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UF "TALLAGA" CHEESE QUALITY MADE BY INCORPORATING BIFIDOBACTERIA AND DIFFERENT SALTING RATES

K.M.K. Kebary, R.M. Badawi, S.A. Hussein, I.I. Badran and A.F.A. Ahmed

Department of Dairy Science and Technology, Faculty of Agriculture, Minufiya University, Shibin El-Kom, Egypt.

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ABSTRACT: *Nine UF "Tallaga" cheese treatments were made, to three of them salt was added at the rate of 3%, one of them was served as control and to the other two Bif. bifidum ATCC 29521 and Bif. longum BL-04 were added individually. Another three treatments were made as described above except salt was added at the rate of 4%. The other 3 cheese treatments were made as above except salt was added at the rate of 5.0%. Obtained results showed that, increasing salting rate from 3 to 5 caused a significant decrease in ripening indices [water soluble nitrogen (WSN), Shilovich number and total volatile fatty acids (TVFA)], also total scores of sensory evaluation, bifidobacterial counts while increased the salt, ash content and pH value. Moreover, cheese treatments made by adding 3% salt were not significantly different from corresponding cheese treatments made by adding 4% salt. Incorporation of bifidobacteria increased the ripening indices, total score of organoleptic evaluation, acidity, but did not affect significantly fat, total protein, ash and salt contents of cheese. Cheese treatments made by incorporating Bif. longum were not significantly different from corresponding cheese treatments made by incorporating Bif. bifidum. Total counts of bifidobacteria increased up to the 1st week then decreased till to the end of storage period. Cheese treatments those made by adding 4% salt and incorporating bifidobacteria were the most acceptable cheese and even after storage for 4 weeks contained bifidobacterial counts higher than that should be present to achieve their health benefits.*

Key words: *UF "Tallaga" cheese, bifidobacteria, probiotic bacteria, salting rate.*

INTRODUCTION

"Tallaga" cheese is one of soft white cheeses, which are the most popular cheeses not only in Egypt, but also in many regions, especially in Middle East. Sodium chloride is usually added during cheese making at different rate which can be reach to 12% for Domiati cheese in summer.

Ultrafiltration technology has many advantages in cheese making, therefore many efforts have been tried to make cheese varieties.

Ultrafiltration techniques has been applied successfully in the manufacture of many types of soft cheeses.

Bifidobacteria is becoming recognized worldwide because of their health benefits. Their health benefits and its incorporation in many products have been reviewed by Kebary *et al.* (2008). It has been claimed that the minimal number of available cells of bifidobacteria in the product should be more than 10^5 cfu/gm to achieve the therapeutic effects (Samona and Robinson, 1991; Hunger and Peitersen, 1992). Picot and Lacroix (2004) reported that there several factors affecting the survival of bifidobacteria in any products.

The objective of this study were to investigate the effect of salting rate on the survival of bifidobacteria in UF "Tallaga" cheese, also to determine the effect of salting rates and incorporating bifidobacteria on UF "Tallaga" cheese quality and to monitor the survival of bifidobacteria and the changes of cheese quality during the storage period of UF "Tallaga" cheese.

MATERIALS AND METHODS

Bacterial strains and propagation:

Bifidobacterium bifidum ATCC 29521 was gratefully obtained from Dr. Linda J. Brady's Lab (Department of Food Science and Nutrition, University of Minnesota, USA) while *Bifidobacterium longum* BL-04 was obtained from Rodia, Madison, WI. (USA). Bifidobacteria strains were activated individually by three successive transfers in modified MRS (Ventling and Mistry, 1993) followed by three successive transfers in sterile 10% reconstituted non-fat dry milk and incubated at 37°C. under anaerobic condition. Five milliliters from each active bifidobacterial strain were inoculated separately into flasks containing 95 ml. modified MRS and incubated for about 18 h. at 37°C under anaerobic conditions. Cells counts were harvested by centrifugation at 1500 × g. for 15 min. and washed twice with sterile saline solution bifidobacterial cell from each strain were suspended individually in sterile saline to about 1.0 × 10^{10} cfu/ml.

Cheese making:

The retentate used in this study was gratefully provided by a private plant at Tanta City, Egypt (total solids 40%, fat 22% and protein 11%). The retentate was prepared by mixing the calculated amount of non-fat dry milk, water, completely melted palm kernel oil and fresh skim cow's milk. The mixture was thoroughly agitated at 60 $\pm$ 2°C for 1.0 hr, then homogenized (Rannie, Copenhagen, Denmark) at 3000 psi and heated treated at 80°C for 11 sec. The mixture was ultrafiltered at 52°C (Carbosep, Rhodia, France) at 5 par until we get a retentate containing about 40% total solids and 22% fat which compromised the Egyptian legal standard (EOSQC No. 1867 / 2005) for soft white cheese. The retentate was immediately cooled to 5 $\pm$ 1°C and transported to the pilot plant of Department of Dairy Science and Technology, Faculty of Agric., Minufiya Univ., Shibin El-Kom, Egypt, where cheese was made. 9 batches of cheese were made to study the effect of salt added to cheese on the viability of bifidobacteria and investigate the effect of salt and bifidobacteria on the quality of "Tallaga" cheese as follows: T_1: cheese made with adding 3.0% salt, T_2: cheese made with adding 3.0% salt + *Bif. bifidum*, T_3: cheese made with adding 3.0% salt + *Bif. longum*, T_4: cheese made with adding 4.0% salt, T_5: cheese made with adding 4.0% salt + *Bif. bifidum*, T_6: cheese made with adding 4.0% salt + *Bif. longum*, T_7: cheese made with adding 5.0% salt, T_8: cheese made with adding 5.0% salt + *Bif. bifidum*, T_9: cheese made with adding 5.0% salt + *Bif. longum*. Retentate was heated to about 45°C. and potassium sorbate and calcium chloride were added at the rate of 0.10 and 0.02%, respectively. *Bif. longum* BL-04 and *Bif. bifidium* ATCC 29521 were added individually at the rate of 4.0×10^8 cfu / ml. milk. Rennet powder was added to all the retentate batches, then filled in stainless steal trays and incubated at 40°C. until complete coagulation (4.0 hr.). Cheese batches were cooled and kept in the cooler overnight. Each cheese treatment was cut into five cubes those were pickled in polyethylene bags, filled with 7.0% pasteurized brine solution that contained potassium sorbate at the rate of 0.1% and stored in refrigerator (6 – 8°C.) for 4 weeks. The whole experiment cheese was duplicated.

Chemical analysis:

Cheese were sampled when fresh and every week and analyzed for moisture content, fat content, total and WSN content, titratable acidity and pH values according to Ling (1963). Ash content was determined according to the Official Method as described by the A.O.A.C. (1990), while the salt content was estimated as described by Helrich (1990). Shilovich number was determined by the method of Tawab and Hofi (1966). Total volatile fatty acids were estimated by direct distillation methods as described by Kosikowski (1982).

Microbiological examination:

The total bacterial counts was determined using standard plate counts agar (Marth, 1978), while modified MRS agar was used for enumerating bifidobacteria (Ventling and Mistry, 1993). To each 100 ml. of modified MRS, 5 ml. of the following solution was added before pouring plates: Neomycine suplphate (0.80% w/v), Paromomycine sulphate (0.20% w/v), Nalidixic acid (0.30% w/v) and Lithium chloride (6.00% w/v) (Samona and Robinson, 1991). Yeasts and moulds were enumerated on Potato Dextrose Agar (acidified) medium (Difco, 1953).

Sensory evaluation:

Cheese samples were evaluated for the appearance body, texture and flavour by a regular score panel including the staff members of the Department of Dairy Science and Technology, Minufiya University, Shibin El-Kom, Egypt, according to the scoring sheet of Abdou *et al.* (1977).

Statistical analysis:

2 × 2 factorial design was used to analyses all the data and Newman-keuls test was followed to make the multiple comparisons (Steel and Torrie, 1980) using Costat program. Significant differences were determined at ($p \leq 0.05$).

RESULTS AND DISCUSSION

The obtained results revealed that moisture content of all cheese treatments decreased by increasing the amount of salt added and this decrease was proportional to the salt rate (Tables 1, 6). However, no considerable difference was noticed in the average moisture content among cheeses made by adding the same amount of salt, which means there was no significant ($p > 0.05$) effect of incorporating bifidobacteria on moisture content. Moisture content of all cheese treatments decreased during the storage period progressed (Tables 1, 6). This decrease might be due to the contraction of curd as a result of developed acidity during the storage period which helps to expel the whey from the curd and/or the difference in osmotic pressure between the curd and the brine solution. The general trend for the changes in moisture content of all cheese treatments agreed with those obtained by Badawi and Hussein (1999), El-Zayat and Osman (2001), Al-Otaibi and Wilbey (2004), Yilmaztekin *et al.* (2004) and Madadlou *et al.* (2007).

Fat content of all cheese treatments increased ($p \leq 0.05$) during the storage period (Tables 1, 6). This increase in fat content might be due to the reduction of moisture content throughout the storage period. These results are in agreement with those reported by Badawi and Hussein (1999), Osman (2000), El-Zayat and Osman (2001) and El-Kholy *et al.* (2005). All cheese treatments were not significantly ($p > 0.05$) different from each other which means that neither incorporation of bifidobacteria nor the rate of adding salt affected significantly the fat content of the resultant cheeses.

Protein content of all treatments are decreased gradually during the storage periods (Tables 1, 6). These results may be due to the degradation of protein in to water soluble nitrogen (WSN) compounds and subsequently the loss of some WSN from the degraded protein in the storage solution. Total protein content of all cheese treatments decreased sharply after 4 weeks.

Adding bifidobacteria did not significantly affect the total protein content of cheese treatments (Tables 1, 6). The obtained results are in agreement with those obtained by Hofi (1995), Al-Otaibi and Wilbey (2004) and Kebary *et al.* (2006 a).

Table (1). Effect of salting rate and incorporation of bifidobacteria on moisture, fat and total protein contents (%) of UF "Tallaga" cheese during storage period.

Cheese / Treatments	Moisture content (%)					Fat content (%)					Protein content (%)				
	Storage period (weeks)					Storage period (weeks)					Storage period (weeks)				
	Fresh	1	2	3	4	Fresh	1	2	3	4	Fresh	1	2	3	4
T_1	60.23	59.57	58.38	57.71	57.31	22.2	23.1	23.8	24.2	24.4	11.60	11.20	10.80	10.27	9.57
T_2	60.24	59.37	58.33	57.66	57.10	22.2	23.2	23.9	24.3	24.5	11.50	11.30	10.70	10.21	9.48
T_3	60.25	59.38	58.33	57.67	57.11	22.3	23.2	23.9	24.4	24.7	11.50	11.30	10.70	10.19	9.50
T_4	59.80	58.38	57.34	56.70	56.29	22.4	23.1	24.0	24.4	24.6	11.60	11.40	10.81	10.07	9.75
T_5	59.70	58.17	57.12	56.50	56.25	22.2	23.2	23.8	24.1	24.6	11.67	11.00	10.69	10.35	9.70
T_6	59.70	58.18	57.13	56.49	56.23	22.3	23.3	23.9	24.2	24.5	11.60	11.00	10.70	10.30	9.60
T_7	58.90	57.37	56.35	55.69	55.22	22.4	23.3	24.0	24.3	24.6	11.60	11.40	10.95	10.40	9.80
T_8	58.70	57.33	56.10	55.40	55.01	22.3	23.1	23.7	24.1	24.5	11.60	11.30	10.80	10.30	9.78
T_9	58.80	57.30	56.11	55.40	55.00	22.4	23.3	23.9	24.3	24.5	11.60	11.20	10.90	10.20	9.76

T_1: cheese made with adding 3.0% salt.
T_2: cheese made with adding 3.0% salt + *Bif. bifidum*.
T_3: cheese made with adding 3.0% salt + *Bif. longum*.
T_4: cheese made with adding 4.0% salt.
T_5: cheese made with adding 4.0% salt + *Bif. bifidum*.
T_6: cheese made with adding 4.0% salt + *Bif. longum*.
T_7: cheese made with adding 5.0% salt.
T_8: cheese made with adding 5.0% salt + *Bif. bifidum*.
T_9: cheese made with adding 5.0% salt + *Bif. longum*.

Ash and salt contents of all cheese treatments increased slightly ($p \leq 0.05$) during the storage periods (Tables 2, 6). This increase in ash content could be attributed to the loss in the moisture content during the storage period. These results revealed that ash and salt contents increased significantly ($p \leq 0.05$) as the salting rate was increased. Cheese treatments those made by adding salt at the rate of 5.0% contained the highest one of ash and salt contents followed with corresponding treatments. Those made with adding salt at the rate of 4%, then those made with adding salt at the rate of 3%. On the other hand, treatments those made with the same salt rate were not significantly ($p > 0.05$) different from each other which means that incorporation of bifidobacteria did not affect significantly on the ash and salt contents of cheese (Tables 2, 6). These results are in agreement with those of Abbas *et al.* (1993), El-Zeny (1991), Badawi and Hussein (1999) and Kebary *et al.* (2006 a, b).

Titratable acidity content of all cheese treatments increased significantly ($p \leq 0.05$) as the storage period progressed. Titratable acidity of all cheese treatments increased markedly during the first 3 weeks after that its increased gradually up to the end of storage period (4 weeks). It is evident from the obtained results that incorporation of bifidobacteria caused a significant ($p \leq 0.05$) increase in titratable acidity (Table 2, 6). In the other hand, cheese treatments made with adding *Bif. longum* were not significantly different from corresponding treatments these made with adding *Bif. Bifidum* (Tables 2, 6) which means that bifidobacterial strains did not affect significantly ($p > 0.05$) the titratable acidity. On the other hand, cheese treatments made with adding 3% salt had the highest titratable acidity followed with corresponding cheese treatments those made with adding 4% salt, then cheese treatments those made with adding 5.0% salt, which means that titratable acidity decreased with increasing the salting rate. These results might be due to the suppression of lactic acid bacteria growth by adding salt and consequently the reduction of acidity development (Hussein, 2004). The general trend of cheese acidity are agreed with those obtained by Badawi and Hussein (1999) and Malium (2006).

Water soluble nitrogen content (WSN) is one of proteolysis indices which playing an important role in developing proper body and texture. WSN of all resultant cheese treatments increased significantly ($p \leq 0.05$) as the storage period progressed. However, WSN increased sharply during the first 3 weeks of the storage period then increased gradually up the end of storage period (4 weeks) (Tables 3, 6). Similar results were reported for soft white cheese by El-Sonbaty (1999), El-Abd *et al.* (2003) and Kebary *et al.* (2006 b). Increasing of salting rate caused a significant ($p \geq 0.05$) decrease in WSN content which might be due to the suppression of the growth of proteolytic bacteria and might inhibit the proteases acidity themselves. Similar trends were reported

Table (2). Effect of salting rate and incorporation of bifidobacteria on ash and titratable acidity contents (%) of UF "Tallaga" cheese during storage period.

Treatments \ Cheese	Ash content (%)					Titratable acidity content (%)				
	Storage period (weeks)					Storage period (weeks)				
	Fresh*	1	2	3	4	Fresh	1	2	3	4
T_1	4.98	5.00	5.05	5.08	5.11	0.31	0.41	0.43	0.48	0.55
T_2	4.99	5.01	5.06	5.08	5.10	0.32	0.42	0.45	0.49	0.57
T_3	4.98	5.01	5.06	5.08	5.12	0.31	0.43	0.46	0.50	0.59
T_4	5.95	5.98	6.04	6.08	6.11	0.29	0.39	0.42	0.45	0.51
T_5	5.96	5.99	6.03	6.08	6.12	0.30	0.41	0.44	0.46	0.53
T_6	5.95	5.99	6.04	6.07	6.12	0.30	0.42	0.45	0.47	0.54
T_7	6.97	7.01	7.06	7.09	7.11	0.28	0.37	0.40	0.43	0.49
T_8	6.97	7.02	7.05	7.09	7.12	0.27	0.39	0.42	0.45	0.51
T_9	6.97	7.01	7.06	7.10	7.12	0.28	0.39	0.43	0.46	0.52

* See Table (1).

Table (3). Effect of salting rate and incorporation of bifidobacteria on water soluble nitrogen content (WSN) (%), Shilovich number (%) and total volatile fatty acid content (TVFA) (ml 0.1 N NaOH / 100 g) of UF "Tallaga" cheese during storage period.

Cheese / Treatments	Water soluble nitrogen (%)					Shilovich number (%)					Total volatile fatty acid content (ml 0.1 N NaOH / 100 g)				
	Storage period (weeks)					Storage period (weeks)					Storage period (weeks)				
	Fresh	1	2	3	4	Fresh	1	2	3	4	Fresh	1	2	3	4
T_1	0.22	0.38	0.43	0.55	0.63	31.30	51.57	55.62	61.25	70.10	8	14	19	23	25
T_2	0.24	0.40	0.47	0.58	0.67	31.50	51.70	56.87	63.70	72.30	9	16	20	24	26
T_3	0.23	0.42	0.48	0.59	0.68	31.60	52.80	56.82	63.86	72.50	8	15	21	25	27
T_4	0.23	0.33	0.37	0.49	0.57	30.80	49.22	53.31	59.19	69.12	7	12	17	21	23
T_5	0.24	0.36	0.42	0.53	0.64	30.90	50.92	55.90	62.70	71.53	8	14	18	22	24
T_6	0.23	0.38	0.44	0.54	0.65	30.70	50.98	55.98	62.80	71.59	8	15	19	23	25
T_7	0.22	0.28	0.30	0.45	0.51	29.90	40.01	51.10	55.20	58.13	7	10	12	17	18
T_8	0.23	0.34	0.38	0.49	0.57	29.80	49.50	54.70	56.85	60.80	8	11	14	18	20
T_9	0.24	0.35	0.39	0.50	0.59	29.90	49.88	54.80	57.10	61.70	8	12	15	19	21

* See Table (1).

for "Tallaga" cheese by Badawi and Hussein (1999) and Al-Otaibi and Wilbey (2004). However, differences was noticed in the average soluble nitrogen percentage between cheese treatments made with adding bifidobacteria and in control cheese (Yilmaztekin *et al.*, 2004 and Malium, 2006). While the cheese treatments made with bifidobacteria were not significantly ($p > 0.05$) different from each other, which means bifidobacterial strains did not affect significantly the WSN contents of the resultant cheese by Malium (2006).

Shilovich number of all resultant cheese treatments increased significantly ($p \leq 0.05$) as the storage period progressed (Hussein, 1985). It is evident from these results that Shilovich number of all treatments cheese made with bifidobacteria were higher than those in the control cheese (Tables 3, 6). These results are agreement with those reported by Badawi and Hussein (1999). Cheese treatments those made by incorporating *Bif. longum* were not significantly ($p > 0.05$) different from corresponding treatment these made by incorporating *Bif. Bifidum*, which means bifidobacterial strains did not affect significantly the Shilovich number of cheese (Tables 3, 6). There were negative correlations between the Shilovich number and the salting rate and increasing the salting rate to 5.0% was more effective to decrease on the Shilovich number. These results might be due to the inhibitory effect of salting rate on the growth of proteolytic bacteria.

Total volatile fatty acid (TVFA) contents increased significantly ($p \leq 0.05$) in all cheese treatments as the storage period progressed. Similar results were reported by Mehanna *et al.* (2002) and El-Abd *et al.* (2003). Cheese treatments (T_1, T_2 and T_3) which made from milk containing 3% salt had a higher content of TVFA than (T_7, T_8 and T_9) which made from milk containing 5% salt these results could be attributed to the preservative effect of salt and suppression of the growth of lipolytic bacteria (Banwart, 1981). TVFA of cheese treatments decreased by increasing the salting rate, however, increasing the salting rate to 5.0% was more effective than 4.0% to decrease the TVFA, therefore, cheese treatments those made by adding 4% salt were almost not significant different from corresponding cheese treatment made by adding 3.0% salt (Tables 3, 6).

Cheese treatments which made by adding bifidobacteria had higher total volatile fatty acids (TVFA) than in the control cheeses (Malium, 2006).

Total bacterial counts of all treatments at the first week of the storage period was increased and decreased after that gradually up to the end of storage period (Table 4). Similar results were reported by Badawi and Hussein (1999) and Malium (2006). These results might be due to the low temperature, developing acidity and the effect of salting rate in cheese. It can also be noticed that cheese treatments containing bifidobacteria had lower total bacterial counts than untreated control cheese; when fresh and throughout the storage period. These results might be due to the production

Table (4). Effect of salting rate and incorporation of bifidobacteria on total and bifidobacterial counts of UF "Tallaga" cheese during storage period.

Cheese / Treatments	Total counts					Bifidobacterial counts				
	Storage period (weeks)					Storage period (weeks)				
	Fresh*	1	2	3	4	Fresh	1	2	3	4
T_1	43×10^6	28×10^7	72×10^5	33×10^5	26×10^5	2×10^2	1.2×10^3	6.5×10^2	2.9×10^2	1.5×10^2
T_2	35×10^6	20×10^7	68×10^5	31×10^5	16×10^5	44×10^7	22×10^8	92×10^6	35×10^6	23×10^6
T_3	36×10^6	22×10^7	69×10^5	30×10^5	13×10^5	42×10^7	21×10^8	90×10^6	33×10^6	22×10^6
T_4	40×10^6	19×10^7	70×10^5	31×10^5	17×10^5	1.8×10^2	1.1×10^3	5.9×10^2	2.3×10^2	1.2×10^2
T_5	32×10^6	17×10^7	68×10^5	28×10^5	10×10^5	40×10^7	20×10^8	88×10^6	32×10^6	1.2×10^6
T_6	33×10^6	18×10^7	69×10^5	29×10^5	9×10^5	41×10^7	21×10^8	89×10^6	31×10^6	1.1×10^6
T_7	39×10^6	18×10^7	69×10^5	30×10^5	33×10^4	1.6×10^2	1×10^3	4×10^2	1.7×10^2	9×10
T_8	30×10^6	16×10^7	65×10^5	27×10^5	18×10^4	40×10^7	19×10^8	69×10^6	30×10^6	11×10^5
T_9	31×10^6	15×10^7	66×10^5	26×10^5	17×10^4	39×10^7	18×10^8	65×10^6	31×10^6	10×10^5

* See Table (1).

of antimicrobial agents by bifidobacteria, which inhibits the growth of microflora in the cheese and decreased the total bacterial counts (Kebary *et al.*, 2006 b). Similar results were reported by Badawi and Hussein (1999). Total bacterial counts of cheese treatments made with different bifidobacterial strains and the same salting rate were not significantly different from each there. On the other hand, increasing the salting rate decreased the total bacterial counts. Cheese made by adding 3.0% salt had the highest of total bacterial counts, followed by corresponding cheese treatments those made by adding 4% salt and finally corresponding cheese treatments made by adding 5% salt. These results might be attributed to the preservation effect of salt which inhibits the growth of cheese microflora.

Bifidobacterial counts in all cheese treatments increased during the first weak of the storage period then its decreased gradually up to the end of storage period (Table 4). These results might be due to the cold of storage, developed acidity and effect of salt. Similar results were reported by Badawi and Hussein (1999), Abou Dawood (2002) and Malium (2006). Cheese treatments made by incorporation bifidobacteria had the highest bifidobacterial counts and there were no significant effect for bacterial strains, which means cheese made with either *Bif. longum* or *Bif. bifidum* were not different in the counts of bifidobacteria. On the other hand, increasing the salting rate caused a pronounce decrease in the counts of bifidobacteira, which might be due to the inhibition effect of salt (Mehanna *et al.*, 2002). The count of bifidobacteria of cheese treatments made by incorporating bifidobacteria even at the storage for 4 weeks were higher than that showed by present to achieve the beneficial roles. of bifidobacterial which means that "Tallaga" cheese even at the storage for 4 weeks could be a good source for delivering this probiotic bacteria to consumers.

Moulds and yeasts were not detected in all resultant cheeses treatments throughout the storage period. These results might be due to the addition of potassium sorbate at the rate of 0.1%, which mainly inhibits the growth of moulds and yeasts (Hanafy *et al.*, 1995; El-Abbassy and Shenana, 2001 and Kebary *et al.*, 2001).

Total scores was stable up to the 2nd week of the storage then its decreased at the end of the storage period (4 weeks) (Tables 5, 6). These results are in accordance with those reported by Badawi and Hussein (1999) and El-Zayat and Osman (2001). Cheese treatments which made by adding 4% salt and bifidobacterial gained the highest scores for organoleptic properties than cheese made by adding 3% salt and finally cheeses made with adding 5% salt. Cheese treatments made by incorporating bifidobacteria gained higher of total scores than those of corresponding cheese treatments made without adding bifidobacteria (Malium, 2006). On the other hand, cheese made by adding *Bif. bifidum* were not significantly different from corresponding cheese treatments made by adding *Bif. longum*.

Table (5). Effect of salting rate and incorporation of bifidobacteria on organoleptic scores of "Tallaga" cheese during storage period.

Treatments♦	Flavour (60)					Body and texture ( )					Appearance (10)					Total score (100)				
	Storage period (weeks)					Storage period (weeks)					Storage period (weeks)					Storage period (weeks)				
	Fresh	1	2	3	4	Fresh	1	2	3	4	Fresh	1	2	3	4	Fresh	1	2	3	4
T_1	42	43	43	41	40	35	36	36	32	31	8	8	9	7	6	85	87	88	80	77
T_2	43	44	45	42	42	36	36	35	33	32	8	8	9	7	7	87	88	89	82	81
T_3	42	43	43	43	42	35	35	36	35	32	8	9	9	7	6	85	87	88	85	82
T_4	42	45	44	43	42	34	35	35	35	34	9	8	8	8	8	86	87	88	86	84
T_5	44	45	45	44	43	37	36	36	35	35	8	8	9	8	7	89	89	90	87	85
T_6	43	45	45	44	43	35	35	35	34	34	8	8	9	8	7	86	88	89	86	84
T_7	40	43	43	41	40	35	33	34	32	31	7	7	8	7	6	82	83	85	80	77
T_8	41	42	43	42	41	36	34	34	32	32	8	8	8	7	7	89	84	85	81	80
T_9	40	41	42	41	40	35	35	34	32	32	7	7	8	7	7	82	83	84	80	79

* Each value in the table was the mean of three replicates.
♦ See Table (1).

Table (6). Statistical analysis of "Tallaga" cheese made with different salting rates.

Stirred yoghurt of properties	Effect of treatments										Effect of storage period (days)					
	Multiple comparisons•										Multiple comparisons•					
	Mean squares	T_1♦	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	Mean squares	Fresh	1	2	3	4
Moisture (%)	8.816*	AB	A	A	AB	BC	BC	BC	C	C	56.310*	A	B	C	D	D
Fat (%)	0.614	A	A	A	A	A	A	A	A	A	15.653*	D	C	B	A	A
Protein (%)	0.07257	A	A	A	A	A	A	A	A	A	16.0145*	A	B	C	D	E
Ash (%)	9.175*	C	C	C	B	B	B	A	A	A	0.0935*	D	CD	BC	AB	A
Salt (%)	4.718*	C	C	C	B	B	B	A	A	A	0.0728*	C	B	B	AB	A
Acidity (%)	6.496*	B	A	A	C	B	B	D	C	C	0.209*	E	D	C	B	A
pH	0.1407*	C	D	D	B	C	C	A	B	B	0.522*	A	B	C	D	E
Water soluble nitrogen(%)	9.5966*	BC	A	A	C	AB	AB	E	CD	C	0.6202*	E	D	C	B	A
Shilovich number (%)	61.334*	BC	A	A	C	AB	AB	E	D	D	5134.96*	E	D	C	B	A
Total volatile fatty acid(%)	74.116*	BC	A	A	C	AB	AB	E	D	D	996.233*	E	D	C	B	A
Organoleptic properties :																
Flavour	18.657*	D	BC	C	AB	B	B	D	D	D	18.618*	B	A	A	B	C
Appearance	2.066*	A	A	A	A	A	A	A	A	A	14.233*	A	A	B	C	D
Body and texture	16.966*	CD	C	B	B	A	A	D	CD	CD	43.433*	A	B	B	C	C
Total organoleptic scores	98.849*	BC	B	B	AB	A	A	CD	C	C	179.233*	A	A	AB	C	D

♦ See Table (1).

• 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.

* Significant at 0.05 level ($p \leq 0.05$).

It could be concluded that, "Tallaga" cheese treatments those made by salting rate at 4.0% and incorporating bifidobacteria were the most acceptable cheese.

REFERENCES

Abbas, H. M., N. H. El-Sayed and M. A. Khorshid (1993). Improving the quality of fresh white soft cheese made from ultrafiltered. Egyptian J. Food Sci , 21 (3): 249 – 255.

Abdou, S. M., L. B. Abd El-Hamid, A. H. M. Dawood, A. M. Youssef and G. A. Mehran (1977). Studies on cephalotyre "Ras" cheese coating. II. Effect on ripening. Egypt J. Dairy Sci., 5: 191.

Abou Dawood, S. A. I. (2002). Survival of non encapsulated and encapsulated *Bifidobacterium bifidum* in probiotic Kareish Cheese. Egyptian J. of Dairy Sci., 30 (1): 43 – 52.

Al-Otaibi, M. M. and R. A. Wilbey (2004). Effect of temperature and salt on the maturation of white salted cheese. International J. of Dairy Technology, 57 (1): 57 – 63.

A.O.A.C. (1990). Official Method of Analysis of the Association of Analytical Chemists. 15th Ed. Published by the Association of Official Agriculture Chemists, Washington. D.C. (USA).

Badawi, R. M. and S. A. Hussein (1999). Survival of microentrapped bifidobacteria during storage of white cheese and their effect on cheese quality. Minufiya J. of Agric. Res., 24 (2): 493 – 513.

Banwart, G. J. (1981). Basic food Microbiology. AVI Publishing company INC., Westport, Conneticut, USA.

Difco manual (1953). Dehydrated culture media and reagents 9th ed. Difcolaboratories, Detriot, Michigan.

El-Abbassy, M. M. Z. and M. E. Shenana (2001). Quality of UF-feta like cheese as affected by adding culture of *Propionibacterium freudenreichii* subsp. *shermanii* and *Lactobacillus rhamnosus* Lc 705 or potassium sorbate. Annals of Agricultural Science, Meshtohor, 39 (1): 395 – 406.

El-Abd, M. M., A. M. Abd El-Fatah, S. G. Osman and R. S. Abd El-Kader (2003). Effect of some lactic acid bacteria on the properties of low salt Domiati cheese. Egypt. J. Dairy Sci., 31: 125 – 138.

El-Kholy, W. I., B. A. Effat, N. F. Tawfik and O. M. Sharaf (2005). Improving soft cheese quality using growth stimulator for *Bifidobacterium bifidum*. Egyptian J. of Dairy Sci. 33 (2): 229 – 245.

El-Sonbaty, A. H. (1999). Studies on some Biochemical changes in Domiati cheese during pickling. Minufiya J. Agric. Res., 25 (1): 135.

El-Zayat, A. I. and M. M. Osman (2001). The use of probiotics in Tallaga cheese. Egyptian J. of Dairy Sci. 29 (1): 99 – 106.

El-Zeny, H. M. (1991). Rennet coagulation of salt milk and rheology of soft white cheese prepared from it. Dissertation Abstracts international B, Sciences and Engineering, 52 (6): 28409.

EOSQC (2005). Egyptian Organization for Standards and Quality Control. Egyptian Standards for Soft Cheese, ES: 1867 / 2005.

Hanafy, N., El-Hoda and S. A. Farrag (1995). Characteristics of low salt Kareish cheese made with added potassium sorbate. Assiut Journal of Agricultural Sciences, 26 (3): 59 – 66.

Helrich, K. E. D. (1990). Official methods of analysis. 15th, ed., Association of Official Analysis Chemists (AOAC). Washington DC, USA.

Hofi, M. (1995). Production of Domiati cheese utilizing uf retentates of salted whey and uf skim milk retentate. Annals of Agricultural Science, Moshtohor, 33 (1): 219 – 228.

Hunger, W. and N. Peitersen (1992). New technical aspects of the preparation of starter cultures. Int. Dairy Fed. Bull, 277: 17 – 21.

Hussein, S. A. M. (1985). Studies on the use of starter cultures in the manufacture of cheese. M.Sc. Thesis, Minufiya Univ., Egypt.

Hussein, S. A. M. (2004). Effect of sodium chloride and potassium chloride on the growth and activity of microentrapped and free cells bifidobacteria. Proc. The 9th Egyptian Conf. for Dairy Sci. and Tech. Cairo, Egypt, pp. 297 – 308.

Kebary, K. M. K., A. I. Hamed, A. N. Zedan and Amal A. F. Beheary (2006 b). Manufacture of low fat Domiati cheese using Novagel. Egyptian J. Dairy Sci., 34: 175 – 184.

Kebary, K. M. K., A. I. Hamed, A. N. Zedan and Amal A. F. El-Beheary (2006 a). Impact of adding Avicel on the quality of low fat Domiati cheese Minufiya J. Agric. Res., 31 (4): 833 – 851.

Kebary, K. M. K., A. M. Moussa, A. L. Hamed and A. M. T. Japre (2001). Influence of preservative mixtures on losses and quality of Ras cheese. 8th Egyptian conference for Dairy Science and Technology, held at the international Agriculture Center, Cairo, Egypt. 3 – 5 November, 2001: Research Papers (1). Egyptian Society of Dairy Science, Cairo, Egypt, 2001, pp. 331 – 346.

Kebary, K. M. K., K. A. Shaheen, S. A. Kheder and Maally, B. M. AboBakr (2008). Studying the effect of probiotic bacteria on correcting the liver disorder. Proc. 12th Arab. Conference of Home Economics. Minufiya Univ., 18 – 19 August, 2008.

Kosikowski, F. V. (1982). Cheese and fermented milk foods. 2nd, printing with revisions, 573 F.V. Kosikowski and Associated, P. O. B. 139 Brook. Tondale, Ith, New York, USA.

Ling, E. R. (1963). A Text Book of Dairy Chemistry. Vol. 2. 3rd ed. Chapman and Hall, London, pp. 66 – 75.

Madadlou, A., A. Khosrowshahi, M. E. Mousavi and J. Farmani (2007). The influence of brine concentration on chemical composition and texture of Iranian white cheese. Journal of Food Engineering, 81 (2): 330 – 335.
Malium, M. A. (2006). Studies on soft cheese. M.Sc. Thesis, Fac. of Agric., El-Fayoum University.
Marth, E. H. (1978). Standard method for the examination of dairy products 14th ed. Am. Public Health Assoc. Washington, D.C.
Mehanna, N. S., B. A. Effat, M. A. Dabiza, N. F. Tawfik and O. M. Sharaf (2002). Incorporation and viability of some probiotic bacteria in functional dairy foods. Minufiya J. Agric. Res., 27 (2): 225 – 241.
Osman, M. M. (2000). Probiotic fresh skimmed milk (Karish) cheese. Annals of Agric. Sci., Moshtohor, 38 (2): 995 – 1006.
Picot, A. and C. Lacroix (2004). Encapsulation of bifidobacteria in whey protein based microcapsules and survival in simulated gastrointestinal conditions and in yoghurt. Inter. Dairy J., 14: 505.
Samona, A. and R. K. Robinson (1991). Enumeration of bifidobacteria in dairy products. J. Soc. Dairy Technol., 44: 64 – 66.
Steel, R. G. D. and J. H. Torrie (1980). Principles and Procedures of Statistics: A Biometrical Approach, 2nd Ed. McGraw-Hill, New York.
Tawab, G. A. and A. A. Hofi (1966). Testing cheese ripening by rapid chemical technique. Ind. J. Dairy Sci., 19: 96 – 41.
Ventling, B. L. and V. V. Mistry (1993). Growth characteristics of bifidobacteria in ultrafiltered milk. J. Dairy Sci., 76: 962 – 971.
Yilmaztekin, M., B. H. Ozer and F. Atasoy (2004). Survival of *Lactobacillus acidophilus* LA-5 and *Bifidobacterium bifidum* BB-02 in white-brined cheese. International J. of Food Sci. and Nutrition, 55 (1): 53 – 60.

تأثير نسب الملح على حيوية الـ Bifidobacteria فى جبن الثلاجة المصنع بالترشيح الفائق

خميس محمد كامل كعبارى ، رجب محمد بدوى ، سامى عبد الرحمن حسين ، إبراهيم إبراهيم بدران ، أحمد فؤاد عبد اللطيف أحمد

قسم علوم وتكنولوجيا الألبان – كلية الزراعة – شبين الكوم – جامعة المنوفية

الملخص العربى :

يهدف هذا البحث لدراسة تأثير الملح على حيوية بكتريا الـ Bifidobacteria وصفات جبن الثلاجة المصنعة بالترشيح الفائق . ولذلك صُنعت ٩ معاملات ، ثلاثة منها أضيف إليها الملح بنسبة ٣% واحدة استخدمت ككنترول والثانية أضيف لها بكتريا *Bif. bifidum* والثالثة أضيف لها بكتريا *Bif. longum* . وصنّعت ثلاثة معاملات أخرى مرتين كما سبق مع استخدام نسبة ملح ٤ ، ٥% على التوالى . ولقد أوضحت النتائج المتحصل عليها بعد تحليلها إحصائيا ما يلى :

- أدى زيادة معدل إضافة الملح خاصةً عند نسبة ٥% إلى انخفاض دلائل التسوية (النيتروجين الذائب – رقم سالوفيش – الأحماض الدهنية الطيارة) ودرجات التحكيم والحموضة والعدد الكلى للبكتريا وعدد بكتريا الـ Bifidobacteria . بينما أدى الى زيادة نسب كل من الملح والرماد ورقم الـ pH .
- لم تختلف المعاملات التى صُنعت بإضافة ٣% ملح على مثيلاتها المصنعة بإضافة ٤% ملح .
- أدى إضافة الـ Bifidobacteria إلى زيادة دلائل التسوية ودرجات التحكيم والحموضة. بينما لم تؤثر على نسب كل من الدهن والبروتين الكلى والرماد والملح .
- لم تختلف المعاملات المصنعة بإضافة *Bif. longum* على مثيلاتها المصنعة بإضافة *Bif. bifidum* .
- ازداد عدد الـ Bifidobacteria حتى الأسبوع الأول من التخزين ثم انخفضت تدريجيا حتى نهاية فترة التخزين .
- حصلت العينات المصنعة بإضافة ٤% ملح وإضافة الـ Bifidobacteria على أعلى درجات التحكيم واحتوت على أعداد من الـ Bifidobacteria حتى بعد التخزين لمدة أربعة أسابيع أعلى من تلك الواجب تواجدها لتحقيق خواصها الصحية .