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MAKING OF LOW FAT RAS CHEESE USING FAT REPLACER

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ABSTRACT

Seven Ras cheese treatments were made to study the effect of replacing milk fat with Novagel® RCN15 (a carbohydrate-based fat replacer) on the quality of low fat Ras cheese. Control cheeses were made from cow's milk containing 3.0% fat, another three Ras cheese treatments were made from the same milk but were standardized to 2.0% fat with adding Novagel® at the rate of 0.0, 0.25% and 0.50% respectively. The other three Ras cheese treatments were made from cow's milk standardized to 1.0% fat with adding Novagel® at the rate of 0.0%, 0.50% and 1.0% respectively. Reducing the fat content of cheese milk caused a significant decrease in moisture, fat, titratable acidity, soluble nitrogen (SN), Shilovitch ripening index (S1) total volatile fatty acid content and scores of organoleptic properties of Ras cheese, meanwhile increased total nitrogen, salt, ash content and hardness of cheese was detected. Adding Novagel® increased the ripening indices, scores of organoleptic properties, acidity and moisture content, while decreased the hardness of cheese. Cheese treatment that made from 2.0% fat milk was the most acceptable one, and was not significantly different from control cheese. Ripening indices, titratable acidity scores of cheese, total nitrogen, fat and ash content of Ras cheese increased as ripening period proceeded, while cheese hardness and moisture decreased.
Keywords: Low fat Ras cheese, hardness, ripening indices, Novagel®, fat replacer.

INTRODUCTION

Ras cheese is the most popular hard cheese in Egypt. Milk fat plays crucial roles in developing the texture, color, flavor perception, flavor stability, flavor generation and the overall sensation of dairy products (deRoos, 1997 and Akoh, 1998). Several problems are encountered in the production of low fat hard cheese. The use of traditional processes to manufacture low fat Cheddar cheese results in the production of cheese which lack of the full flavor and the desired texture (Anderson and Mistry, 1994). The development of dairy products with a reduced fat content is one of the priorities of most dairy companies because of the health problems associated with high fat intake such as obesity, diabetes, some types of cancer and hypertension (Akoh, 1998). Thus, there is a great interest in using fat replacers as a possibility to manufacture good dairy products with a reduced fat content. Many efforts have been devoted to utilize the fat replacers in the manufacture of low fat dairy products in the last few years (Tamime *et al.*, 1994; Ma *et al.*, 1997; Badawy, 1998). Many fat replacers are commercially available for use in foods and they are classified as fat-based fat replacers, protein-based fat replacers and carbohydrate-based fat replacers (Huyghebaert *et al.*, 1996; Giese, 1996; Banks *et al.*, 1989; Anderson and Mistry, 1994). As the different fat replacers behave differently, therefore each one should be evaluated to be used.

In view of the aforementioned the objectives of this study were to investigate the possibility of making a good quality low fat Ras cheese using Novagel® RCN 15 a carbohydrate based fat replacer. The effect of using this fat replacer on Ras cheese quality and to monitor changes during ripening period.

MATERIALS AND METHODS

Bulk fresh cow's milk was obtained from the herd of Tokh Tanbesha Farm, Faculty of Agriculture, Minoufiya University. Seven Ras cheese treatments were made to study the effect of using fat replacer on low fat Ras cheese quality. Control Ras (C1) cheese treatment was made from milk standardized to 3.0% fat. Another 3 treatments (C2, T3, T4) were made from milk standardized to 2.0% fat with adding 0, 0.25 and 0.50% Novagel® RCN 15 (FMC Biopolymer, Philadelphia, PA, USA), respectively. The other three Ras cheese treatments (C3, T1, T2) were made from the same milk being standardized to 1.0% fat with adding 0.0, 0.5 and 1.0% Novagel® RCN 15 in the same order. Novagel® was added the cold milk and mixed thoroughly. Cheese milk patches were heat treated at 63°C for 30 min., then cooled to 30°C. Ras cheese was made from different milk according to Abdel Tawab, (1963). Calcium chloride was added at the rate of 0.02% of milk. The resultant cheese treatments were ripened for 150 days. Cheese treatments were sampled when fresh and every month for chemical, rheological and sensory analysis. The experiments were carried out in duplicates.

Cheese samples were analyzed for moisture, fat, salt, total, soluble and nitrogen contents and titratable acidity according to the methods described by Ling (1963). The total volatile fatty acids were determined according to Kosikowski (1966). Shilovitch Ripening Index was measured using the method of Abd EL-Tawab and Hoffi (1966). Total energy was calculated based on conversion factors as follows: protein 4 k.cal/ gm, carbohydrate 4 k.cal/ gm and fat 9 k.cal/ gm, taking into consideration that the total carbohydrate content of cheese was calculated by difference.

For detecting the cheese hardness, two cubes from each treatment were cut into 4X4X4 cm and tempered at room temperature. Cheese hardness was assessed using a penetrometer supplied by Koehler (Instrument company Inc. New York, USA). The penetrometer spindle was adjusted to touch the surface of cheese sample, and then the spindle was released to penetrate into the sample for 5 sec. The penetration depth was recorded in units of 0.1 mm penetrometer reading which is related inversely to the hardness of sample.

Cheese samples were evaluated for appearance, flavor, and body, & texture according to the scoring sheet of El-Shafei *et al.*, (1995) by the staff members of the Department of Dairy Science and Technology, Fac. of Agric., Menoufia Univ.

Factorial design was used to analyze all of the data, and Duncan's test was followed to make the multiple comparisons (Steel and Torric, 1980) using Costat program. Significant differences were determined at ($p < 0.05$).

RESULTS AND DISCUSSION

Moisture content of all Ras cheese treatments decreased significantly as ripening period progressed (Tables 1, 6). These results are in agreement with those reported by Badawi (1998), Hussein (2000), Taha *et al.* (2007), Abd Alla *et al.* (2008) and Mehanna *et al.* (2009). Reducing the fat content of cheese milk caused a significant ($P < 0.05$) decrease in moisture content of the resultant cheese (Tables 1, 6). These results might be attributed to the ability of fat to reduce whey synopsis from cheese curd (Storry *et al.*, 1983; Van Dijk and Walsha, 1986). Cheese treatments made with adding Novagel® contained higher moisture content than those made from the same milk without adding Novagel® (Tables 1, 6). This increase was proportional to the concentration of adding Novagel®. These results could be attributed to the higher water holding capacity of Novagel® than that of milk fat (Badawi, 1998).

Fat content of all Ras cheese treatments increased significantly ($P < 0.05$) as ripening period proceeded (Tables 1, 6). These results are similar to those reported by Badawi (1998), Hussein (2000), EL-Shibiny *et al.* (1991), Kebary *et al.* (2010). This increase in fat content might be due to the decrease in moisture content. Fat content of low fat Ras cheese is decreased by reducing the fat content of cheese milk. These results are in accordance with those reported by Badawi (1998), Hussein (2000). Cheese treatment made from the same milk were not significantly different from each other, which means that adding Novagel® did not affect the fat content (Tables 2, 6).

Total nitrogen content of all Ras cheese treatments increased significantly ($P < 0.05$) as ripening period advanced (Table 1). Similar results are reported by Badawi (1998); Hussein (2000); Kebary *et al.* (2010). Cheese treatments made from 1.0% fat milk contained the highest total nitrogen content then with the corresponding cheese treatments being made from 2% fat milk, followed with cheese treatments made from 3.0% fat milk (Table 1). These results revealed that the reduction of fat content of cheese milk caused a marked increase in the total nitrogen content of the resultant cheese (Table 1). On the other hand, adding Novagel@ did not affect significantly the total nitrogen content of Ras cheese. Similar results are reported by Kebary *et al.* (2006).

Ash content of all Ras cheese treatments increased slightly ($P < 0.05$) as ripening period proceeded, which might be due to the loss of moisture (Table 2). Similar trends were reported by Badawi (1998); Kebary *et al.* (2006). Reducing the fat content of cheese milk caused a significant increase in ash content (Table 2). On the other hand, cheese treatment those made from the same milk were not significantly ($P > 0.05$) different from each other (Table 2). Similar trends were reported by Badawi (1998) and Kebary *et al.* (2006) for Damietta cheese.

Salt content of all Ras cheese treatments increased as ripening period advanced (Table 2). These results are in agreement with those reported by Khader *et al.* (1995); Kebary *et al.* (1996); Badawi (1998); Hussein (2000). Reduction of milk fat caused a significant change ($P < 0.05$)

as ripening period progressed (Table 2). These results are in accordance with those reported by Badawi (1998); Hussein (2000); Taha *et al.* (2007); Abd Alla *et al.* (2008); Mehanna *et al.* (2009). Reduction of fat content of cheese milk caused a significant decrease in titratable acidity of the resultant Ras cheese (Table 2) and this reduction was proportional to the fat content. These results could be attributed to the lower moisture content and consequently the lower water activity, which suppresses the growth of cheese microflora and subsequently, reduces the production of acid (Banwart, 1981). Similar trends were reported by Badawi (1998) and Hussein (2000) for Ras cheese and Kebary *et al.* (2006) for Damietta cheese. Cheese treatments those made with adding Novagel® had higher acidity than corresponding Ras cheese made without adding Novagel® (Table 2) and this increase was proportional to the rate of adding Novagel®. These results might be due to the increase in moisture and water activity that might enhance the growth of lactic acid bacteria and consequently increase the ability to produce acid (Banwart, 1981).

Ripening indices (water soluble nitrogen [SN], Shilovitch ripening index (Sh) and total volatile fatty acids [TVFA]) followed almost similar trends (Table 3). SN, Sh and TVFA of all Ras cheese treatments increased significantly ($P < 0.05$) as ripening period progressed. These results are in agreement with those reported by Badawi (1998); Hussein (2000); Kebary *et al.* (2010); Taha el al. (2007); Abd Alla *et al.* (2008); Mehanna *et al.* (2009). Cheese treatment C_1 contained the highest SN, Sh and TVFA content followed by C_2 that made from 2.0% fat milk, then C_3 that made from 1.0% fat milk, which means that reduction of fat content of cheese milk caused a significant ($P < 0.05$) decrease in SN, Sh and TVFA of the resultant cheese, and there was a positive correlation between fat content and the amount of SN, sh and TVFA (Table 3). These results could be attributed to the lower moisture content and lower water activity that suppress the growth of bacterial groups, especially, the proteolytic and lipolytic bacteria and proteases and lipases altimeters. Ras cheese treatments made by adding Novagel® contained higher SN, Sh and TVFA than corresponding cheese treatments being made without adding Novagel® (Table 3) and this increase was proportional to the rate of adding Novagel®. These results might be due to the increase in moisture content and consequently, higher water activity that enhance the growth of proteolytic and lipolytic bacteria. Similar results are reported by Badawi (1998), Hussein (2000) for Ras cheese and Kebary *et al.* (2006) for Damietta cheese.

Penetrometer reading which is inversely related to cheese hardness is presented in Table (4). Hardness of Ras cheese was increased by reducing the fat content of cheese milk (Table 4). Similar results are reported by Badawi (1998); Hussein (2000). Cheese treatments those made with adding Novagel® had less hardness that the corresponding cheese treatments those made without adding Novagel®, and this reduction was proportional to the rate of adding Novagel®. Hardness of all Ras cheese treatments decreased at ripening period progressed, which might be due to the proteolysis during ripening period (Table 4).

Table (1): Effect of fat replacer on moisture, fat and total nitrogen content (TN) of Ras cheese

Cheese Treatment	Moisture (%)						Fat (%)						Total Nitrogen (%)					
	Ripening Period (months)						Ripening Period (months)						Ripening Period (months)					
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
C1	62.85	60.85	52.08	46.47	36.84	36.14	26.71	29.2	31.9	33.2	36.2	39.1	1.70	1.85	2.02	2.23	2.50	2.80
C2	56.19	50.71	40.31	39.26	34.26	32.27	22.75	21.3	22.1	23.2	23.8	35.22	2.06	2.86	3.25	3.45	3.95	4.12
C3	50.56	49.14	40.00	35.40	32.00	31.01	11.8	12.7	14.7	16.1	17.8	19.3	3.80	2.02	2.015	2.25	2.45	5.95
T1	55.94	53.22	41.52	40.96	32.42	32.20	11.6	12.5	13.8	15.1	15.9	18.65	3.87	2.04	2.19	2.37	2.55	6.60
T2	58.18	53.62	44.78	40.97	38.42	35.37	11.3	12.1	13.3	13.9	14.5	19.1	3.84	2.01	2.26	2.59	2.65	6.63
T3	58.42	53.73	45.44	42.35	36.48	34.95	23.72	18.15	19.25	20.5	25.75	35.3	2.32	4.82	5.04	5.54	5.75	4.15
T4	62.13	55.10	45.42	40.20	35.15	36.48	22.71	18.8	19.3	20.45	25.93	35.65	2.55	2.96	3.35	3.75	3.95	4.26

C1: Ras cheese manufactured from 3% fat milk
C2: Ras cheese manufactured from 2% fat milk
C3: Ras cheese manufactured from 1% fat milk
T1: Ras cheese manufactured from 1% fat milk + 0.5% Novagel®
T2: Ras cheese manufactured from 1% fat milk + 1% Novagel®
T3: Ras cheese manufactured from 2% fat milk + 0.5% Novagel®
T4: Ras cheese manufactured from 2% fat milk + 0.25% Novagel®

Table (2): Effect of fat replacer on salt, ash and titratable acidity of Ras cheese

Cheese Treatment	Salt (%)						Ash (%)						Titratable Acidity (%)					
	Ripening Period (months)						Ripening Period (months)						Ripening Period (months)					
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
C1	2.55	1.94	1.95	1.98	2.22	3.98	7.61	8.67	8.72	8.96	8.96	9.25	0.40	1.45	1.74	1.80	1.85	1.88
C2	2.25	2.43	2.52	2.70	2.96	3.20	6.25	7.22	7.35	7.72	7.15	7.45	0.35	1.40	1.44	1.70	1.72	1.81
C3	2.30	2.40	2.46	2.63	2.70	3.34	6.11	8.57	8.63	8.72	9.00	9.44	0.30	1.13	1.20	1.28	1.30	1.33
T1	2.55	2.52	2.81	2.87	2.93	3.93	7.11	7.16	7.28	8.00	8.82	8.30	0.35	1.10	1.88	1.25	1.30	1.82
T2	2.53	2.97	3.04	3.33	3.33	3.68	7.61	8.67	8.72	8.96	8.96	9.25	0.39	1.11	1.20	1.26	1.32	1.86
T3	2.22	2.92	3.16	3.16	3.28	3.25	6.21	8.57	8.63	8.72	9.00	9.44	0.38	1.38	1.42	1.50	1.64	1.87
T4	2.50	2.34	2.46	2.69	2.81	3.96	7.51	8.43	8.50	8.53	8.73	9.20	0.41	1.45	1.48	1.50	1.75	1.87

Table (3): Effect of fat replacer on soluble nitrogen, total volatile fatty acid (TVFA) and Shilovitch Ripening Index of Ras cheese

Cheese Treatment	SN (%) Ripening Period (month)						TVFA (ml 0.1 NaOH/100g) Ripening Period (month)						Shilovitch Ripening Index Ripening Period (month)					
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
C1	0.59	0.76	0.86	0.98	1.16	1.40	36	42	60	66	84	90	45	50	80	90	210	270
C2	0.27	0.48	0.98	1.23	1.38	1.48	31	36	48	50	64	80	35	50	60	90	140	210
C3	0.23	0.67	0.98	1.20	1.34	1.47	15	32	44	50	54	58	25	40	40	50	62	85
T1	0.25	0.58	0.88	1.12	1.22	1.45	32	36	43	50	63	81	34	30	50	80	90	205
T2	0.36	0.48	0.83	0.97	1.21	1.53	34	20	26	35	39	88	40	20	30	40	42	267
T3	0.34	0.58	0.98	1.01	1.30	1.44	33	30	48	60	70	85	42	40	70	85	120	265
T4	0.58	0.76	0.86	0.98	1.16	1.38	35	42	50	66	73	89	44	45	78	88	200	268

Table (4): Effect of fat replacer on Total Calorie and Hardness of Ras cheese

Cheese Treatment	Total Calorie of cheese Ripening Period (month)						Hardness of cheese Ripening Period (month)					
	0	1	2	3	4	5	0	1	2	3	4	5
C1	283.77	360.02	365.65	355.71	389.04	420.06	4.5	4.3	3.83	2.9	2.7	1.1
C2	220.46	229.45	277	294.32	310.48	340.65	9.1	8.6	6.4	5.9	4.9	4.1
C3	152.57	164.5	179.388	196.38	208.17	325.17	10.5	9	8.83	8.6	5.7	5.3
T1	139.46	160.19	177.37	191.19	198.12	225.15	7	6.15	4.35	3.12	3.3	3.1
T2	142.15	160.19	177.37	191.19	198.12	220.12	6.7	5.9	4.35	3.9	2.8	2.2
T3	215.38	229.45	277	294.32	310.48	335.69	7	6.19	4.41	3.7	3.4	3.2
T4	213.38	232.77	260.67	284.52	298.25	330.35	6.8	5.6	4.45	4.9	3.95	2.9

Reduction of fat content of cheese milk caused a significant decrease in total calories (Table 4). Cheese treatment that made from 3.0% fat exhibited the highest total calories followed with C_2 which made from 2.0% fat milk and then C_3 that made from 1.0% fat milk. These results are in agreement with those reported by Badawi (1998) and Hussein (2000) for Ras cheese and Kebary *et al.* (2006) for Damietta cheese. Total calorie of all Ras cheese treatments increased as ripening period proceeded (Table 4). These results might be due to the increase of total solids. Similar trends were reported by Badawi (1998) and Kebary *et al.* (2006). Replacement of milk fat with Novagel® decreased the total calorie of the resultant Ras cheese, which might be due to the increase of moisture content and consequently decrease the total solids content (Table 4). These results are in accordance with those reported by Badawi (1998) and Kebary *et al.* (2006).

Scores of organoleptic properties (flavor, body & Texture, color and appearance) followed almost similar trends. Scores of organoleptic properties of all Ras cheese treatments increased significantly ($P < 0.05$) as ripening period advanced (Table 5). These results are in agreement with those reported by El-Shibiny *et al.* (1991); Badawi (1998), Hussein (2000); Mehanna *et al.* (2009); Kebary *et al.* (2010). Cheese treatment C_1 that made from 3.0% fat milk gained the highest scores followed with C_2 which made from 2.0% fat milk and then C_3 that made from 1.0% fat milk, which means that reducing the fat content of cheese milk caused a significant decrease in organoleptic scores (Table 6). On the other hand, adding Novagel® improved the acceptability of low fat Ras cheese and increased their scores. Cheese treatment that made from 2.0% fat milk with adding 0.25% Novagel® was the most acceptable cheese and was not significantly different from control cheese and was preferred than cheese made from the same milk with adding 0.50% Novagel® because the crumbly texture.

It could be concluded that reducing the fat content decreased the fat, acidity, moisture, SN, Sh, TVFA and organoleptic scores of Ras cheese, on the other hand adding Novagel® increased the moisture content, SN, Sh and TVFA and improved acceptability of Ras cheese and it is possible to decrease the fat content by 33% and adding 0.25% Novagel® without significant effect on Ras cheese quality.

Table (5): Effect of fat replacer on organoleptic properties scores

Cheese Treatments	Organoleptic properties																							
	Flavor (out of 50) Ripening Period Months						Body and Texture (out of 40) Ripening Period Months						Appearance (out of 10) Ripening Period Months						Total Score (100) Ripening Period Months					
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
C1	42	43	43	45	48	48	37	37	37	38	38	38	8	9	9	9	9	9	87	89	89	92	95	95
C2	38	43	43	43	44	45	35	35	36	36	36	36	9	8	9	9	9	9	82	88	88	88	89	90
C3	30	32	33	33	34	36	28	31	31	31	32	36	6	6	7	7	7	7	64	69	71	71	73	79
T1	33	36	37	38	38	38	30	30	30	31	31	34	5	5	6	6	6	6	68	71	73	75	75	78
T2	35	34	36	36	36	39	32	33	33	33	34	35	6	6	8	8	6	6	75	75	75	75	76	80
T3	42	44	44	45	48	49	37	35	35	33	35	38	8	9	9	9	7	9	87	88	88	87	90	96
T4	41	43	45	45	45	47	36	34	36	36	36	37	9	7	7	7	8	9	86	87	88	88	89	93

Table (6): Statistical analysis of low fat Ras cheese properties

Cheese Properties	Effect of treatment								Effect of ripening per. Month						
	Mean Squares	Multiple Comparisons							Mean Squares	Multiple Comparisons					
		C 1	C2	C3	T1	T2	T3	T4		0	1	2	3	4	5
Chemical properties:-															
Moisture (%)	116.747*	A	C	D	C	B	B	A	1451.57*	A	B	C	D	E	E
Acidity	0.379*	A	C	D	C	B	AB	A	0.449*	E	D	CD	BC	AB	A
Fat (%)	589.35*	A	B	C	C	C	B	B	122.079*	F	E	D	C	B	A
Salt (%)	1.681*	A	C	C	A	A	C	A	0.709*	E	D	C	B	A	A
Ash (%)	12.889*	A	C	C	A	A	C	A	2.055*	C	BC	ABC	AB	A	A
TN (%)	0.096*	C	B	A	A	A	B	B	1.422*	D	C	B	AB	AB	A
SN (%)	0.108*	A	C	D	C	B	B	A	0.996*	E	D	C	B	AB	A
Shilovitch Ripening Index	14632.9*	A	C	D	C	B	BA		38229.4*	F	E	D	C	B	A
TVFA (ml 0.1N NaOH/ 100gm)	2020.4*	A	B	D	ED	E	BC	C	4146.1*	F	E	D	C	B	A
Total Calorie	55003.9*	A	C	E	DE	D	BC	B	14047.7*	F	E	D	C	B	A
Cheese Hardness (mm)	44.385*	DE	B	A	C	D	C	CD	30.612*	A	B	C	D	DE	E
Organoleptic properties:-															
Flavor (50)	160.302*	A	B	E	D	C	A	AB	9.305*	E	D	C	B	AB	A
Body and texture (40)	93.190*	A	B	D	C	B	A	AB	6.562*	D	C	B	AB	A	A
Color and appearance (10)	17.524*	A	A	C	D	D	B	A	2.448*	C	B	AB	A	A	A
Total Score (100)	652.778*	A	B	B	D	C	A	AB	51.314*	E	D	C	B	AB	A

Significant at level 0.05. For each effect the different letters in the same row means the multiple comparisons are different from each other letter A is the highest mean followed by B.C....etc.

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تصنيع الجبن الراس منخفض الدهن باستخدام بديل الدهن

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يهدف هذا البحث إلى محاولة دراسة تأثير استبدال دهن اللبن بواسطة بديل دهن كربوهيدراتي الأصل (نوفاجيل) على خواص جبن الراس منخفض الدهن ولذلك فقد تم تصنيع سبع معاملات من جبن الراس حيث صنعت العينة الضابطة من لبن بقري يحتوي على ٣% دهن وصنعت ثلاث معاملات أخرى من لبن بقري يحتوي على ٢% دهن مع إضافة النوفاجيل بنسبة صفر، ٠,٢٥%، ٠,٥% على الترتيب أما المعاملات الثلاث الأخرى فقد صنعت من لبن يحتوي على ٣% دهن مع إضافة النوفاجيل بنسبة صفر، ٠,٥%، ١,٠% على التوالي.

وقد أوضحت النتائج المتحصل عليها بعد تحليلها ما يلي:

- أدى خفض نسبة الدهن في اللبن الذي صنعت منه الجبن إلى خفض كل من نسبة الرطوبة، ونسبة الحموضة، ونسب دلائل التسوية، ودرجات التحكيم والطاقة الكلية في حين أدت إلى زيادة نسبة النيتروجين الكلي والملح والرماد وصلابة الجبن.
- أدت إضافة النوفاجيل إلى زيادة نسب كل من الحموضة، ودلائل التسوية، والرطوبة، ودرجات التحكيم وخفض الصلابة.
- ازدادت نسب كل من النيتروجين الكلي والدهن والرماد والملح ودلائل التسوية ودرجات التحكيم بتقدم فترة التخزين في حين انخفضت نسبة الرطوبة وصلابة الخثرة.
- كانت أكثر العينات قبولاً تلك المعاملة التي صنعت من لبن بقري يحتوي على ٢% دهن مع إضافة ٠,٢٥% نوفاجيل ولم تختلف عن العينة الضابطة في حين أنها كانت مفضلة عن العينة المصنعة من نفس اللبن مع إضافة ٠,٥% حيث كانت أكثر تركيزاً ومغرولة وبذلك يمكن تصنيع جبن راس يجفف نسبة الدهن بنسبة ٣٣% مع إضافة ٠,٢٥% نوفاجيل بدون التأثير معنوياً على صلابة الجبن.

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