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Quality Evaluation of Yoghurt Collected From the Local Market in Some Governorates of Egypt

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Abstract

The present study was carried out to evaluate quality of yoghurt collected from the local market in Cairo, Giza, Gharbia and Minufiya governorates and to compare it with the manufactured yoghurt using Bifidobacteria bifidum (B. bifidum) added to normal starter. Physicochemical, microbiological and organoleptic properties of all yoghurt samples were determined during 12 days storage period in a refrigerator. The results showed that yoghurt collected from Cairo and Giza markets contained less content of total solids and fat than that collected from Gharbia and Minufiya markets as compared to the manufactured yoghurt using B. bifidum. Microbiological examination revealed that the total viable bacterial count was less in yoghurt collected from Cairo and Giza markets than that collected from Gharbia and Minufiya markets. The coliform, mold and yeast count was nil or ignorable in all yoghurt samples till 6 days of storage, then these microorganisms were detected on the 9^{th} and the 12^{th} day of storage period. Organoleptic properties showed that the yoghurt collected from Cairo and Giza markets has higher sensory scores and more acceptable than that collected from Gharbia and Minufiya markets. The manufactured yoghurt using B. bifidum has the best quality and high degree of acceptability by consumers.

Key words: Yoghurt - Quality evaluation - Chemical properties –Microbiological properties - Organoleptic properties- Bifidobacteria bifidum

Introduction

Yoghurt is one of the most popular and oldest fermented milk products which result from fermentation of lactic acid of milk. It is very healthy and nutritious dairy product that commonly consumed in Egypt by all ages, especially in the fasting month of Ramadan. It had been proved that yoghurt has a value for controlling the growth of gastrointestinal bacteria and curing intestinal diseases such as constipation, diarrhea and bacillary dysentery ***(Shahani and Chandan, 1974).*** Yoghurt is being enjoyed everywhere in the world for its beneficial properties. It is easily digestible

and has a high nutritional value ***(Hewitt and Bancroft, 1985 and Cakmakaci et al., 1993)*** and therapeutic benefits ***(Blanc, 1986 and Gilliland, 1991).*** The effects of yoghurt include reducing the risk of cancer, improving the immune response, lowering the high blood cholesterol and helping the body to assimilate protein, calcium and iron ***(Perdigeon et al., 1998 and Marona and Perdigeon, 2004).***

Bifidobacteria are gram-positive anaerobic bacteria commonly found in the intestinal tract of human and other mammals. Many Bifidobacteria containing dairy products have been developed due to their reported health promoting effects. These organisms are used to increase the beneficial properties of fermented milk, infant formulas, cheese and ice cream ***(Davidson et al., 2000; McBrearty et al., 2001 and Saaveda et al., 2004).*** From the strains used in the industry of dairy products is Bifidobacteria bifidum which is particularly suitable due to its technological properties such as tolerance to oxygen and ability to grow in milk-based media ***(Meile et al., 1997 and Janer et al., 2004).***

The quality of yoghurt in Egyptian local markets varies from shop to shop as there is no common standard for its processing. However, the general public becomes more conscious about the quality of yoghurt. Poor quality or adulterated milk, unhygienic practices associated with the involved manufacture process and the use of "wild-type" of starter culture give rise to poor quality yoghurt having only 6 – 12 hours shelf-life. Moreover, the vending alfresco and loose packed or unpacked yoghurt increase the chance of its contamination and hence deteriorate its keeping quality ***(Aziz, 1985).***

The purpose of this study was to evaluate the quality of yoghurt samples collected from the local market in some Egyptian governorates and to compare it with the manufactured yoghurt using B. bifidum during 12 days storage in a refrigerator.

Material and Methods

The present study was conducted at Dairy Science Department, Food Technology Research Institute, Agricultural Research Center, Giza.

Manufacture of yoghurt:

Fresh cow's milk was obtained from the herd of Tokh Tanbisha Farm, Faculty of Agriculture, Minufiya University. Milk was heated to 85oC for 20 minutes, then inoculated with the starter (Bifidobacteria bifidum: normal starter at a ratio of 2:1). The inoculated batch was packed in plastic cups, cooled and incubated at 40 °C for 3.0 to 3.5 hours for coagulation. The produced yoghurt was stored in a refrigerator at 6 ± 1 °C for 12 days and sampled for analysis on the same day of manufacturing (day 0) and three, six, nine and twelve days of storage period .

Collection of samples:

Yoghurt samples were randomly collected from the local market of Cairo, Giza, Gharbia and Minufiya governorates under hygienic conditions at the same day of manufacture. Twenty samples were collected from each governorate and the samples of each governorate were separately pooled, kept directly in a refrigerator at 6 ± 1 °C for 12 days and used for different analyses on days zero, three, six, nine and twelve days of storage period.

Physicochemical analysis

Total solids, pH values and titratable acidity were determined according to the methods described in ***AOAC (1995).*** Fat content was estimated by Gerber method as described by ***Pearson (1976).*** Total volatile fatty acids were determined by the method of ***Kosikowski (1984)*** and diacetyl methyl carbinol was determined according to ***Lees and Jago (1969).***

Microbiological Analysis:-

For total bacterial counts, the standard methods for examination of dairy products were followed according to ***Marth (1978).*** Coliform, yeasts and molds were counted according to the methods described by ***APHA (1992).*** Lactic acid bacilli were counted according to ***Tharmaraji and Shah (2003).***

Organoleptic Evaluation:

Ten well trained panelists from the staff members of Dairy Science Department, Food Technology Research Institute, Agricultural Research Center were selected on the basis of training and experience for the sensory evaluation. They evaluated 20 gm of the collected and manufactured yoghurt using a quality rating score card for evaluation of flavor (60 points), body and texture (30 points) and color and appearance (10 points) as described by ***Nelson and Trout (1980).***

Statistical Analysis:

The obtained data were statistically analyzed using student "t" test according to ***Steel and Torrie (1980).***

Results and Discussion

Data in Table (1) showed that pH values of the collected yoghurt from the local markets and that manufactured using B. bifidum gradually decreased, while the titratable acidity gradually increased during 12 days storage period. This may be due to fermentation of lactose as a result of an increase in the bacterial activity with subsequent increased lactic acid production as explained by ***Hofi et al. (1979).***

The results in Table (2) revealed that the content of total solids in both the collected and manufactured yoghurt decreased during the storage period. This may be attributed to addition of some stabilizers during processing of yoghurt which decrease the total solid content during storage period ***(Tamime and Deeth, 1980).*** However, the total solids content was high (16.88%) in the manufactured yoghurt using B. bifidum compared to that collected from Cairo (15.30%), Giza (15.20%), Gharbia (15.70%) and Minufiya (15.85%) markets at zero time of storage(day of manufacturing). The fat content of the collected and manufactured yoghurt slightly decreased during 12 days storage period. This result may be due to fat hydrolysis and liberation of free fatty acids from fat. Moreover, the contents of total solids and fat were in agreement with those reported by ***Abd El-Salam et al. (1996)*** who attributed the decrease in the content of total solids and fat to the hydrolysis of protein and fat, respectively, by the heat stable bacterial enzymes.

There was a slight increase in the total volatile fatty acids in the collected and manufactured yoghurt during 12 days storage period as shown in Table (3). This result may be due to the increased bacterial activity causing lipolysis via heat stable bacterial enzymes leading to an increase in the total volatile fatty acids. The content of diacetyl methyl carbinol in the manufactured yoghurt was higher than that of the collected yoghurt from the local markets (Table 3). However, the content of diacetyl methyl carbinol in both collected and manufactured yoghurt increased up to the 6^{th} day of storage and then decreased till the end of storage period (12 days).

Results given in Table (4) show the total bacterial count and lactic acid bacilli in yoghurt samples. At zero time of storage, the counts of total bacteria and lactic acid bacilli were higher in the yoghurt collected from Minufiya and Gharbia markets than that collected from Cairo and Giza markets, while the manufactured yoghurt using B. bifidum contained the least bacterial count. Moreover, the bacterial count increased during the storage period up to the 6^{th} day, then decreased till the 12^{th} day of storage period. These findings could be attributed to the use of low quality milk or unhygienic measures practiced during manufacturing of the yoghurt collected from the local markets as compared to the manufactured yoghurt using B. bifidum in the laboratory.

Concerning coliform bacterial count in yoghurt samples, the results in Table (5) revealed that the manufactured yoghurt using B. bifidum was devoid of these bacteria. The yoghurt collected from Minufiya markets contained up to 4.0 CFU/ml x 10^3 at the 12^{th} day of storage, while that collected from Cairo, Giza and Gharbia markets contained 3, 2.8 and 3.8 CFU/ml x 10^3 at the end of storage period (12 days), respectively. The presence of coliform bacteria in the collected yoghurt samples is an indication of poor quality product and unsanitary conditions during processing that lead to contamination of the product. As shown in Table (5), the yeasts and moulds were not detected in all yoghurt samples up to the 6^{th} day of storage, while these organisms were detected at the 9^{th} and the 12^{th} day of storage period.

The microbiological study clearly indicated the superiority of the manufactured yoghurt using B. bifidum than the collected yoghurt from the local markets in all Egyptian governorates. However, the yoghurt collected from Cairo and Giza markets has lesser contamination than that collected from Gharbia and Minufiya markets.

Results given in Table (6) revealed that the overall sensory evaluation scores were high (91 %) in the manufactured yoghurt using B. bifidum after 12 days of storage. The yoghurt collected from Minufiya (64%) and Gharbia (70%) markets has lower organoleptic properties as compared to that collected from Cairo (80%) and Giza (78%) markets after the same period of storage.

It could be concluded that the quality and microbiological properties of yoghurt collected from the local markets in Cairo and Giza are better than that collected from Gharbia and Minufiya markets. The manufactured yoghurt using B. bifidum has the best quality and high degree of acceptability. It is very necessary to protect yoghurt from contamination during and after its processing and great attention should be taken for the quality of milk used for the manufacture of yoghurt.

Table (1): pH and titratable acidity for the collected yoghurt samples (20gm each) and yoghurt manufactured using B. bifidum.

Collection sites	pH					Titratable acidity				
	Storage period (days)					Storage period (days)				
	Zero	3	6	9	12	Zero	3	6	9	12
Cairo	4.6	4.3	4.2	4.1	3.9	1.04	1.20	1.25	1.27	1.28
Giza	4.6	4.4	4.3	4.1	4.0	1.10	1.24	1.30	1.32	1.33
Gharbia	4.5	4.2	4.1	4.0	3.8	1.12	1.25	1.32	1.34	1.34
Minufiya	4.5	4.1	4.1	3.9	3.7	1.14	1.27	1.36	1.37	1.39
Manufactured yoghurt	4.8	4.5	4.3	4.2	4.1	0.98	1.18	1.21	1.25	1.26

Table (2): Total solids and fat contents for the collected yoghurt sample (20gm each) and yoghurt manufactured using B. bifidum.

Collection sites	Total solids content (%)					Fat content (%)				
	Storage period (days)					Storage period (days)				
	Zero	3	6	9	12	Zero	3	6	9	12
Cairo	15.30	15.25	14.80	14.28	14.09	3.4	3.4	3.3	3.1	3.0
Giza	15.20	15.20	14.85	14.31	14.00	3.4	3.4	3.3	3.1	3.1
Gharbia	15.70	15.51	15.44	15.00	14.88	3.8	3.7	3.6	3.2	3.1
Minufiya	15.85	15.65	15.50	15.20	14.92	3.9	3.8	3.7	3.3	3.2
Manufactured yoghurt	16.88	16.60	16.45	16.00	15.84	4.8	4.8	4.7	4.5	4.5

Table (3): Total volatile acids and diacetyl methyl carbinol for the collected yoghurt samples (20gm each) and yoghurt manufactured using B. bifidum.

Collection sites	Total volatile fatty acids (ml 0.1 Na^+ OH/100 g)					Diacetyl methyl carbinol (µg/100 ml)				
	Storage period (days)					Storage period (days)				
	Zero	3	6	9	12	Zero	3	6	9	12
Cairo	6.4	7.3	8.5	8.6	8.6	13.10	19.00	20.90	14.70	11.60
Giza	6.4	7.2	8.5	8.5	8.7	13.00	18.80	20.20	14.50	11.50
Gharbia	6.4	7.3	8.4	8.5	8.6	12.00	16.70	18.00	13.60	11.20
Minufiya	6.5	7.4	8.6	8.7	8.9	12.70	16.90	18.60	13.80	11.30
Manufactured yoghurt	6.4	7.4	8.6	8.9	9.1	14.20	20.20	25.70	22.20	19.80

Table (4): Total bacterial and lactic acid bacilli count of yoghurt samples (20 gm each) and yoghurt manufactured using B. bifidum. (n=3 samples)

Collection sites	Total bacterial count (CFU/ml x 10^7)					Lactic acid bacilli count (CFU/mlx10^7)				
	Storage period (days)					Storage period (days)				
	Zero	3	6	9	12	Zero	3	6	9	12
Cairo	70.50 ± 3.3 ^{b}	150.00 ± 3.6 ^{b}	220.00 ± 5.6 ^{b}	165.00 ± 6.4 ^{b}	60.00 ± 3.2 ^{b}	42.00 ± 3.6 ^{b}	105.00 ± 2.8 ^{b}	165.00 ± 4.5 ^{b}	118.50 ± 11.8 ^{b}	69.00 ± 2.5 ^{b}
Giza	79.00± 2.8 ^{b}	155.00 ± 3.9 ^{a}	240.00 ± 4.5 ^{b}	170.00 ± 12.6 ^{b}	62.00 ± 9.3 ^{a}	45.00 ± 2.4 ^{b}	110.00 ± 2.4 ^{b}	170.00± 4.6 ^{b}	130.00± 7.8 ^{a}	72.50± 3.3 ^{a}
Gharbia	85.50 ± 6.2 ^{a}	160.00 ± 4.5 ^{a}	260.00 ± 6.6 ^{a}	180.50 ± 8.5 ^{a}	70.00 ± 6.4 ^{a}	49.50 ± 5.6 ^{a}	112.00 ± 6.3 ^{a}	172.50 ± 6.6 ^{a}	135.00 ± 7.8 ^{a}	75.00 ± 3.6 ^{a}
Minufiya	90.00 ± 3.2 ^{a}	171.50 ± 8.0 ^{a}	266.00 ± 6.5 ^{a}	190.00 ± 7.6 ^{a}	76.00 ± 3.4 ^{a}	55.00 ± 8.5 ^{a}	120.00 ± 3.6 ^{a}	180.50 ± 2.5 ^{a}	138.00 ± 3.6 ^{a}	82.50 ± 1.6 ^{a}
Manu-factured yoghurt	35.00 ± 1.7 ^{c}	56.00 ± 5.5 ^{c}	71.50 ± 2.8 ^{c}	40.00 ± 1.3 ^{c}	30.00 ± 3.6 ^{c}	31.00 ± 5.2 ^{c}	34.50 ± 4.8 ^{c}	40.00 ± 2.3 ^{c}	30.50 ± 1.8 ^{c}	23.00 ± 2.6 ^{c}

Means with different letters (a, b or c) in the same column are significantly different at $P < 0.05$, while means with similar letters (a & a or b & b) are non significant.

Table (5): Coliform bacteria, yeast and mold counts of the collected yoghurt samples (20 gm each) and yoghurt manufactured using B. bifidum.

Collection sites	Coliform bacterial count (Cfu/ml x 10^3)					Yeast and mold count (Cfu/ml x10^2)				
	Storage period (days)					Storage period (days)				
	Zero	3	6	9	12	Zero	3	6	9	12
Cairo	ND	ND	ND	1.20	3.00	ND	ND	ND	60.0	118.0
Giza	ND	ND	ND	1.30	2.80	ND	ND	ND	65.5	120.8
Gharbia	ND	ND	ND	2.60	3.80	ND	ND	ND	72.5	129.7
Minufiya	ND	ND	ND	2.50	4.00	ND	ND	ND	80.9	140.60
Manufactured yoghurt	ND	ND	ND	ND	ND	ND	ND	ND	20.5	52.6

ND = Not detected.

Table (6): Organoleptic evaluation scores of the collected yoghurt samples (20 gm each) and yoghurt manufactured using B.bifidum.

Evaluation scores	Flavor (60 points)	Body & texture (30 points)	Color &appearance (10 points)	Total (%)
Collection sites				
Cairo				
After 3 days	53	25	9	87
After 6 days	52	22	8	82
After 12 days	50	22	8	80
Giza				
After 3 days	50	24	9	83
After 6 days	50	23	8	81
After 12 days	49	23	7	78
Gharbia				
After 3 days	47	22	7	76
After 6 days	46	20	7	73
After 12 days	45	19	6	70
Minufiya				
After 3 days	42	20	6	68
After 6 days	40	19	6	65
After 12 days	40	19	5	64
Manufactured Yoghurt				
After 3 days	58	28	9	95
After 6 days	58	27	9	94
After 12 days	57	26	8	91

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تقييم جودة الزبادي المجمع من السوق المحلي في بعض محافظات مصر

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الملخص العربى

أجريت هذه الدراسة بهدف تقييم جودة الزبادي الذي تم تجميعه من السوق المحلي فى محافظات القاهرة ، الجيزة ، الغربية والمنوفية ومقارنته بالزبادي المصنع باستخدام بكتيريا البيفدو (Bifidobacteria bifidum). وتم تعيين الخواص الفيزيائية ، الكيميائية ، الميكروبية والحسية لعينات الزبادي أثناء الحفظ لفترة ١٢ يوم في الثلاجة . وأظهرت النتائج أن الزبادي الذي تم تجميعه من أسواق القاهرة والجيزة يحتوي على نسبة أقل من المواد الصلبة الكلية والدهن عن الزبادي المجمع من أسواق الغربية والمنوفية مقارنة بالزبادي المصنع باستخدام بكتيريا البيفدو . وأظهر الفحص الميكروبي أن العد الكلي للبكتيريا كان أقل في الزبادي المجمع من أسواق القاهرة والجيزة عن المجمع من أسواق الغربية والمنوفية . وكانت كل عينات الزبادي المجمعة من الأسواق خالية من بكتيريا الكولي فورم والفطريات والخمائر حتى اليوم السادس من الحفظ، ، بينما احتوت على هذه الميكروبات بنسبة قليلة في اليوم التاسع والثاني عشر من الحفظ . وكان تقييم الخواص الحسية للزبادي المجمع من أسواق القاهرة والجيزة أعلى جودة وأكثر قبولاً من الزبادي المجمع من أسواق الغربية والمنوفية ، وكان الزبادي المصنع باستخدام بكتيريا البيفدو هو الأعلى في الجودة ودرجة القبول عن الزبادى المجمع من كل الأسواق .