Minufiya J. Agric. Res. Vol. 28 No. 1: 155 - 168 (2003)

INFLUENCE OF HEAT TREATED STARTER CULTURE ON THE QUALITY OF EDAM CHEESE MADE FROM RECONSTITUTED WHOLE MILK POWDER

A.A. Al-Tanboly, A.A. Awad and Y.B. Youssef
Dairy Technology Department, National Research Centre, Dokki, Cairo Egypt.

(Received : Dec., 19 , 2002)

ABSTRACT: *The main objective of this study was to improve the yield and quality of Edam cheese by application of reconstituted whole milk powder (WMP) and heat treated mesophilic starter culture as an adjunct to lactic starter. Edam cheese Ta , Tb and Tc (control) was made by the traditional method from whole milk powder (WMP). Physicochemical properties were determined during manufacture and ripening. During ripening moisture, fat on dry matter basis, protein and lactose decreased, while pH and fractions of nitrogen {(total nitrogen (TN), soluble nitrogen (SN),* non protein nitrogen *(TCA-SN) and* peptide-N and amino acid N *(PTA-SN)} increased. Protein degradation, the amount of SN in cheese Ta and Tb from the beginning until the end of ripening were larger than in control cheese Tc. On the other hand, TCA-SN content did not differ among the three cheeses when fresh and increased slowly during ripening. The PTA-SN of cheese were increased progressively during ripening. Organoleptic evaluations showed that cheese Ta* gained *the highest score 17.8 points followed by cheese Tb 17.6 points whereas cheese Tc obtained the smallest score 15.4 points.*

Key words: *Edam cheese, cheese proteolysis, whole milk powder, heat treated mesophilic starter culture, sensory evaluation.*

INTRODUCTION

It is a well known fact that the annual production of milk in Egypt is very low. It amounts to almost 3.2 million tons / year. increasing. Meanwhile the population increase imposes a serious problem in Egypt where it is now reaching almost 70 million inhabitants by the end of the year 2002. The rate of the annual population increase is about 3.7% by year. The low level of milk production can be attributed to several factors i.e. the comparatively a low number of milking animals. They include 5 million buffaloes and 2.5 million cows. About 65% of milk is obtained from buffaloes while 34% come from of cows whereas goats and ewes milk accounts for only 1% of milk production which is of a minor industrial value. Also, the hot climate of Egypt, around 35°C, predominates during six months of the year (May-October) and inadequate refrigeration facilities represent negative impact on the development of the dairy industry in Egypt (El-Koussy, 1988). The manufacture of cheese from recombined milk is now a well established

technology (Gilles and Lawrence, 1981). Worldwide demand for milk products is increasing but in developing countries raw milk supplies are frequently unable to meet the need of the consumer demand. Also dairy products made from recombined milk are particularly important in these countries. Fermented milk products such as yogurt and fresh cheeses can readily be manufactured from recombined milk, but its difficult to produce hard and semi-hard cheeses. Several attempts have been made to modify the cheese processing steps for successful use of whole milk powder (Sharker *et al.*, 1988), milk concentrated by ultra-filtration (El-Shibiny *et al.* 1991, Renner and Abd El-Salam 1991, Sutherland and Jameson 1981). Edam cheese is one of the Dutch cheese varieties that has gained popularity in Egypt . Edam cheese has a spherical shape, semi-hard to hard consistency and smooth texture with small holes (Walstra *et al.*, 1993). Pahkala *et al.*, (1985) made Edam cheese from pasteurized milk concentrated by ultrafiltration to different levels of solids. They found that Edam of best sensory characteristics was obtained from two folds concentrated milk, and milk retentates of higher solids gave cheese of inferior quality. Adding heat treated whole cell of lactic acid bacteria to cheesemilk for enhancement of flavor development in cheese has been reported previously (Petterson and Sjostrom 1975; El-Soda *et al.*, 1988; El-Tanboly 1991; Ramasamy and Narasimhan Khan,1997 and Hassan 2000). The aim of the present work was to study the effect of heat treated whole biomass cells of mixed mesophilic strains as an adjunct to lactic starter on biochemical, sensory characteristics and quality in Edam cheese manufactured from reconstituted whole milk powder (WMP).

MATERIALS AND METHODS

Imported spray dried WMP from Olsztyn, Poland was used. The milk was standardized to 3.2% fat. Calf rennet (HA-LA) powder was obtained from Chr. Hansen's Laboratorium, Copenhagen, Denmark A/S. Calcium chloride was obtained from Merck, Darmstadt, Germany. Mixed strains of mesophilic lactic starter bacteria 022, composed of *Lactococcus lactis subsp.Lactis 1200, Lactococcus lactis biovar diacetylactis 249, Lactococcus lactis subsp. cremoris 024, and Leuconostoc mesenteroides subsp. cremoris N9*) were obtained from the production laboratory of Dairy Biopreparation in Olsztyn, Poland.

Culture preparation

The mixed cultures were inoculated at 2% level into sterile 11.5% reconstituted non-fat dry milk (NFDM). It was subcultured at least twice for 18 h at 23°C before treatment. Biomass cells were heat treated by adding 1.8 kg of mesophilic culture to about 18 kg whole milk at 60 or 70°C. After 18 sec, 77 kg of milk at 9°C was added which rapidly cooled the heated milk to about 37°C. Milk for control cheese was prepared in the same manner

including the addition of 1.8 kg of uncultured 11.5% NFDM (Bartels *et al.*, 1987).

Cheese manufacture

Edam cheese were manufactured as described by El-Tanboly (1991) from three trials Ta and Tb and Tc (control) of reconstituted WMP with heat treated mixed mesophilic bacteria as an adjunct to lactic starter (The powder reconstituted to 20% total solids in preheated water then cooled to 40°C). After heat treat, a lactic starter culture was added at the rate of 2% to the milk. The milk was ripened for 1 h at 31°C. Calf rennet (HA-LA) powder (3 g per 100kg) was added and the curd was cut after 30 min. The curd was stirred for 30 min and one-half of the whey was drained. Water at 52°C, equal to 20% of the original milk volume, was added to raise the temperature of the curd to 38°C. The curd was held at this temperature for 35 to 45 min and fused into a block under the whey. After the whey was drained, the curd was pressed overnight and brined for 2 days to obtain a salt content of approximately 1.7%. The cheese was allowed to develop a light rind and was then vacuum-packed in polyethylene bags and stored at 13°C and 80-90% relative humidity for 10 weeks.

Cheese composition

Samples of milk, whey and Edam cheese were taken during manufacturing and ripening. pH was measured by pH-meter 646 with glass electrodes (Ingold, Knick, Germany). Titratable acidity (°SH) was done with Soxhlet Hankel method as described by Scott (1981). Moisture, fat and lactose contents were estimated using standard methods as described by Petterson and Sjostrom (1975). Salt, Calcium and Phosphorus contents were determined according to method of Budslawki and Drabent (1972).

Proteolysis measurement

Proteolysis in cheese was measured after 24 h, 6 and 10 weeks of ripening period by determination of N contents using the Kjeldahl method as described by Ardo and Pettersson (1994). Total N (TN) was determined in a 0.1 M–trisodium citrate extract. Soluble-N (SN) was determined by precipitation at the isoelectric pH (4.6) for casein. To one part of the filtrate obtained an equal volume of water and 10% tricholoroacetic acid (TCA) were added to determine Non protein nitrogen (TCA-SN). The difference between TN and SN is referred to as the casein fraction . To another diluted part of the SN filtrate was added 2.5% phosphotungstic acid (PTA) and 8.75% sulphuric acid for determination of peptide–N and amino acid N (PTA–SN).

Sensory evaluation

The cheeses were evaluated organoleptically by a team of experienced cheese graders. The cheeses were graded for appearance (5 points), body

and texture (holes, color and consistency) (5 points), aroma (3 points) and taste (8 points).

RESULTS AND DISCUSSION

The process of cheese making techniques

Table 1 shows the main features of cheese making technique process from three trials Ta, Tb and Tc. Viable cell counts of the mesophilic lactic starter bacteria were estimated following growth in NFDM medium and after heating. In trials Ta and Tb 92 % and 94 % of the cells were killed respectively due to heating (as calculated from starter before and after heat treatment). It could be concluded that Increased total solids in the reconstituted WMP, increased the fat and protein content, and consequently increased the acidity. Titratable acidity (°SH) value ranged from 14.49 to 14.94, and that attributed to the higher total solids. The pH value was between 6.28 and 6.40. Titratable acidity (°SH) of whey derived from Tc cheese was higher than that in whey came from Ta and Tb cheeses. This can be due to the more loss of protein and fat in whey during cheese processing (Omar 1977). The fat and protein content in reconstituted milk was high, this gave the expectation that the cheese yield would be increased. Experimental cheese Ta showed the highest yield (20.01%) and that yield was over those for Tb and Tc by 1.3 and 2.44%, respectively. Loss in yield may be due to violent agitation of the curd particles in whey. Differences in clotting time, non protein nitrogen (NPN) in milk and whey, total nitrogen recovery (TN) and cheese yield for the three cheese trials were found to be significant ($p \leq 0.01$). Analysis of variance revealed that dependency of cheese yield as a function of milk and whey compounds was highly significant ($p \leq 0.01$). It was shown by the results of cheese yield that cheese Ta had larger yield than that of Tb and Tc. It is obvious that the highest moisture content in cheese Tc, (49.6%) paralleled to the lowest yield (17.57). Furthermore, cheeses Ta and Tb had moisture content of 46.67% and 45.97%, respectively at the beginning of ripening period (Table 2). This result is in agreement with those reported by Mostafa (1999); El-Shibiny (1991) and El-Tanboly *et al.*, (2000). The loss of moisture was noticed during ripening period due to the whey expulsion.

Cheese composition

The composition of the Edam cheese was almost identical between the control and experimental vats within a single heat treated trials (Table 2). The composition was similar between trials with an average moisture content of 45.58%, fat of 23.39% and pH values at 6 weeks. It should be noted from the same table that cheese Ta contained higher protein and fat content than those for cheese Tb and TC. At the end of 10 weeks ripening, the protein contents was 24.93, 23.75 and 23.32 % and fat content was 24.71, 23.14 and 20.87 % in cheese Ta, Tb and TC, respectively. Calcium and phosphorus content were at the same ratios in the three cheeses. These results of gross

Table 1 : Main features of the Edam cheese making technique

	Trials*	Symbol	Ta	Tb	Tc
1	Reconstituted milk				
	Weight	kg	50	50	50
	Pasteurization	°C, sec	72, 20	72, 20	72, 20
	Acidity	pH	6.28	6.40	6.31
	Titratable acidity	°SH	14.94	14.49	14.92
	Fat	%	5.79	5.30	5.44
	Total N	%	0.967	0.882	0.999
	Non protein N	%	0.042	0.049	0.069
2	Additives				
	C_aCl_2	%	0.02	0.02	0.02
	$KN0_3$	%	0.015	0.015	0.015
	Starter before heatig	**cfu/ml	$2.5X10^9$	$2.5X1^9$	$2.5X10^9$
		kg	0.9	0.9	0.9
	Starter after heating	**cfu/ml	$2.0X10^8$	$1.5X10^8$	----
		kg	0.9	0.9	----
	Rennet	g/50 kg milk	1.5	1.5	1.5
3	Clotting				
	Temperature / Time	°C/min	33 / 40	33/ 40	33 / 40
4	Scalding				
	Volume	l	10	10	10
	Temperature / Time	°C/min	40 / 30	40 / 30	40 / 30
5	Whey				
	Titratable acidity after cutting	°SH	8.98	9.14	9.63
	Titratable acidity after washing	°SH	5.86	6.94	6.49
	Acidity after washing	pH	5.54	5.34	5.27
	Fat	%	0.42	0.49	0.67
	Total N	%	0.118	0.120	0.230
	Non protein N	%	0.049	0.052	0.080
6	Recovery				
	Total N	%	87.80	86.11	84.95
	Non protein N	%	92.76	91.67	88.58
	Fat	%	92.40	90.92	87.60
7	Cheese yield	kg /100 kg	20.01	18.71	17.57

*Trials Ta : cheese made from reconstituted milk + heat treated starter at 60°C /18 sec., Tb : cheese made from reconstituted milk + heat treated starter at 70°C /18 sec., Tc : control cheese. **cfu/ml :Colony forming units.

Table 2: Physicochemical composition of Edam cheese made from whole milk powder and heat treated mesophilic starter culture during ripening.

Composition (%)	Trials*	Ripening period (week) 0	6	10
Fat	Ta	24.43	24.29	24.71
	Tb	23.81	23.53	23.14
	Tc	24.61	23.98	20.87
Protein	Ta	25.58	25.07	24.93
	Tb	24.75	24.27	23.75
	Tc	24.61	23.98	23.32
Moisture	Ta	46.67	44.17	43.03
	Tb	45.97	43.79	43.10
	Tc	49.6	48.79	47.89
Salt	Ta	ND	ND****	2.79
	Tb	ND	ND	2.87
	Tc	ND	ND	3.01
Lactose	Ta	0.39	ND	ND
	Tb	0.37	ND	ND
	Tc	0.24	ND	ND
Calcium	Ta	ND	ND	1.07
	Tb	ND	ND	1.01
	Tc	ND	ND	1.04
Phosphorus	Ta	ND	ND	0.77
	Tb	ND	ND	0.71
	Tc	ND	ND	0.73
FDM**	Ta	45.75	43.52	43.36
	Tb	44.07	41.86	40.67
	Tc	42.14	40.81	40.05
S/M***	Ta	ND	ND	6.48
	Tb	ND	ND	6.66
	Tc	ND	ND	6.29
pH	Ta	5.12	5.34	5.56
	Tb	5.12	5.34	5.50
	Tc	5.18	5.37	5.50

*Trials Ta : cheese made from reconstituted milk + heat treated starter at 60°C /18 sec., Tb : cheese made from reconstituted milk + heat treated starter at 70°C /18 sec., Tc : control cheese
FDM** :fat in dry matter S/M*** : salt in moisture
ND**** : Not Determined

chemical composition of Edam cheese exhibited nearly the same trend as previously reported (El–Hofi and Ismail1998-2000, El-Sheikh *et al.*, 1999 and Omar 1977).

Protein degradation

The amount of pH 4.6-soluble N (SN) in cheese Ta and Tb at the beginning of ripening was larger than in cheese TC , while the amount of pH 4.6-Insoluble N (ISN) runs on parallel lines with the amount of SN (Table 3). Changes of SN and ISN during ripening are shown in Fig. 1. At the end of 10 weeks , the highest SN and the lowest ISN content were recorded for the cheese Ta, where the obtained values were 25.15 , 23.56 and 21.60% for SN and 74.85, 76.44 and 78.40% of ISN for cheese Ta, Tb and TC, respectively. From the results obtained above, it can be seen that the SN percentage in Edam cheese accounts for about or less than 25% of TN (Omar 1977). These results indicate that the release of SN in cheese made from dry milk takes place at a slower rate than that in cheese made from fresh milk. Czuiak and Hammond (1974) gave similar results. They reported that cheese manufactured from reconstituted milk, ripened more slowly than that made from natural milk .

The data show in Fig.1 and Table 3 indicate that there was no considerable differences TCA-SN content between the three cheese trials when fresh and before ripening period. The amount of TCA-SN increased slowly during the cheese ripening to be 10.36, 10.71, 12.9% of TN and 41.23, 45.9, 56.65% of SN in cheese Ta, Tb and TC, respectively at the end of 10 weeks ripening period. Similar results were reported on Edam cheese ripening (El-Tanboly, 1991; Mostafa, 1999 and Hassan, 2000).

Fresh cheese Tb had higher peptide–N content than those of Ta and TC. These differences from cheese Tb may be due to the level of TN at the beginning ripening (Table 3.). At the end of 10 weeks ripening, the peptide–N content increased in cheese Ta, being 4.62% of TN and 18.28% of SN. This content of peptide–N was higher than that in cheese Tb and TC which had values of 3.58% and 3.46% for TN, 15.3 and 16.39% for SN, respectively.

The amounts of amino acid N (PTA–SN) of cheese was increased progressively during ripening (Table 3). After 10 weeks ripening AAN contents were 8.75, 6.54, 6.97% of TN, 34.95, 28.25, 32.65% of SN in cheese in cheese Ta, Tb and TC, respectively. Similar results were reported by Bartels *et al.*, (1987), Ardo and Pettersson (1994) and Ramasamy and Narasimhan Khan (1997).

The increase of peptide–N and AAN content observed in this study runs on parallel line with the soluble content during ripening and that agreed with that reported for traditional Edam cheese.

Sensory evaluation

No significant differences ($p \leq 0.01$) were found between the cheese trials in appearance (Table 4). The cheese had rectangular size covered with

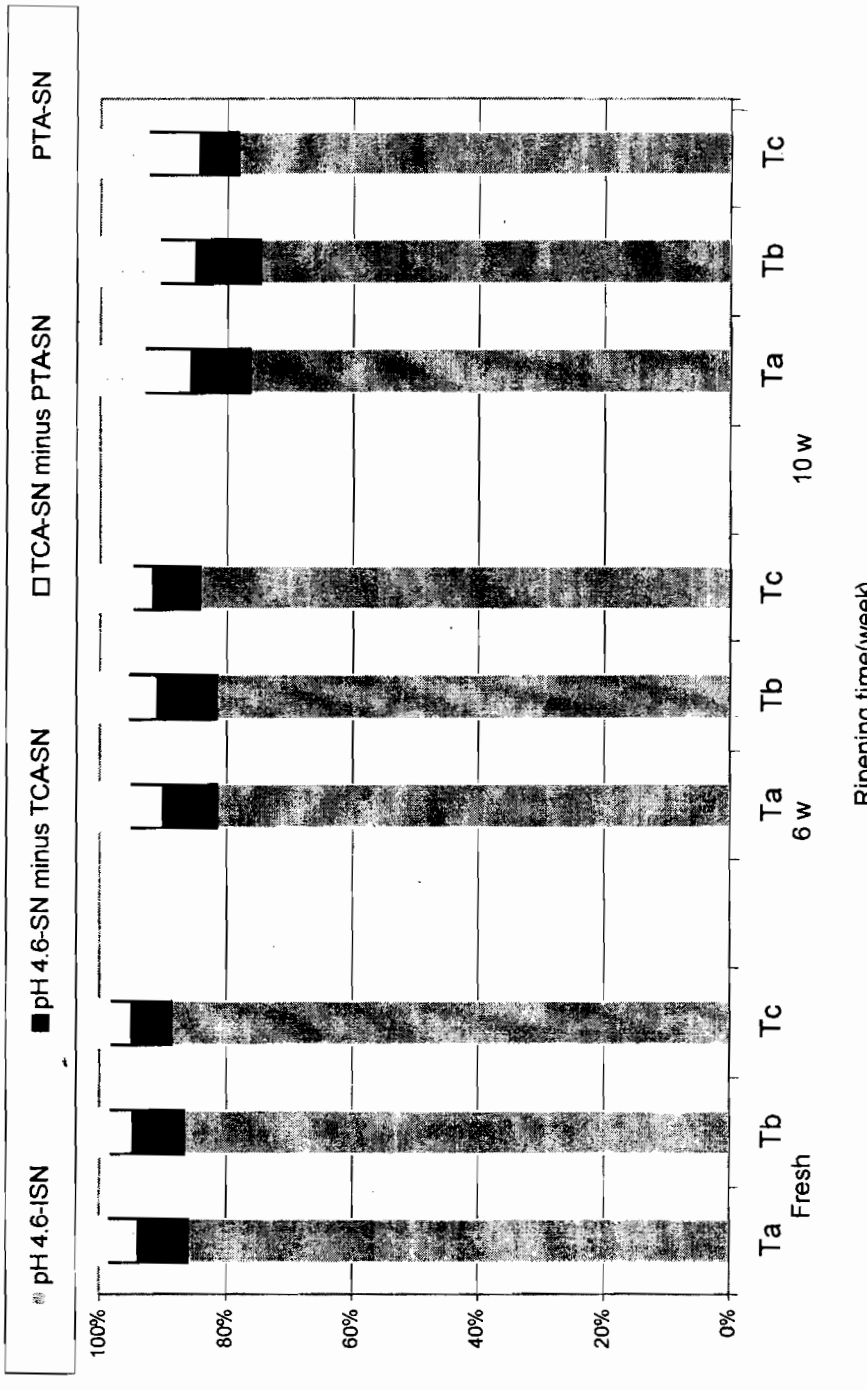

Fig.1: Protein breakdown in Edam cheese made from the whole milk powder and heat treated mesoph

Table 3:Change in total nitrogen (TN) , pH 4.6 soluble nitrogen SN (pH 4.6 -SN) ,trichloroactic acid soluble nitrogen (TCA), peptide - SN and phosphotungstic acid soluble nitrogen (PTA-SN) of Edam cheese made from whole milk powder and heat treated mesophilic starter culture during ripening.

Trials	Ripening Period (week)	% TN	pH 4.6 -SN as % TN	TCA - SN		Peptide - SN		PTA - SN	
				as % TN	as % SN	as % TN	as % SN	as % TN	as % SN
Ta	0	4.23	13.95	5.16	36.63	0.93	7.09	0.84	6.78
	6	4.26	18.45	7.73	41.42	2.16	11.74	4.29	23.42
	10	4.36	25.15	10.36	41.23	4.62	18.28	8.75	34.95
Tb	0	4.05	13.34	4.07	30.79	1.23	9.57	1.13	8.89
	6	4.08	18.37	6.66	36.58	2.33	13.18	3.94	22.04
	10	4.17	23.56	10.71	45.9	3.58	15.3	6.54	28.25
Tc	0	4.02	11.36	4.03	35.37	1.03	9.22	1.25	11.51
	6	4.04	15.91	6.89	44.18	1.68	10.61	4.57	29.5
	10	4.14	21.6	12.09	56.65	3.46	16.39	6.97	32.65

*Trials Ta : cheese made from reconstituted milk + heat treated starter at 60° C /18 sec., Tb : cheese made from reconstituted milk + heat treated starter at 70° C /18 sec., Tc : control cheese

Table 4 : Organoleptic evaluation of Edam cheese made from whole milk powder and heat treated mesophilic starter culture after 10 weeks ripening period

Sample cheese No.		Appearance			Body and texture				Flavour		Total
		Max. points 5			Max. points 5		Max. points 3		Max. points 8		Score 21
			Score	Holes	Colour	Consistency	Score	Aroma	Score	Taste	Score	
	1		5			Normal,elastic	4.5	Typical	3	Delicate,pure	8	20.5
	2		5			Open,soft	4.3	Pure	3	Piquant	4.5	16.8
	3		5	A few		Firm,gassy	4.6	Acidulate	2.7	Acid,piquant	6	18.3
Ta	4		5	uniformly	Natural,	Normal,corky	3.9	Not pure	2.5	Flat	3.5	14.9
	5		5	eyes	uniform	Mealy,open	4.5	Piquant	2.6	Bitter	4	16.1
	6		5			Firm,open	3.9	Typical	3	Delicate,pure	8	19.9
	7		5			Gassy,curdy	4.4	Acidulate	2.8	Acid,piquant	6	18.2
	*X-	Rectangular	**5**				**4.3**		**2.8**		**5.7**	**17.8**
	1	blocked	5			Firm,pasty	4.1	Piquant	2.4	Bitter	4	15.5
	2	shape ,	5			Normal,open	4.5	Pure	3	Delicate	7	19.5
	3	smoothness	5	A few		Brittle	3.1	Not pure	2.4	Bitter	4	14.5
Tb	4	surface covered	5	distributed	Natural,	Britte	3.2	Acidulate	2.6	Acid	5	15.8
	5	with paraffin	5	eyes	uniform	Normal,pasty	4.4	Acidulate	2.5	Piquant	6.5	18.4
	6		5			Firm,open	3.5	Typical	3	Delicate,pure	8	19.5
	7		5			Normal,gassy	3.8	Typical	3	Delicate,pure	8	19.8
	*X-		**5**				**3.8**		**2.7**		**6.1**	**17.6**
	1		5			Slitty	3.3	Not pure	2.3	Salty	3	13.6
	2		5			Firm, pasty	4.1	Pure	3	Delicate	7	19.1
Tc	3		5	A few		Natural	4.5	Piquant	2.4	Salty	3	14.9
	4		5	distributed	Natural,	Weak, curdy	3.1	Acidulate	2.6	Bitter	4	14.7
	5		5	eyes	uniform	Mealy, short	3.1	Acidulate	2.6	Piquant	6.5	17.2
	6		5			Brittle	2.9	Not pure	2.3	Bitter	4	14.2
	7		5			Britte	2.8	Not pure	2.3	Bitter	4	14.1
	*X-		**5**				**3.4**		**2.5**		**4.5**	**15.4**

*Trials Ta : cheese made from reconstituted milk + heat treated starter at 60°C /18 sec., Tb : cheese made from reconstituted milk + heat treated starter at 70°C /18 sec., Tc : control cheese

*X- : Average of appearance, consistency, aroma, taste and total score.

smooth surface of blistered paraffin, therefore, all cheeses were 5 points. In addition , the color was uniform yellow and a few round or oval eyes were uniformly distributed within the cheese matrix. An elastic consistency was noted more in cheese Ta and some of cheese Tb while brittle consistency was observed in cheese Tc. However, the internal evaluation of body and texture awarded 4.3 points in cheese Ta , 3.8 points in cheese Tb and 3.4 in cheese Tc (Table 4). The mean score for flavor (aroma and taste), in cheese Ta and Tb was nearly typical as in Edam cheese, delicate and pure. Some samples had piquant or bitter taste and both cheeses Ta and Tb awarded 8.8 points for flavor, while 7 points were scored for cheese Tc due to the salty and bitterness taste and without of pure aroma. It is of interest that all cheeses did not gain the maximum scores (21 points). Cheese Ta obtained the higher points 17.8 whereas cheese Tc obtained the smaller points 15.4 and cheese Tb 17.6 points. The slightly difference in the pH, peptide-N and AAN contents in cheese Ta may be the important factors responsible for the increasing of the scores of organoleptic evaluations.

An attention must be drawn to the fact that no difference in flavor was found between cheese Ta and Tb. Thus, the flavor of the cheese made from whole dry milk can be attributed to a complex chemical factors occur during milk and cheese processing. These results also had the same trend as those reported by Czuiak and Hammond (1974) and El-Tanboly *et al.*, (2000) .

It was evident from the results a satisfactory Edam cheese can be manufactured from reconstituted WMP and heat treated mesophilic starter culture to improve sensory characteristics in Edam cheese.

REFERENCES

Ardo, Y. and H. E. Pettersson (1994). Accelerated cheese ripening with heat treated cells of *Lb. helveticus* and a commercial proteolytic enzyme. J.Dairy Res., 55: 239 - 245.

Bartels, H. J.; Johnson, M. E. and N. F. Olson (1987). Accelerated ripening of Gouda cheese.1: Effect of freeze-shocked *Lb. helveticus* on proteolysis and flavour development. Milchwissenschaft., 42: 139 - 144.

Budslawki, J. and Z. Drabent (1972). Metody analizy zywnosci. WNT, Waszawa.

Czuiak, J. and L. A.Hammond (1974). Manufacture of cheese from recombined milk. XIX International Dairy Congress IE, 781-782.

El-Koussy, L. (1988). Traditional Domiati cheese processing. The International Dairy Federation, Alexandria, Egypt, 12-16 November : 227-239.

El-Hofi, M. A. and A. A. Ismail (1998-2000). Utilization of purified and characterized lipase from Papaya *(Carica papaya)* in acceleration of Ras cheese slurry. Egyptian J. Food Sci., 26-28: 61-72.

El-Sheikh, M. M.; A. F. Farrag; A. F. Al-Khamy and S. El- Shibiny (1999). Edam cheese from low whey proteins milk retentate. Egyptian J. Dairy Sci., 27 :317-329.

El-Shibiny, S.; G. A. Mrharn; H.F. Heggag; M.B. Mahfouz and M. M. El-Sheikh (1991). Accelerating ripening of UF Ras cheese. Egyptian J. Dairy Sci.,19 :25 -35.

El-Soda, M., N., Ezzat; A. Salam; and A. Khamis (1988) Accelerated ripening of cheese made from recombined milk. The International Dairy Federation, Alexandria, Egypt, 12-16 November 290-297.

E l-Tanboly, E. E. (1991). Study on accelerated ripening of Edam cheese made from modified mesophilic lactic acid stardar. Ph.D.Thesis, Faculty of Food Technology, Olsztyn Univ., Poland.

El-Tanboly, E.E.; M. A. El-Hofi and A. A. Ismail (2000). Changes of proteolytic and lipolytic activities during ripening of Gouda cheese prepared with fungal rennet substitute.Milchwissenschaf 55 : 624 -628.

Gilles, J. and R. C. Lawrence (1981). The manufacture of cheese and other fermented products from recombined milk . New Zealand J. of Dairy Sci.& Technology, 16: 1-12.

Hassan, F. A. M. (2000) Effect of mixed coccus to rod starter ratio on Mozzarella cheese quality. Egyptian J. Dairy Sci., 28: 219-229.

Mostafa, M. B. M. (1999). Quality and ripening of Gouda cheese made from goat's milk as affected by certain feeding ratlons. Egyptian J.Dairy Sci. 27: 179-190.

Omar, M. M. (1977). Study on prcduction of whole dry milk powder. Ph.D. Thesis , Faculty of Food Technology, Olsztyn Univ., Poland.

Ramasamy, D. and M. M. D. Narasimhan Khan (1997) Effect of commercial modified starters on accelerated ripening of Chadder cheese. Egyptian J.Dairy Sci. 25:149-156.

Renner, E. and M. H. Abd El-Salam (1991). Application of ultrafiltration in the Dairy Industry .El-Sevier applied Science,London and New York.

Pahkala, E.; M. Turonen and V. Antila (1985). Ultrafiltration in the manufacture of Edam cheese Meijerttieteeinen Aikakouskirja XLIII,n,1,p 47.

Petterson, H. E. and G. Sjostrom (1975). Accelerating ripening cheese: a method for increasing of lactic starter bacterla in cheese without determinal effect to the cheese making process and its effect on the cheese ripening. J.Daity Sci., 42: 313 - 323.

Scott, R.(1981) Cheesemaking Practice. 1st edn. London : Applied Science Publishers.

Sharker, R. R.; J. Lelievre.; F.P. Dunlop and J. Gilles (1988). A Review of the manufacture of cheese from recombined milk. The In[cfternational Dairy Federation, Alexandria, Egypt, 12-16 November 334-341.

Sutherland, B. J. and G. W. Jameson (1981). Composition of hard cheese manufacture by ultrafilration. Aust. J. Dairy Technol., 36: 136 -146.

Walstra, P.; A. Noomen and T. J. GEURIS (1993). Dutch type varieties. In P.F.Fox (Ed) . Cheese : Chemistry, Microbiology and Physics. Chapman & Hall , London. 2: 39 - 51.

تأثير بادئ البكتيريا المعاملة بالصدمة الحرارية على جودة الجبن الإيدام المصنعة من لبن مسترجع كامل الدسم

السيد الطنبولى وأحمد عوض ويوسف بحر
المركز القومى للبحوث - قسم الألبان- الدقى - القاهرة

الملخص العربى

تهدف الدراسة إلى بيان تأثير صناعة الجبن الإيدام من لبن مسترجع مجفف كامل الدسم والمدعم ببادئ بكتريا حمض اللاكتيك - الميزوفيلك - المعدل فيزيقياً كعامل مساعد بالإضافة إلى بادئ الجبن على الخواص البيوكيميائية والحسية وذلك لتحسين جودة الجبن الناتج وسد الفجوة فى إنتاج الألبان المخصصة لتصنيع الجبن . تم تصنيع ثلاث معاملات من الجبن إيدام من لبن مسترجع كامل الدسم . المعاملة الأولى : جبن مدعم ببكتريا حمض اللاكتيك الميزوفيلك المعدلة حرارياً على ٦٠م°/ ١٨ث والمعاملة الثانية: جبن مدعم ببكتريا حمض اللاكتيك الميزوفيلك المعدلة حرارياً على ٧٠م°/ ١٨ث والمعاملة الثالثة : جبن غير معامل(كنترول)

أجريت بعض التحاليل البيوكيميائية لدراسة التركيب الكيميائي للجبن وكذلك تتبع التحلل الكربوهيدراتي و التحلل البروتيني في الجبن الطازج وكذلك بعد ٦-١٠اسابيع من التسوية وتم تحكيم حسي على الجبن خلال فترة التسوية ثم مقارنة النتائج بعينة الجبن (الكنترول)

أوضحت النتائج زيادة معدلات التسوية للجبن المصنع من اللبن المسترجع كامل الدسم والمعامل بإضافة بادئ ببكتريا حمض اللاكتيك الميزوفيلك و المعدلة حرارياً على ٦٠م° و٧٠م°/ ١٨ث وكذلك وجد زيادة ملحوظة في نسبة النيتروجين الذائب والنيتروجين الغير بروتيني والنيتروجين البيبتيدي والأميني في نهاية فترة التسوية مما يدل علي أن المعاملة الحرارية للبادئ المستخدم كان له أثر واضح لتحلل البروتين للجبن المعامل بالإضافة إلى زيادة النكهة عند استخدام الخواص الحسية في التقييم. وقد وجد أيضا أثناء مراحل التسوية أن هناك تشابها في تركيب الجبن المعامل بالجبن المصنع بالطريقة التقليدية من حيث نسبة الدهن والبروتين والرطوبة والملح واللاكتوز والكالسيوم والفوسفور.