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EFFECT OF SALTING METHOD ON THE QUALITY OF MUENSTER - TYPE CHEESE.

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ABSTRACT

To compare between the effect of brining or dry salting method on the quality of Muenster type cheese, cow, buffalo and goat milks were individually processed into Muenster type cheese. Each groups of cheese divided into two portions, first was brined for 24 hours in saturated brine solution, while the other portion was salted by sprinkling the dry salt on both surface of the cheese for four days. Cheese was sorted for 60 days at 18° C. Samples were chemically and organoleptically analyzed. Obtained results showed that moisture content and yield were higher in dry salting cheese, while brined salted cheese had higher TS, salt, ash, protein, fat, SN, NPN and TVFA Content Organoleptic evaluation was of higher scoring points for dry salted cheese than brined cheese. Always cows milk cheese gained the highest scoring points, while goat milk cheese gained the lowest scoring points.

Keywords: Muenster cheese, brine and dry salting)

INTRODUCTION

Muenster cheese is a famous French type of cheese ripened by using starter and through the surface ripening by yeasts and moulds. This type of cheese is normally processed from cow,s milk, and salted in brining solution for 24 hours.

Salting is an important step in cheese manufacture. There are 3 different salting methods that are commonly used. Dry salt can be mixed in with the curd prior to pressing (i.e. Cheddar cheese), rubbed onto the surface of a cheese block, or immersion of cheese block in salt brine (Guinee, 2004; Bintsis, 2006).

Precise control of factors that affect salt uptake and distribution in cheese are a critical part of the cheese making process to ensure consistent, high quality cheese (Guinee, 2004).

Salt is added mainly as flavoring substance to cheese and for several other purposes: controlling microbial growth and enzyme activities, promoting curd syneresis (whey expulsion), modifying flavor, texture and other physical properties (Guinee, 2004; Johnson *et al.*, 2009).

Adding salt to cheese seems to reduce the hydration of caseins. However, increased salt content has also resulted in no decrease in the moisture content of cheese (Cervantes *et al.*, 1983; Paulson *et al.*, 1998). (Pastorino *et al.*, 2001), injecting a concentrated solution of sodium chloride significantly increased the salt content of cheese. Salt to moisture (S/M) level is significantly correlated with cheese quality (Guinee, 2004; Guinee and Fox, 2004.,). The

level of salting in cheese and the resultant S/M influence the amount of residual lactose, cheese pH, and rate and extent of protein hydrolysis in the cheese (Pastorino et al., 2003;).

Salt is a flavoring agent masks some of the acidity of cheese (Wendroff, 1996). It also controls the growth of the starter and the other microorganisms present in cheese (Reddy and Marth, 1993; Schroeder, 1988; turner and Thomas, 1980).

Brine solutions may become contaminated with microorganisms that may affect the quality of the resultant cheese. Brine-salted cheeses also are more likely to have variations in chemical composition, which can affect the final quality of the cheese. Disposal of contaminated brine has become a major problem for cheese makers ((Wendroff, 1996).

The objective of this study was to compare between the effect of brining and dry salting methods on the quality of Muenster type cheese, cow, buffalo and goat milks.

MATERIALS AND METHODS

Cheese Manufacture:

Muenster type cheese was made from cow,s milk having 11.89TS, 4.1fat, and 3.11% protein, and from buffalo,s milk having 16.92 TS, 6.9 fat and 4.52, protein Goat milk having 11.93, 4.2, 3.26 % and TS, fat, and protein was also used in making Cheese. Cheese milk was heated to 63C for 15 minutes and cooled to 32 C. The three tapes of milk were obtained from the experimental from Animal Production Research Institute (APRI.) Milk was individually inoculated with 0.70% Dansco Mesophilic starter containing 6 strains of lactic acid bacteria at 320C .

1-lactococcus lactis subsp. lactis
2- lactococcus lactis subsp. cremoris.
3- Streptococcus. thermophilus
4- lactobacillus delbrueckii subsp. bulgaricus.
5- lactobacillus helveticus
6- lactobacillus casei subsp. case.

After 40 minutes of inoculation 30 ml local animal rennet was used for each 100L of milk. Coagulation was carried out within 40 minutes. The coagulum was cut into cubes, scolding was done in 45 minutes reaching 38 C and pH 6.2. The curd was hooped in round moulds 3kg capacity, and left without pressing to get rid of the whey. After 2 hours the cheese turned on the other surface. Each treatment divided into two portions, first was dipped into the saturated brine solution for 24 hours, while the second part was salted by sprinkling on the surface. 50 gm of dry coarse salt / kg of cheese was used. The dry salt divided of into 4 portions, salting was done in 4 days. The cleaned cheese was kept at storing room 18±2 C for 60 day. Fresh samples, 15 and after 30, 45 and 60 days cheese samples were taken for both chemical and organoleptic analysis.

Compositional Analyses:

Milk was analyzed for the total solids (TS), fat, and protein contents according to Ling (1963).The cheese was ground in a food mill (Black & Decker, Power Pro FP 1000, and Shelton, CT). Analyses of cheeses were done at 0, 15, 30, 45 and 60 day of age. The moisture content was determined by drying 3 g of ground cheese in vacuum oven at 140°C for 20 min (Bradley *et al.*, 1993). Fat content was determined by the conventional Gerber's method (Ling, 1963) and protein by the Kjeldahl method (Bradley, 1995). Water soluble nitrogen (WSN) and non protein nitrogen (NPN) contents of cheese was determined as described by Ling (1963). The pH of milk and cheese was determined using a glass electrode pH meter The pH was determined using the quinhydrone / gold electrode .for determining the pH values of milk, the electrode was immersed directly into the sample. For cheese, 20gm of the sample were softened in a porcelain mortar by mixing with the same amount of distilled water and the whole homogenous paste was left 5-10 min. before measuring. Titratable acidity of milk and cheese were estimated as lactic acid % according to Ling (1963). The salt content was determined using the Volhard's method as described by Richardson (1985) All determinations were carried out in triplicate.

Organoleptic analysis:

The panel for the sensory analysis was composed of 10 trained panelists from the staff of the El-Serw Animal Production Research Station, Ministry of Agriculture. Cheeses were evaluated as fresh and after 60 days The panelists were asked to evaluate the cheeses in terms of cheese flavor intensity, bitterness, acidity, off flavor and firmness characteristics 50 points for flavor, 40 points for texture and 10 points for colour and appearance.

RESULTS AND DISCUSSION

Effect of salting method on the cheese yield:

Yield of the fresh and ripened cheese is shown in Table (1). For all treatments, prolonging the period of ripening decreased the yield of the cheese . This is due to the continuous evaporation of moisture during ripening Buffaloe (B) treatment had the highest yield, followed by goat. Brined cow milk cheese had higher yield values than dry salting, This Wight be due to the higher moisture content of the cheese. Losses of weight were higher in buffalo milk than other two types of milk and were higher for dry salting than brine salting method.

Similar results were obtained by (Kirin, 2002). Also Pappa *et al.*, (2006) showed that the yield of Teleme cheese/100 kg milk is evident, which decreased significantly ($P < 0.05$) during the early days of cheese manufacture and ripening, regardless of the kind of milk and culture used. The yield did not change significantly ($P > 0.05$) after the cheese was transferred to the cold room and, especially, after 60 days of ripening. The changes in yield could be attributed to changes in moisture content.

Guinee, *et al.*, (2000) found that using of dry salting resulted in a significantly higher content of cheese moisture and a higher actual cheese

yield than brine salting or combining salting (brine + dry). The yield of all the cheeses was influenced by the type of milk used and loss of moisture during the storage period (Abd El-Rafee and Abd El-Gawad 2002). The yield of buffaloe milk cheese were higher than that of cow or goat milk cheese (Ismail *et al.* 2007). The weight loss of cheese during the ripening process an important factor affecting the yield of cheese. Weight loss of cheese arises partly due to mechanical processes during care and ripening of cheese, mostly as a result of continuous evaporative processes that occur between cheese and the air in the ripening room (Kirin,S. 2002)

Table (1): Effect of salting method on the yield % of cheese.

Treatments	Salting method	Fresh %	Ripened %	Losses %
Buffalo cheese	Brine salting	14.01	12.56	10.92
	Dry salting	14.42	12.91	10.48
Cow cheese	Brine salting	12.14	11.02	9.22
	Dry salting	12.45	11.51	9.72
Goat cheese	Brine salting	12.23	11.18	8.85
	Dry salting	12.66	11.53	8.92

Effect of salting method on T.S of cheese:

From Table (2) it is clear that buffaloe milk cheese had the highest T.S, while cow milk cheese had the lowest T.S, still goat milk T.S value is nearer to that of cow milk. For all treatments as the ripening period progressed the T.S of all cheeses increased. The dry salting treatment had higher moisture content than that salted in brine solution. After 45 days of ripening moisture content values were (48.12,46.68) ,(49.52 ,50.17) and (49.82 and 50.36 %) for (Brine and dry salting cheeses). , for buffaloe , cow and goat milk cheese respectively. Ponce De Leon –Gonzalz,*et al* (2000) found higher moisture content in dry salted muenster cheese than brine salting.

Table (2): Effect of salting method on total solid (T.S) and moisture content of different cheeses.

Treatments	Salting method	properties	Storage periods (days)				
			Fresh	15	30	45	60
Buffaloe	Brine salting	TS %	47.18	49.22	51.32	53.32	54.47
		Moisture%	52.82	50.88	48.68	46.68	45.53
	Dry salting	TS %	46.89	48.64	50.22	51.88	52.99
		Moisture%	53.11	51.36	49.78	48.12	47.01
Cow	Brine salting	TS %	45.44	47.38	49.18	50.48	51.88
		Moisture%	54.56	52.68	50.82	49.52	48.12
	Dry salting	TS %	44.32	46.18	48.32	49.83	51.20
		Moisture%	55.68	53.82	51.68	50.17	48.80
Goat	Brine salting	TS %	45.33	47.44	49.08	50.18	52.40
		Moisture%	54.67	52.56	50.92	49.82	47.60
	Dry salting	TS %	44.18	46.08	47.89	49.64	51.18
		Moisture%	55.82	53.92	52.11	50.36	48.82

Effect of method of salting on the fat and fat/DM% of different cheeses :

As shown in Table 3 for all treatments, as ripening period progressed, fat values and Fat / DM% increased. This apparent increase is owing to the increase in total solids of the cheese. Buffalo milk cheeses had higher fat content, as compared with cow or goat milk cheese treatments. This is due to the higher content of fat in buffalo milk. On the other hand, fat contents of brined cheeses are higher than those of salted by dry salting method. Again this increase is owing to the total solid contents of the cheese El-zogby (1994) found F/D in fresh Mozzerella cheese 38.33, 46.01 and 46.52% for (B,C)and goat milk made from standardized milk .

Ponce De Leon Gonzalez *et al* (2000) found 32.18 and 32.40% fat in dry salting and brined Muenster cheeses, respectively. Ponce De Gonzalez *et al* (2000) also found 36.59 and 36.09 moisture in dry salting and brined Muenster cheese respectively. The cheese was made from cow milk 3.6% fat

The effect of salting method on TP and TP/TS

Table (3) shows the total protein and TP/TS of different treatments of salting. It seems that salting method had no marked effect on the total protein content. The difference is due to the different in total solids, for example TP of fresh cow milk cheese were 12.88 and 12.54 in brine and dry salting, respectively.

Table (3): Effect of salting method on fat (F), total solid (T.S), the ratio of fat: total solid (F/TS), TP and TP/TS of different treatments.

Treatments	Salting method	Properties	Storage periods (days)				
			Fresh	15	30	45	60
Buffaloe	Brine salting	Fat %	23.26	25.06	26.54	27.98	28.98
		F/T.S %	49.30	51.02	51.71	52.48	53.20
		T.P %	17.92	19.18	20.85	22.08	23.30
		TP/TS %	37.98	38.97	40.96	41.41	42.78
	Dry salting	Fat %	20.32	22.18	24.08	25.28	27.12
		F/T.S %	43.14	46.04	47.94	48.38	51.18
		TP %	17.08	18.42	19.68	21.12	22.18
		TP/T.S %	36.43	37.78	39.19	40.71	41.85
Cow	Brine salting	Fat %	19.18	20.68	21.92	22.99	23.68
		F/T.S %	42.09	43.65	44.57	45.54	45.56
		TP%	12.88	13.92	15.18	16.11	17.12
		TP/TS %	28.35	29.38	30.23	31.91	32.99
	Dry salting	Fat %	18.65	20.44	22.14	23.54	24.05
		F/T.S %	42.08	44.26	45.82	47.24	47.67
		TP%	12.54	13.48	14.42	15.58	16.68
		TP/TS%	28.29	29.19	29.92	31.27	32.55
Goat	Brine salting	Fat %	20.15	22.17	23.98	25.02	26.27
		F/T.S %	44.45	46.73	48.86	49.68	50.13
		TP %	15.16	16.68	18.02	19.04	19.98
		TP/TS %	33.44	35.16	36.72	37.94	38.13
	Dry salting	Fat %	19.54	21.18	22.88	24.20	24.88
		F/T.S %	44.23	45.96	47.77	48.45	48.61
		TP %	14.66	15.58	17.08	18.22	19.18
		TP/TS %	33.18	33.81	35.69	36.70	37.48

On the other hand, difference in TP and TP/TS of buffalo, cow and goat milk cheese is owing to their origin chemical composition of milk The values of TP/TS for brine and dry salted cheese were (42.78/41.85), (32.99/32.58) and (38.13 and 37.48%) for B, C and G milk cheese treatments.

Ponce De Leon Gonzalez *et al* (2000) salted cow milk Muenster cheese by dry or brined salting protein content of cheese was 25.18 for dry salting and 25.75 for brined Muenster cheese.

Effect of method of salting on salt content of the cheese:

The salt content and salt/moisture values were tabulated in Table (4). It is clear from the obtained data that brine salting resulted in higher salt content in the cheese,and also salt / moisture content were higher.

As the ripening period progressed, the salt content values increased. The apparent increase is owing to the decrease in moisture content. On the other hand the salt content values were within the standard salt content of this cheese (1.2/1.4%) for fresh dry and brined cheese. Salt content of ripened buffalo cheese (3.02/2.90%) was higher than cow milk salt content (2.88/2.66%) and goat milk cheese (2.72and 2.63%) for brine and dry salt cheese, respectively. Ponce De Leon –Gonzalez et al (2000) salted Muenster cheese by dry and brine methods, fresh cheese contained .47, 1.16% salt, and 4.02 and 3.21 S/M for dry and brined cheese, respectively.

Table (4): Effect of salting method on salt content, moisture and salt /moisture content S/M of cheese during ripening period.

Treatments	Salting method	Properties	Storage periods (days)				
			Fresh	15	30	45	60
Buffaloes	Brine salting	Salt (S)	1.80	2.01	2.63	2.99	3.02
		S/M %	3.41	3.95	5.40	6.41	6.63
	Dry salting	Salt (S)	1.68	1.99	2.28	2.67	2.90
		S/M %	3.16	3.87	4.58	5.55	6.17
Cow	Brine salting	Salt(S)	1.74	1.88	2.64	2.48	2,88
		S/M %	3.19	3.57	4.06	5.02	5.99
	Dry salting	Salt (S)	1.73	1.82	2.22	2.36	2,66
		S/M %	3.11	3.45	4.30	4.70	5.45
Goat	Brine salting	Salt (S)	1.80	1.88	2.36	2.58	2.72
		S/M %	3.29	3.58	4.63	5.18	5.71
	Dry salting	Salt (S)	1.63	1.79	2.22	2.48	2.63
		S/M %	2.92	3.32	4.26	4.92	5.39

Effect of salting method on SN and SN/TN of different cheese during ripening:

Table (5) included the SN and SN/TN values of different cheese during ripening. Generally as ripening period progressed the soluble nitrogen content increased under the activity of starter enzymes. On the other hand, proteolysis was slower in buffalo milk cheese as compared with either cow or goat milk cheese. The method of salting had a slight effect on soluble nitrogen content of cheese. slight increase in brine salted cheese than dry salting cheese. The value of SN and SN/TN of different cheeses salted by brining after 60 days were (0.54/14.59), (0.45/16.92) and (0.398/13.72%) for

B, C and goat milk cheese respectively. Values for dry salting cheese were (0.44/12.64), (0.408 /15.33) and (0.368 and 12.22%) respectively. Ponce De Leon Gonzalez *et al* (2000) found that 73% of alfa-casein and 12% of ß casein were hydrolyzed in dry salted Muenster cheese while 81 % of alfa casein and 9% ß casein were hydrolyzed in brine salted Muenster cheese at the same age. El-zogby (1994) found the highest SN/TN for 4 weeks old. Mozzarella cheese was for cow treatment 10.248% while the lowest for buffaloe (5.575%).Goats milk cheese had (9.071 %.)

Effect of salting method on NPN and NPN /TN of different cheese during ripening:

NPN and NPN /TN of different cheese were tabulated in Table (5). NPN values were similar to SN. The salting method had little effect on NPN content of the cheese. Brining had slight higher content of NPN as compared with dry salting. NPN contents of the ripened cheese were (0.122/0.0838), (0.168 /0.0968) and (0.176 and 0.956%) for brine and dry salting B, C and goat milk cheese, respectively. Ponce De Leon-Gonzalez *et al*, (2000) found that TCA soluble nitrogen was not and significantly different between the brine and dried – salted Muenster cheese but increased significantly through the ripening.

Effect of salting method on the TVFA values of different cheese during ripening:

Values of TVFA of different cheese during ripening were tabulated in Table (5). Regardless of salting method, as ripening period progressed the TVFA values increased, the lowest values were for buffalo milk cheese and the highest was for goat milk cheese. The values of TVFA for cow milk cheese were higher than buffalo milk cheese, but slightly lower, compared with goat milk cheese. *Ponce De Leon Gonzalez et. Al, (2000)* found that concentration by butyric (C4.0) and caprylic (C8.0) fatty acids in the brine cheese were significantly higher than in direct salted cheese at zero day . The concentrations of the other free fatty acids were not significantly different; cheese with the lowest amount of salt have higher levels for fatty acids. Lindsay et al (1982) reported few differences in the levels of free fatty acids in cheeses with low (3.5) and intermediate (4.2%) salt to moisture ratios. The concentrations of free fatty acids significantly increased with ripening time, with the exceptions of butyric(C4,0) caprylic (C8.0) and capric (C10.0)acids This result could be related to the increased growth of lactoba-cilli and yeast during the ripening time.

Table (5): Effect of salting method on TN, SN, SN /TN, NPN, NPN/TN and TVFA of different cheese.

Treatments	Salting method	Storage period(days)	TN %	SN %	SN/TN %	NPN %	NPN/TN %	TVFA*
Buffaloes	Brine salting	0	2.81	0.281	9. 96	0.0199	0.71	4.64
		15	3.01	0.332	10. 96	0.0238	0.79	6.98
		30	3.08	0.380	12. 06	0.0267	0.85	8.44
		45	3.31	0.421	12.14	0.0612	1.77	10.64
		60	3.48	0.543	14. 59	0.1220	3.30	11.88
	Dry salting	0	2.68	0.251	9.32	0.0180	0.70	4.58
		15	2.88	0.302	10.42	0.0212	0.74	6.22
		30	3.08	0.321	10.49	0.246	0.80	8.12
		45	3.31	0.390	11.78	0.0318	0.96	10.06
		60	3.48	0.442	12.64	0.0838	2.41	11.18
Cow's	Brine salting	0	2.02	0.282	13.96	0.0192	0.95	8.92
		15	2.18	0.311	14.27	0.0342	1. 57	11.28
		30	2.38	0.366	15.38	0.0417	1.75	14.37
		45	2.53	0.419	16.56	0.0804	3.18	17.36
		60	2.68	0.450	16.92	0.1680	6.27	22.17
	Dry salting	0	1.97	0.264	13.40	0.0184	0.93	8.46
		15	2.11	0.288	13.65	0.0315	1.49	10.58
		30	2.26	0.318	14.08	0.0408	1.81	13.77
		45	2.44	0.398	15.08	0.0698	2.86	15.97
		60	2.66	0.408	15.33	0.0968	3.63	20.58
Goat's	Brine salting	0	2.37	0.244	10.30	0.0211	0.89	9.18
		15	2.61	0.288	11.03	0.0288	1.10	12.81
		30	2.82	0.318	11.63	0.0392	1.39	14.16
		45	2.98	0.362	12.15	0.0774	2.60	17.30
		60	3.13	0.398	13.72	0.1760	5.62	23.18
	Dry salting	0	2.30	0.222	9.65	0.0201	0.87	9.08
		15	2.44	0.248	10.16	0.0266	1.09	11.88
		30	2.68	0.268	11.27	0.0362	1.35	13.48
		45	2.86	0.342	11.95	0.0654	2.29	16.18
		60	3.01	0.368	12.22	0.0956	3.18	22.17

T.VFA= expressed as ml 0.1 NaOH 100 g-1 cheese

Effect of method of salting on the organoleptic properties of Muenster cheese:

Table (6) deals with the scoring points attained by the ten Judgers for the three type of cheese, salted by dry or brining method. For the three treatment, always buffaloe milk cheese having less scoring points than cow milk cheese. On the other hand goat milk gained the lowest scoring points although its texture was accepted, but goaty flavors still unaccepted by Judgers. Dry salting cheese gained higher scoring points as compared with brined cheese. This is may be due to the higher moisture content of dry salt cheese; the Judgers detected the smooth feeling of the cheese. Also the salt content was less. the very important observation was the less mould growth on the surface of dry salting cheese may owing to the rind formed for dry salting cheese.

The scoring points of cow dry and brine salting cheese were (94/90), (84/79) for buffaloe , and (74/71) of 100 for goat milk cheese. Ponce De Leon-Gonzalez (2000)Reported the possibility of dry salting method for Muenster cheese without affecting its quality, and minimizing the umlaut of salt required for salting and reducing the high Cl discharge from the cheese –making process.

Table (6): Effect of method of salting on the Organoleptic properties of fresh and old cheese 60 days.

Treatments	Salting method	Storage periods (days)							
		Fresh				60			
		colour	texture	flavor	total	colour	texture	flavor	total
		10	40	50	100	10	40	50	100
Buffalo	Brine salting	5	30	37	72	6	32	41	79
	Dry salting	6	31	39	76	7	34	43	84
Cow	Brine salting	7	32	38	77	8	36	46	90
	Dry salting	8	34	42	84	9	37	48	94
Goat	Brine salting	5	28	31	64	5	30	36	71
	Dry salting	5	29	33	67	6	31	37	74

CONCLUSION

Muenster type cheese was processed from buffalo, cow, or goat milk. Each type of cheese was salted by usual method (brining) and dry salting. Cow milk cheese gained the highest scoring paints followed by buffalo milk cheese, goat milk cheese was not highly accepted because of the goaty flavor. Dry salting did not affect the quality of the cheese and also dried salted cheese gained higher scoring points. Dry salting is easier to be applied by Egyptian processors and more economic as well reducing the toxicity of CL in surface water.

REFERENCES

Abd El-Rafee S., Abd El-Gawad M.A.M., (2002). Effect of milk types on the properties of Provolone cheese. J. Dairy Sci. 30, 243-252

Bradley, R. L., Jr (1995). Dairy Products. Chap. 33. Pages 13, 18–19 in Official Methods of Analysis of the A.O.A.C. 16th Ed., Association of Official Analytical Chemists. Arlington, VA.

Bradley, R. L., Arnold, jr., E. BarbaD.M. Semerad R.G., Smith D.E., and Vines B.K., (1993). Chemical and physical methods. Pages 456–515 in Standard Methods for the Examination of Dairy Products, 16th Ed. R. T. Marshall, ed. Am. Publ. Health Assn., Washington, DC.

Bintsis, T. 2006. Quality of Brine. Pages 264–301 in Brined Cheeses. A.Tamime, ed., Blackwell Publishing, Oxford, UK.

Cervantes, M. A., Lund, D. B., & Olson, N. F. (1983). Effects of salt concentration and freezing on Mozzarella cheese texture.Journal of ElDairy Science, 66, 204-213.

EL- Zoghby (1994) Studies on Mozzarella cheese. Ph.D. Thesis, Fac., of Agric., Zagazig, univ., Egypt.

Guinee, T. P. (2004). Salting and the role of salt in cheese. Inte. J. of Dairy Technology, 57, 99–109.

Guinee, T. P., & Fox, P. F. (2004). Salt in cheese: physical, chemical and biological aspects. In P. F. Fox (Ed.), General aspects (2nd

ed.).Cheese: Chemistry, physics and microbiology, Vol. 1 (pp. 207-259) London, UK: Chapman & Hall.

Guinee T.P., Mulholland E.O., Mullins C., Corcoran M.O. (2000) Effect of salting method on the composition, yield and functionality of low moisture Mozzarella cheese, Milchwissenschaft 55 135–138.

Ismail M.M., Ayyad K.M., Hamad M.N., (2007). Manufacture of Mozzarella cheese using Glucono- Delta-Lacton. In: Proc. 10th Egypt. Conf. Dairy Sci. Techn. 19-21 November 2007. Cairo, 415-432.

Johnson, M. E., Kapoor R., McMahon D.j., McCoy D.R., and Narasimmon R.G.,(2009). Reduction of sodium and fat levels in natural and processed cheeses: Scientific and technological aspects. Compr. Rew. Food Sci. F. 8:252-268.

Kirin, S. (2002): Utjecaj načina zrenja na kalo sira Trapista, ljekarstvo, 52, 2, 155-161.

Ponce De Leon-Gonzalez ,W L. Wendorff2,, B.H. Ingham, J.J. Jaeggi and Houck, K. B. (2002) Influence of Salting Procedure on the Composition of Muenster-Type Cheese. University of Wisconsin-Madison, Madison 53706.

Pappa. E.C. , Kandarakis I., Anifantakis E.M.,and Zerfiridis G.K., (2006). Influence of types of milk and culture on the manufacturing practices, composition and sensory characteristics of Teleme cheese during ripenin. Food Control 17: 570–581.

Pastorino, A. J., Ricks, N.P., Hansen, C.L., and McMahon D.J., (2001). Salt and calcium distribution in injected cheese. J. Dairy Sci. 84(Supp. 1):145.

Pastorino, A. J., Hansen,C.L., and McMahon D.J., (2003a). Effect of salt on structure function relationships of cheese. J. Dairy Sci. 86:60-69.

Pastorino, A. J., C. L. Hansen, and D. J. McMahon. 2003a. Effects of pH on the chemical composition and structure-function relationships of Cheddar cheese. J. Dairy Sci. 86:2751–2760.

Paulson, B. M., McMahon, D. J., & Oberg, C. J. (1998). Influence of sodium chloride on appearance, functionality, and protein arrangements in nonfat Mozzarella cheese. J. of Dairy Sci., 81, 2053–2064.

Reddy K.A., Marth E.H., (1993). Lipolysis in Cheddar cheese made with sodium chloride, potassium chloride or mixtures of sodium and potassium chloride. Milchwissenschaft 48:488–493.

Richardson, G. H., ed. 1985. Page 351 in Standard Methods for the, Examination of Dairy Products. 15th ed. Am. Publ. Health Assoc.,Washington,DC.

Schroeder, C. L., Bodyfelt F.W., Wyatt C.J., and McDaniel M.R., (1988)Reduction of sodium chloride in Cheddar cheese: Effect on sensory, microbiological, and chemical properties. J. Dairy Sci. 71:2010-2020.

Turner, K. W., and T. D. Thomas. (1980). Lactose fermentation in Cheddar cheese and the effect of salt. N. Z. J. Dairy Sci. Technol. 15:265–276.

Wendorff, W. L. (1996). Chloride regulation update. Journal of Dairy Science Vol. 83, No. 6, 2000

تأثير طريقة التمليح علي خواص الجبن المونستر

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للمقارنه بين التمليح الجاف و التمليح الرطب للجبن المونستر تم تصنيع الجبن من اللـبن الجاموس و البقرى لمقارنة بين التمليح الجاف و الماعز وتم تمليح كل صنف من الجبن بالطريقتين الأول باستخدام محلول مشبع لمدة ٢٤ساعه والثانية باستخدام الملح الخشن الذي يرش على سـطح الجبن لمدة ٤أيام بواقع٥٠ جرام لكل كيلو جبن مونستر وتم تخزين الجبن لمدة ٦٠ يوم على درجة حرارة ١٨± ٢م وتم تحليل العينات كيماويا وحسيا. وبينت النتائج أن جبن التملح الجاف أحتـوى على نسبة رطوبة أعلى من جبن التمليح الرطب الذي أحتوى نسب أعلى من المادة الصلبة ، الدهن ، البروتين والبروتين الذائب والأحماض الدهنية الطيارة .أعطيت نتائج التحكـيم الحـسي أعلـى الدرجات للجبن المملح تمليحا جافا وكان الجبن الناتج من اللبن البقرى أفضل من اللبن الجـاموس وأقل الدرجات كانت للجبن الناتج من لبن الماعز

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