic and lipolytic bacteria behaved in an another trend to TC and LAB, so they increased gradually to the highest counts at the end of the ripening period.

Results in Table (4) reveal that there is a reverse relationship between cheese hardness and its fat content, when fresh and throughout the ripening period, and the highest value of 7.8 Newton after 90 days of ripening, was belonged in (T3). whereas the lowest one of 5.05 Newton was detected in the control FF-cheese (T1). Sipahioglu *et al*. (1999) mentioned that increasing the fat content of milk decreased markedly the firmness of the resultant cheese owing to the more and large voids within the protein matrix of high fat Mozzarella cheese, as well as the decrease of the proportions of protein to moisture fractions. Washing the curd by warm water or treated it by sodium citrate had low effect on the cheese firmness, when fresh or during ripening. Pasorino *et al*. (2003) came to the same coclusion, while contradictory results were obtained by Abdel-Hamid *et al*. (2006).

Table (4): Textural properties of Low-fat Ras, during ripening, as affected by some modifications in the manufacturing process.

	Ripening Period (day)	Treatments				
		T1 Control	T2	T3	T4	T5
Hardness (N)	15	4.15	6.30	6.75	6.55	6.65
	30	4.35	6.60	7.13	6.87	7.00
	60	4.75	7.01	7.62	7.30	7.50
	90	5.05	7.40	7.80	7.60	7.72
Cohesiveness	15	0.685	0.623	0.608	0.594	0.582
	30	0.715	0.648	0.620	0.629	0.610
	60	0.750	0.680	0.638	0.655	0.645
	90	0.765	0.700	0.655	0.670	0.654
Springiness (m.m)	15	10.20	14.04	15.30	15.07	15.20
	30	10.51	14.46	15.76	15.40	15.55
	60	10.97	15.79	16.02	15.80	15.93
	90	11.30	15.45	16.23	15.96	16.14
Gumminess (N)	15	2.84	3.90	3.85	3.93	4.06
	30	3.10	4.25	4.28	4.33	4.40
	60	3.51	4.72	4.78	4.84	4.86
	90	3.82	5.01	5.09	5.15	5.20
Chewiness (N.m.m)	15	28.75	52.10	57.93	56.30	58.25
	30	32.55	55.45	59.04	57.25	60.30
	60	36.10	57.15	61.65	58.83	60.72
	90	38.15	60.40	64.50	62.32	63.71

N: Newton m.m: Millimeter N.m.m: Newton millimeter.

Cohesiveness values of cheese decreased as the fat content of cheese-milk decreased (Table 4). Gwartney *et al*. (2006) found that hardness and springiness increased while adhesiveness and cohesiveness of Cheddar cheese being made with different levels of fat (13-34%) decreased with the decrease of the fat content. Results, moreover, showed that the curd of LF-Ras cheese treated either by warm water (T3) or sodium citrate (T4 and T5) exhibited a slightly lower cohesiveness values after 15 and 90 days of ripening, compared to (T2) (Pastorino *et al*., 2003).

Springiness of all treatments (Table, 4) took the same trend of hardness, during ripening, so it increased as the fat content of cheese

decreased. Control cheese was found to have the lowest values of springiness along the ripening period, followed by T2, T4, T3 and T5, in a descending order. Springiness of washed curd (T3) or sodium citrate treatments (T4 and T5) was found to be slightly higher than (T2), when fresh and during ripening. Confirmatory to these results were also mentioned by Fredrick and Duely (1984).

Indirect relationship between cheese gumminess and chewiness and fat content of cheese was found (Table, 4). Fox *et al*., (2000) and Awad *et al*. (2003) noticed a positive relationship between hardness and chewiness of Ras cheese. It could be stated that reducing fat content from 50.4% wt/wt (full-fat) to 13.5% in the manufacture of Gaziantep cheese increased textural parameters (hardness, gumminess, cohesiveness and springiness) in the resultant cheese. Texture parameters were correlated with each others, except cohesiveness. F/DM only correlated with hardness and springiness.

Results in (Table 4) revealed also that washing the cheese curd by warm water (T3) resulted in cheese with low values of gumminess than curd treated with sodium citrate (T4 and T5), and slightly higher than (T2). Chewiness values of T3, T4 and T5 were found approximately similar , and the former modifications and low effect on these properties, compared to control cheese, or (T2) (Gwartney *et al*., 2006).

As the ripening period progressed, the texture profiles of all treatments increased reaching the maximum values at the end of the ripening period. Control cheese was found to have the best texture profiles than the other treatments. Treated cheeses and texture profiles were similar to untreated cheese (T2), and the modifications utilized to improve the structure of these LF-cheeses were found to be of no great effect. These results are in agreement with those found by Abdou *et al*. (2008).

F/DM, moisture in non-fat substances (M/NFS), pH and S/M were considered important factors responsible for the ripening process and to assess the quality of cheese texture (Gilles & Lawrence, 1973).

Results in Table (5) indicate that as the fat content of cheese decreased (T2, T3, T4 and T5), the values of M/NFS and F/DM decreased (Guinee *et al*., 2007). The same results were noticed also for the ratio of moisture/protein (M/P) “especially after 60 and 90 days of cheese ripening”, so it increased as the F/DM increased. Increasing the M/P ratio resulted in softer cheese, and it is thought that water acts as a lubricant or plasticizer between the protein molecules, making the cheese more pliable (Tunick *et al*., 1991). Results also indicated that the S/M values were approximately similar among the five treatments along the ripening period, with the exception of the sodium citrate treatment (T5). Increasing the S/M values resulted in harder cheese (Mistry & Kesperson, 1998).

Concerning the effect of water washing or sodium citrate effect, it was found that values of M/NFS, M/P and F/DM were found approximately similar, and slightly lesser than the LF-cheese (T2) during ripening. As the ripening period increased, values of M/NFS, M/P and F/DM of all treatments decreased, whereas the values of S/M increased gradually till the end of the ripening period .

Table (5): Changes in the structural properties of low-fat Ras cheese during ripening.

Component %	Ripening Period (day)	Treatments				
		T1 Control	T2	T3	T4	T5
MNFS	Fresh	48.39	47.44	45.70	45.52	44.45
	15	47.56	44.65	43.20	42.99	41.60
	30	47.88	42.99	42.36	42.53	41.24
	60	46.97	42.76	41.60	41.90	40.73
	90	45.98	42.64	41.23	40.21	39.68
M/P	Fresh	1.79	1.89	1.96	1.87	1.65
	15	1.59	1.54	1.67	1.60	1.50
	30	1.44	1.39	1.45	1.40	1.34
	60	1.30	1.27	1.25	1.27	1.24
	90	1.17	1.18	1.15	1.13	1.13
S/M	Fresh	12.43	11.21	11.68	11.58	12.0
	15	12.99	12.41	12.59	12.80	13.26
	30	13.9	13.68	13.54	13.96	14.27
	60	14.65	14.25	14.36	14.76	15.52
	90	15.79	14.81	15.24	15.34	16.69

M/NFS: Moisture on non fat substances.
M/P: Moisture on protein
S/M: Salt in the moisture phase

Sensory evaluation showed that control cheese (T1) had the highest score points, compared with the other treatments, along the ripening period Table (6). Ohmes *et al*. (1998) stated that milk fat acts as a solvent for flavor compounds and plays an important role in the softness of cheese texture. Reducing fat in the cheese ≤ 10% without modification of regular procedure resulted in hard, rubbery, translucent and poor flavor development. Versteeg *et al*. (1998) noticed also the same effect of fat on cheese quality.

Washing the curd by warm water had bad effect on the organoleptic properties of the resultant cheese, which was of flat flavor and low body and texture ,compared with the other treatments during ripening. Chen (1991) and Johnson *et al*. (1998) increased the moisture content of reduced-fat Cheddar cheese by washing the curd by cold water and found that the resultant cheese was often bland and very mild in flavor. Results in (Table 6) also indicated that the treatments of sodium citrate (T4 and T5) were not of superior properties, compared with the other treatments (T2 and T3) along the ripening period (Pastorino *et al*., 2003). Generally, it was found that FF-cheese (T1) was the best treatment, during ripening, followed by T2 , T4 and T5 in order. T2 was ranked the best LF-cheese, owing to its higher level of moisture, F/DM and low S/M content throughout the ripening period, and the modifications took placed throughout this study did not improve the rheological and sensory properties of the resultant LF-cheese.

Table (6): Organoleptic evaluation of low-fat Ras cheese, as affected by some modification in the traditional cheese manufacturing process

Treatments	Ripening Period (day)	Organoleptic properties				
		Flavrour (50)	Body texture (40)	Appearance Color (10)	Total Scores (100)	Remarks
T1 Control	15	37	29	9	75	Clean acid taste, smooth body, and over-ripening at the end of maturation. The best treatment and the favourate one.
	30	40	30	9	79	
	60	43	32	8	83	
	90	45	35	8	88	
T2	15	33	24	9	66	Ranked after the control. It characterized by clean acid flavour, body and texture superior than the rest Low-fat cheeses (T3, T4 and T5).
	30	35	25	9	69	
	60	38	28	8	74	
	90	40	30	8	78	
T3	15	30	20	8	58	Had the lowest organoleptic properties along the ripening period. It is flavour was bland and mild, and body and texture was the inferior.
	30	31	22	8	61	
	60	33	24	8	65	
	90	35	27	8	70	
T4	15	32	23	9	64	Followed T2 and had slightly salt taste, clean acid falvrour and inferior body and texture than T1 and T2.
	30	33	25	9	67	
	60	37	27	8	72	
	90	39	29	8	76	
T5	15	31	22	9	62	Salty taste and slightly hard body than the others.
	30	32	24	9	65	
	60	35	26	8	69	
	90	37	27	8	72	

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أثر بعض التعديلات على طريقة صناعة الجبن الراس على صفات وجودة الجبن الناتج المنخفض الدهن أثناء التسوية

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تم صناعة الجبن الراس منخفض الدهن من لبن بقرى مبتسر ١,٥± ٠,١% دهن مع إجراء بعض التعديلات على طريقة الصناعة تشمل غسل الخثرة بعد انتهاء السمط بالماء الدافئ (٣٥°م /٥ق) أو نقعها لمدة ٥ق فى نفس الشرش بعد إضافة سترات الصوديوم بنسبة ٠,١ أو ٠,٢% وزن / وزن ثم أيضاً صناعة الجبن كامل الدسم من لبن بقرى مبستر ٣ ± ٠,١% دهن (مقارنة ١) والجبن منخفض الدسم (الدهن) ١,٥ ± ٠,١% دهن (مقارنة ٢) بدون أى تعديلات فى طريقة الصناعة للمقارنة. ثم تسوية الجبن الناتج من جميع المعاملات على درجة حرارة ٨ ± ٢°م ورطوبة نسبية ٨٥% لمدة ٣ شهور وتم تحليل الجبن الناتج كيمياوياً وبكتريولوجياً وريولوجياً وحسياً وهى طازجة وبعد ١٥ ، ٣٠ ، ٦٠ ، ٩٠ يوم من التسوية. وقد أظهرت النتائج ما يلي:

- يؤدي خفض نسبة الدهن فى الجبن إلى زيادة نسبة الرطوبة والملح والبروتين وإلى خفض نسبة الحموضة والدهن ودلائل التسوية طوال مدة التخزين.
- أدى غسل الخثرة بالماء الدافئ إلى انخفاض الحموضة بدرجة كبيرة فى الجبن الناتج مما أثر ذلك على صفاته الحسية والريولوجية أثناء التسوية.
- أظهر الفحص الميكروبيولوجى للمعاملات التى أجرى عليها التعديلات فى طريقة الصناعة أو التى لم تجرى عليها أى تعديلات أن أعداد الميكروبات بها أقل من جبن المقارنة (٣% دهن) طوال مدة التسوية.
- أظهرت النتائج أن الصفات الريولوجية للجبن كامل الدهن (٣%) كانت أفضل من باقى المعاملات طوال مدة التسوية ويلعب الدهن دوراً رئيسياً فى ذلك.
- حصل الجبن كامل الدسم على أعلى الصفات الحسية طوال مدة التسوية يليه جبن المقارنة (٢) ثم الجبن الناتج من المعاملات بالسترات وأخيراً الجبن المعامل خثرته بالماء الدافئ.

الخلاصة:

يستخلص من هذه النتائج عموماً أن التعديلات التى أجريت على خثرة الجبن منخفض الدسم لم تحسن الصفات الريولوجية والحسية لهذا الجبن طوال مدة التسوية.

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