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QUALITY OF RICOTTA CHEESE AS AFFECTED WITH THE WAY ACIDIFICATION .

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ABSTRACT

Ricotta cheese was made from skim milk by direct acidification with, lactic, phosphoric,GDL,ABT starter and yogurt starter*(streptococcus thermophillus ,lactobacillus delbrukii subsp bulgaricus*) at pH 5.9- 5.8 at 87 -88˚c . Cheese was made by using yogurt starter had a higher yield(17.5%), compared with other acid coagulant . (16- 15.75-15%) Respectively , Cheese treated with phosphoric acid and yogurt starter had the highest total solids(31.59-31.33%), compared with other treatments (31.05, 30.02, 29.93%)while the cheese made with yoghurt starter and phosphoric acid had the highest total protein content(24.24, 24.20%) than that from in the other treatments(24.15, 23.15, 23.10%), either fresh or during storage period .In addition ,cheese made by using phosphoric acid had the highest fat content(2.25%), either fresh or during storage period, compared with other treatments (2.20-1.65-1.2-1.80 %). While cheese made using by yoghurt starter had the highest rheological properties, where hardness ,cohesiveness, springiness ,gumminess, chewiness, modules (5119(N)-0.74(ratio)- 11.42(mm)- 3793(N)- 4336.96(J)- 146.8(J) respectively, compared with other treatments, while cheese coagulated with phosphoric acid had the highest adhesiveness of 1067.26(J). cheese treat with ABT starter had the highest modulus (162.23) while the cheese made with phosphoric acid had the lowest highest rheological properties as hardness , springiness ,gumminess, chewiness and modules were 2145 -9.49-1381 -13107.21 -73.43 respectively. Cheese made with lactic acid had the lowest adhesiveness of 764.05(J) ,than the cheese treated with lactic acid which obtained the lowest cohesiveness of ratio (0.63) . Cheese made by using phosphoric acid had lower total bacteria (T.C), proteolytic bacteria count ,lipolytic bacteria counts and moulds and yeasts (M&Y). On the other hand, cheese treated with yogurt starter and phosphoric acid had higher scoring points of 86- 84.8 % either fresh or during storage, compared with the cheese treated GDL which had the lowest scoring points of 72.2 % .

Keywords;Ricotta cheese ,milk , lactic acid, phosphoric acid ,yogurt starter, GDL and ABT starter .

INTRODUCTION

Ricotta is a soft , cream-coloured , unripended cheese , with a sweet cream. The cheese which was traditionally produced in Italy and Latin-American countries such as Argentine from cheese whey of ewes' milk , now enjoys more widespread popularity , in particular, in North America , where it is produced mainly from whole or partly skimmed bovine milk , or whey / skim mixtures (Kosikowski, 1977) .Coagulation of this type of cheese was done through a direct acidification process (pH 5.9-6.0) and heating (80-85ºc), which resembles Cottage cheese curd in appearance .Fresh Ricotta is a white ,soft ,moist and unripend grainy cheese which resembles Cottage cheese curd in appearance . It is fairly bland or may have semi-sweet flavor, when made from fresh sweet or salt whey. Traditionally ,Ricotta cheese has been prepared by acidification skim milk to pH 5.9-6.0 ,adding salt and

continuing heating until the temperature reached 80 to 85˚c (Shahani,1979;Mathur and Shahani,1981and Modler,1988).

Several different precipitants for Ricotta cheese manufacture has been suggested in the literature . These include ABT starter, yogurt starter GDL, lactic acid and phosphoric .Several factors should be considered when choosing the correct precipitant, these include the availability, cost curd characteristics, yield and flavour (Weatherup ,1986 and Modlerand Emmoms,1994) . Finally, The aim of the present work in to improvw the keeping quality of Ricotta cheese by using different coagulants in it making

MATERIALS AND METHODS

*Skim milk was obtained from dairy department, Faculty of agriculture, Mansoura University.

Table (1) chemical composition of skim milk

Chemical composition of Skim milk				
TS%	**TP%**	**FAT%**	**Lactose%**	**pH**
9.38	3.47	0.45	5.0	6.57

Food grade acidulants (lactic acid ,phosphoric acid) were obtained from El-Gomhoria Chemicals Company , On the other hand ,ABT starter (thermophilic lactic culture. defined mixed strain culture containing *Lactobacillus acidophilus* LA-5, *Bifidobacterium* BB-12 and *Streptococcus thermophilus*.),yoghurt starter were obtained from Dansko Company and GDL(glucose delta lactone) .

Table(2)shows the Amount of acidulantes required to adjust the pH to 5.8 - 5.9ml of 30% sol./liter skim milk (Weatherup,1986) of lactic, and phosphoric acid required, in table (2).

Table (2): Amount of acidulantes required to adjust the pH to 5.8 -5.9.

Skim milk	**Amount of acidulant (ml of 30% sol./liter skim milk**	
	Lactic acid	**phosphoric acid**
	6.5	2.0

SOL: Solution

Table (3): Amount of acidulantes (ABT Starter, Yogurt starter and GDL)

Skim milk	**Amount of acidulant %/ liter skim milk**		
	ABT starter	**Yoghurt starter**	**GDL**
	1.5	1	2

Ricotta was made as recommended by (Scott, 1981) with some modification as follows:

1- Standardization of fresh whole milk with fluid skim milk
2- Acidifying fresh milk in all treatments to pH 5.9-6.0 by adding some types of food-grade organic acids diluted phosphoric, lactic, GDL, ABT starter and starter culture.
3- Heating the milk to 80°c with stirring to produce flakes of curd in clear whey.

4-Scooping the curd from the surface of the clear whey into perforated tinned steel containers lined with open weave cloth.
5- Dipping the filled containers in cold water in then covering with calico and putting crushed ice on the top.
6-Salt was added(0.5%),and the cheese was stored in the refrigerator (4±1^{0}C) untie required for sale or other uses.

Total solids, ash, fat, total protein, and acidity were determined according to Ling (1963) .pH value was measured using laboratory PH meter with glass electrodes pH-meter Jan way 3010 – England ,salt as determined by kosikowski(1966) .Total bacterial count were determined using the melted media (Difco1971) .Mould and yeasts counts were determined using malt extract agar medium(Pitt1979). The texture properties of cheese samples were evaluated using (Texture analyzer by CNS / FARNELLFRA, Borechamwoad, Hertfordsimre, England. Control and experimental cheese samples were taken while fresh cheeses and after 21 days of storage, then were measured immediately. Cheese sample size was 30 mm of diameter and 20 mm of high. Speed was 1 mm / s and 10 mm was the distance of penetration. Samples were allowed to stand at ambient temperature for at least 20 min prior testing. The probe used was TA15-45^{0}C perplex cone. Data were collected on computer and the texture profile parameters were calculated from LFRA texture analyzer and computer interface.
The following texture profile parameters were obtained and calculated as describe by Bourne (1978):
i) The compressive force (g) recorded at maximum compressive during in the first bite as a measure of Hardness
ii)The ratio of the positive force area under the curve during the second compression (bite) to that during the first compression (a2/a1) as a measure of cohesiveness.
iii)The height (mm) to which the sample recovered during the time that clasped between the end of the first bite the start of the second bite, as a measure of Springiness.
iV) The product of hardness X Cohesiveness (g), as a measure of gumminess.
V)The product of gumminess X springiness (g.mm), as a measure of chewiness.
Vi) The modulus (the slope of force, representative of sample rigidity.
Organoleptic properties were evaluated by whey the score system flavor (40 points), body and texture (30 points) and appearance (30 points) according to Hassan (1996).

RESULTS AND DISCUSSION

Effect of different coagulants on chemical properties of Ricotta cheese is show in table (4)

Its clear from this Table that the cheese treated with ABT starter had the highest PH value and the lowest acidity .On the other hand , the cheese

treated with GDL had the lowest PH value and the highest acidity. this might be due to the different concentration of acidulant used in making the cheese

Table(4):Effect of different coagulants on chemical properties of Ricotta cheese during storage periods

Components	Storage Period (days)	Treatments				
		ABT starter	YOGHURT starter	Lactic acid	GDL	Phosphoric acid
Acidity%	Fresh	0.20	0.22	0.23	0.26	0.24
	7	0.21	0.24	0.24	0.27	0.25
	14	0.23	0.27	0.26	0.29	0.28
	21	0.29	0.31	0.29	0.33	0.32
pH	Fresh	5.20	5.15	5.09	4.39	5.06
	7	4.95	4.94	4.96	4.33	4.99
	14	4.89	4.88	4.90	4.25	4.92
	21	4.81	4.82	4.85	4.17	4.84
TS%	Fresh	29.93	31.33	31.05	30.02	31.59
	7	30.15	31.87	31.34	30.27	31.85
	14	30.42	31.98	31.76	30.65	31.98
	21	30.61	32.21	32.01	30.98	32.15
FAT%	Fresh	1.2	1.80	2.20	1.65	2.25
	7	1.25	1.95	2.30	1.80	2.35
	14	1.50	2.00	2.45	2.00	2.55
	21	1.65	2.10	2.65	2.10	2.80
TP%	Fresh	23.10	24.24	24.15	23.15	24.20
	7	23.22	24.51	24.44	23.20	24.65
	14	23.45	24.89	24.61	23.52	24.91
	21	23.61	25.22	25.02	23.93	25.16
Ash%	Fresh	1.85	1.90	1.98	2.01	1.99
	7	1.89	1.94	2.06	2.11	2.05
	14	2.05	1.99	2.13	2.16	2.15
	21	2.13	2.07	2.21	2.25	2.24
Yield%	Fresh	15	17.5	16	15	15.75

It is obvious in Table (4) the effect of coagulants (lactic phosphoric , GDL yoghurt starter and ABT starter) on the chemical compounds of the resultant Ricotta cheese, being made from skim milk. In all treatments the total solids contents increased during storage . Also, date in the same Table indicated that the resultant cheese from lactic acid contained the highest total solids. These results were in agreement with those obtained by Zain el-dine, M. M .E. et al.,(2008). On the other hand ,the resultant cheese from ABT starter achieved the lowest total solids content.

Data presented in Table (4)also ,showed that fat content increased during storage of all treatments. It could also be observed that skim milk treated with phosphoric acid resulted in Ricotta cheese of the highest fat content . Whereas cheese treated with ABT starter had the lowest value. This might be due to the increase of the total solids content during storage periods.

It could also be noticed from the results in Table (4) that total protein content increased during storage period in all treatments depending on the content total solids conten. Also, the cheese treated with yoghurt starter contained the highest total protein content .On the other hand ,the cheese

treated with ABT starter had the lowest total protein content .These results were agreement with those obtained by Zain el-dine, M. M .E. et al.,(2008).

Result in Table (4) showed that ash content increased during the storage period in all treatments, either made with added starter or acid . Also, the cheese treated with GDL contained the highest ash content, compared with other acid coagulants.

Concerning the yield of Ricotta cheese made with different coagulants , it could be observed in Table (4) that the yield of Ricotta cheese made by direct acidification with yoghurt starter had the highest yield compared with other acid coagulants. This disagrees with those obtained by Zain el-dine, M. M .E. et al., (2008).

Table (5):Effect of different coagulants on Rheological properties of Ricotta cheese during storage periods

Rheological properties	Storage Period (days)	Treatments				
		ABT starter	Yoghurt starter	Lactic acid	GDL	Phosphoric acid
Hardness (N)	Fresh	4328	5119	4739	3179	2145
	21	3985	2000	3491	2898	1985
Adhesiveness (J)	Fresh	866.86	764.05	925.38	853.81	1067.26
	21	698.56	744.43	866.86	1143.9	9978
Cohesiveness (ratio)	Fresh	0.67	0.74	0.63	0.69	0.64
	21	0.56	0.71	0.64	0.63	0.58
Springiness (mm)	Fresh	10.65	11.42	9.72	9.88	9.49
	21	9.35	8.39	10.87	8.47	9.26
Gumminess (N)	Fresh	2895	3793	2965	2187	1381
	21	2598	1420	2238	1834	1175
Chewiness (J)	Fresh	30842.29	43336.96	28820.8	21598.9	13107.21
	21	28352.11	11921.37	24329.16	15529.43	13312.54
Modulus	Fresh	162.23	146.8	114.34	107.15	73.43
	21	142.65	76.73	122.65	89.02	71.25

The changes in texture primary parameters (hardness, adhesiveness, cohesiveness, and springiness) and texture secondary parameters (Gumminess and Chewiness) of experimental Ricotta cheeses while fresh at 1st day of manufacture and after 21 days are shown in (Table 5).

Hardness, the force required to compress a sample between the molars, is one of the important factors in determining cheese texture. At 1 day of manufacture, the cheese acidified using phosphoric acid showed lower hardness than other treatments, while the highest value of hardness was found in cheeses acidified by yogurt culture. Cheese acidified by lactic acid recorded little lower hardness than that acidified by culture, but much higher than that acidified by phosphoric acid. There were no too much different in hardness between cheese acidified by yogurt culture and ABT culture. The hardness was lower in cheese acidified by GDL ,when compared with that acidified by culture, but higher than that acidified by phosphoric acid.

The hardness of cheese acidified with phosphoric acid is lower than the cheese made with cultures and lactic acid; this is mostly related to the role of phosphoric acid in milk. Solubilization of calcium during cheese making occurs as a function of phosphoric acid added (Lucey, *et al.,* 2003) as a result, the colloidal calcium phosphate (CCP) dissociates from the casein micelle, leaving calcium and phosphate at the terminals of casein. The decrease in calcium binding to casein is attributed to a decrease in hydrophobic binding sites of submicelles, which results in weakening of the extent of binding strength between submicelles (Kimura, Sagara, Fukushima &Taneya, 1992; Lucey, *et al.,* 2003).

Hardness decreased consistently during 21 days of storage. The decrease in hardness during the 21 days of storage is related to the increase in moisture content which acts as a plasticizer in the protein matrix, thereby making it less elastic and more susceptible to fracture upon compression (Fox *et al.,* 2000).

A reduction in hardness at 21 days of storage has been noticed in all treatments . The decrease in hardness after 3 weeks of storage is due to the initial rubbery texture of cheese, which rapidly transforms into a smoother, and more soft product due to a number of factors: (1) proteolysis of casein network,; (2) increasing the protein hydration as the moisture content decreased at 21 days of storage, comparing to that at 1stday of manufacturing. The proteins in cheese are highly hydrated, and even buried water molecules in globular proteins can exchange with bulk solvent on a nanosecond to microsecond timescale and the protein matrix was absorbing the water originally located in the fat-serum channels (Denisoy et al., 1997; Donald et al., 1999; Guinee (2002) Lucey et al., 2003); and (3) solubilization of CCP in cheese as the soluble calcium increases during acidification and storage. During cheeses storage, the solubilization of CCP results in a weaker association between casein molecules, which decrease the cheese rigidity (Lucey et al., 2003).

Adhesiveness is the work required to pull cheese a way from a surface (e.g., tongue, teeth, palate) (Szczesniak *et al.,* 1963; Bourne, 1978). Evaluation of adhesiveness properties of cheeses at 1 and after 21 days of storage is shown in (Table 5). It is noticeable that the cheese acidified by phosphoric acid had higher adhesiveness values than that acidified by culture. After 21 days of storage, the adhesiveness reduced in all cheese, except the cheese acidified with GDL which recorded high level of adhesiveness after 21 days when compared with fresh one (Table 5)

Cohesiveness is the strength of internal bonds making up the body of the product (Szczesniak *et al.,* 1963; Bourne, 1978). Table(5) shows changes in cohesiveness of cheese at 1 and 21 days of storage. There is no marked difference in cohesiveness among cheeses acidified by lactic and phosphoric acids at 1st day of making , while the cohesiveness is higher in cheese acidified by Yogurt culture and GDL ,comparing to the other treatments . At 21 days of storage, the cohesiveness values of cheeses acidified with byYogurt culture and GDL decreased, as comparing with the values at 1st day of making . During storage, cheese undergoes a hydration, which reduces the structural integrity of the protein matrix. Thus cheese

becomes less cohesive and provides higher internal friction during vibration. Proteolytic activity and also cleaves peptide bonds and thus generates non-ionic groups, which increase the solvation property of protein chains in water (Chen and McMahon 1999). The inversely related correlation of storage period corresponding cohesiveness values indicating that the cheeses developed their characteristic texture during storage as a result of extensive chemical, biochemical and enzyme-induced changes which, in turn, determine the componential and compositional profile. Moreover, the moisture content increased in all cheeses after 21 days of storage, and these had marked effect in the cheese cohesiveness.

Springness is the rate at which a deformed material returns to its original shape on removal of the deforming force.(Szczesniak*et al.,* 1963; Bourne, 1978). From results in (Table 5) it can be observed that this parameter at 1stand after 21 days of storage was lower in cheeses acidified by GDL, phosphoric and lactic acids than in cheese acidified by ABT and Yogurt culture.

Adding phosphoric acid led to slight decrease in the springiness values, when compared to lactic acid. However, cheese made with Yogurt culture had slight increase in the springiness value, as compared with cheese made with ABT culture.

However, springiness reduced after 21 days of storage in samples acidified by GDL and Yogurt culture. It might be attributed to the release of calcium ions from mono-calcium and dicalciumparaK-caseinate molecules. These molecules have been reported to be responsible for the springiness of cheese curd (Kanawjia, et al., 1995).

Gumminess is the energy required to disintegrate a semisolid food for swallowing (Szczesniak et al., 1963, Bourne, 1978). In general, the trend gumminess value was comparable with hardness at 1st day of making (Table 5). The lower gumminess values were in cheeses acidified with phosphoric acid and then in that acidified by GDL.

The gumminess decreased in all treatments after 21 days of storage, comparing to that at 1stdays of stoarge.

Elasticity (Modulus) is the acts as an indication of rigidity or stiffness of the material at selected points within stress-strain curve. As can be observed from results in (Table 5), the elasticity values of Ricotta cheeses were affected by the different acidified agents. The elasticity value was lower in phosphoric-cheese at 1st day of making, comparing to ABT-cheese, using the phosphoric acid in cheese making marketely decreased the elasticity. The values for TPA-elasticity, on the 1stday of making ,were in the order:-Phosphoric>GDL>Lactic>Yogurt>Lactic>ABT cheeses. It is clear from these results in(Table 7) that the elasticity values slightly decreased after 21 days of storage comparing to that at 1stday. The breakdown of protein network during storage has been shown to be related with the decrease in cheese elasticity (Creamer and Olson, 1982; Tunick *et al.,* 1990; Hort and Le Grys, 2001).

Chewiness is the energy required to chew a solid food product to a state,where it is ready for swallowing(Szczensiak*et al.,*1963,Brwne,1978).the

chewiness in cheese trated with phosphoric acid making at 1st day of was lower than in all other treatments (Table 5).
After 21 days of storage, a sharp decrease in chewiness was observed in all treatments than that at 1st day of making . Cheese made with GDLwas much less chewy than those made with cultures. There is a correlation between cheese hardness and chewiness, harder cheese is more difficult to chew (Beal and Mittal, 2000).

The chewiness is lower in cheese treated with phosphoric acid than other treatments , this is also related to the role of phosphoric acid in milk, which increases the protein hydration and the solubilization of CCP.

Table(6):Effect of different coagulants on microbiological properties of Ricotta cheese during storage periods

microbiological properties	Storage Period (days)	Treatments				
		ABT starter	Yoghurt starter	Lactic acid	GDL	Phosphoric acid
TCx10^4 cfu/gm	Fresh	6.0	5.0	3.0	1.0	3.0
	7	13.0	9.0	12.0	3.0	8.0
	14	17.0	22.0	18.0	22.0	15.0
	21	24.0	26.0	21.0	23.0	16.0
Pr. b x10^3 cfu/gm	Fresh	2.0	9.0	11.0	3.0	1.0
	7	4.0	16.0	17.0	2.0	3.0
	14	8.0	18.0	22.0	20.0	6.0
	21	10.0	21.0	24.0	23.0	8.0
Ly. b x10^3 cfu/gm	Fresh	1.0	0.0	3.0	0.0	0.0
	7	1.0	1.0	4.0	2.0	1.0
	14	3.0	3.0	6.0	5.0	3.0
	21	5.0	6.0	8.0	6.0	4.0
M&Y x10^3 cfu/gm	Fresh	0.0	0.0	0.0	0.0	0.0
	7	3.0	2.0	3.0	0.0	1.0
	14	5.0	4.0	6.0	3.0	4.0
	21	9.0	7.0	7.0	5.0	4.0
E coli x10^3 cfu/gm	Fresh	0.0	0.0	0.0	0.0	0.0
	7	0.0	0.0	0.0	0.0	0.0
	14	0.0	0.0	0.0	0.0	0.0
	21	0.0	0.0	0.0	0.0	0.0

T.C.: total bacterial count **M &Y: moulds and yeasts**
Ly. b: lipolytic bacterial counts **Pro. b: proteolytic bacterial counts**

As with microbiological properties of Ricotta cheese made from skim milk, it could be obvious from Table (6) that the total count of bacteria , proteolytic, lipolytic bacteria , moulds and yeasts during storage period. The total bacteria count ranged from 1x10^4- 6x$10^4$when fresh .The total count of bacteria slightly increased during storage period. The ABT starter culture resulted in the highest total count of bacteria either fresh and during the storage period. On the other hand, the cheese treated with GDL had the lowest total count of bacteria in fresh of all treatments .However in during storage period the cheese treated with phosphoric acid had the lowest total count of bacteria .its clear from Table (6) that the cheese treated with phosphoric acid had the lowest proteolytic bacterial counts , compared with either acid coagulants during the storage period. It was also noticed that the lipolytic bacteria could not be found in some treatments in fresh cheese.

While ,after seven days the lipolytic bacteria were found in small numbers in all treatments. Cheese treated with phosphoric acid had the lowest lipolytic bacteria ,compared with other acid coagulants during the storage periods. Also , the results showed that moulds and yeasts were not found in all treatments in fresh cheese while ,after seven days the moulds and yeasts were found in small numbers in all treatments .cheese treated with ABT starter had the highest moulds and yeasts count . It was also noticed ,that the E coli were not found either in fresh and during the storage period.

Table (7) :Effect of different coagulants on Organoleptic properties of Ricotta cheese

properties	Storage Period (days)	Treatments				
		ABT starter	Yoghurt starter	Lactic acid	GDL	Phosphoric acid
Flavour (40)	Fresh	31.0	34.8	32.0	29.6	33.4
	7	32.0	34.3	30.7	28.4	34.7
	14	32.6	33.0	34.4	30.2	35.6
	21	31.0	33.0	33.0	31.5	33.0
Body & Texture (30)	Fresh	24.8	24.8	25.4	21.4	26.0
	7	25.3	26.0	24.0	21.0	26.6
	14	22.8	24.0	24.2	23.4	25.8
	21	26.0	25.0	23.0	22.5	26.0
Appearance (30)	Fresh	24.0	26.4	25.4	21.2	25.4
	7	25.7	25.7	23.7	22.0	27.0
	14	24.4	24.6	25.4	23.0	26.2
	21	21.0	25.5	25.0	22.0	26.0
Total (100)	Fresh	80.8	86.0	82.8	72.2	84.8
	7	83.0	86.0	78.4	71.4	88.3
	14	79.8	81.6	84.0	76.8	87.6
	21	78.0	83.5	81.0	76.0	85.0

Data presented in Table(7) showed that the flavour score was higher in case of using yoghurt starter culture ,lactic and phosphoric acid coagulants.While,ABT starter and GDL obtained the lowest score point as storage period progresses.In general,cheese made with yoghurt starter culture obtained the highest score point in fresh of all treatments The result were inagreement with those obtaind by Zain el-dine,M.M.E.*et al.,*(2008).and (Abdel-Rafee, *et al.* 1997).

While, after seven days cheese treated with phosphoric acid gained the highest scores point ,compared with other treatments. This dis agree with those obtained by Abdel-Rafee, *et al.* (1997). this might be due to different milk type.

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تاثير طرق التحميض علي جودة جبن الريكوتا

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في هذه الدراسه تم تصنيع جبن الريكوتا من اللبن الفرز بو اسطة التجبن الحراري الحمضي مع التحميض المباشر باستخدام حامض واللاكتيك الفوسفوريك و GDL وبادئABT وبادئ الزبادي لدرجة pH٥.٩ - ٥.٨ علي درجة حرارة ٨٧-٨٨ °م وتم تحليل الجبن الناتج وكانت النتائج كالتالي .الجبن الناتج من التحميض بواسطة بادئ الزبادي أعطي أعلي نسبة تصافي وكانت حوالي (١٧,٥ %) بالمقارنه مع الأحماض الاخري(١٦ -١٥,٧٥ - ١٥%) علي التوالي .بينما حصل الجبن الناتج من التحميض بواسطة حمض الفوسفورك وكذلك بادئ الزبادي علي اعلي نسبة للمواد الصلبه الكليه وكانت (٣١,٥٩ – ٣١,٣٣ %) مقارنة بالعينات الاخري (٣١,٠٥ – ٣١,٠٢ – ٢٩,٩٣ %) والبروتين (٢٤,٢٠ – ٢٤,٢٤ %) مقارنة بالعينات الاخري حيث كانت (٢٤,١٥- ٢٣,١٥– ٢٣,١٠ %) , كذلك حصل الجبن الناتج من التحميض بواسطة الفوسفوريك علي اعلي نسبة دهن وكانت (٢,٢٥ %) مقارنة بالعينات الاخري (٢,٢٠- ١,٦٥ -١,٨٠ – ١,٢٠ %) . بينما بالنسبة للخواص الريولوجية حصل الجبن الناتج من التحميض بواسطة بادئ الزبادي حصل علي اعلي درجات للصلابة و التماسك والمرونة واللزوجة ومعدل المضغ (٥١١٩ -٠,٧٤ -١١,٤٢-٣٧٩٣ – ٤٣٣٣٦,٩٦) بينما حصل الجبن الناتج بو سطة التجبن بحمض الفوسفوريك علي اعلي الدرجات للالتصاق (١٠٦٧,٢٦) . والجبن الناتج بواسطة التجبن ببادئ ABT علي اعلي درجات للمعامل (١٦٢,٢٣) بينما حصل الجبن الناتج بواسطة التحميض بالفوسفوريك علي اقل الدرجات للصلابة والمرونه واللزوجة ومعدل المضغ والمعامل (٢١٤٥- ٩,٤٩- ١٣٨١ -١٣١٠٧,٢١ -٧٣,٤٣) وكذلك حصل الجبن الناتج بواسطة التحميض بحمض اللاكتيك علي اقل درجات للتماسك (٠,٦٣) . كذلك حصل الجبن الناتج من التجبن بواسطة الفوسفوريك علي اقل محتوي من العد الكي للبكتريا والبكتريا المحلله للبروتين والبكتريا المحلله و اقل عدد للفطريا والخمائر . بينما حصل الجبن الناتج من التحميض بواسطة الفوسفوريك ثم بادئ الزبادئ علي أعلي درجات للتحكيم الحسي وكانت (٨٦ – ٨٤,٨ %) بينما حصل الجبن الناتج بواسطة التجبن ب GDL علي اقل درجات للتقييم الحسي (٧٢,٢ %). مما يدلل علي ان الجبن الناتج بواسطة التجبن ببادئ الزبادي وحمض الفوسفوريك علي اعلي الدرجات سواء للتقييم الحسي والتصافي والريولوجي ,

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