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THE QUALITY OF YOGHURT ON RETAIL SALE AND ATTEMPTS TO IMPROVE ITS CONSISTENCY BY USING SOME FUNCTIONAL ADDITIVES

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ABSTRACT

Analysis of market plain yoghurt revealed that the fat content varied between 3.2 and 4.2%, whereas the range of the SNF was 9.1-11. 6 % for full-fat yoghurt. The recorded acidity values were 0.95% as a minimum and 1.25% as a maximum, whereas the corresponding pH values were 4.17 and 4.54, respectively. The percentages of curd syneresis ranged from 19.0 to 33.8. Only the two brands represented non-fat yoghurt had the SNF values of 12.25 and 12.88 %, acidity values of 1.11 and 1.15 %, pH of 4.47 and 4.32 and percentages of syneresis were 30.1 and 38.1.

Results of the prepared full-fat yoghurt showed that using milk protein concentrate (MPC) instead of skim milk powder (SMP) greatly decreased the degree of curd syneresis and improved consistency of the product, whereas using MPC with SMP improved properties of non-fat yoghurt. In all cases more improvement was achieved when stabilizer was added to the yoghurt mix.

Such improvement was recorded during storage of all yoghurt samples since curd syneresis, acidity development and the organoleptic properties were slightly changed.

INTRODUCTION

The continuous market growth of yoghurt and the related types in Egypt is primarily attributed to awarance of the consumers with the nutritive value of such products as well as applying sanitary conditions in the modern dairy plants. However, the quality of yoghurt is governed by a multitude of factors (Tamime and Robinson, 1985; Robinson and Tamime, 1986 a,b). For example, the rheological properties are directly affected by the chemical composition of the yoghurt milk, the different additives, the processing conditions and the viscous strains of the yoghurt culture.

Factors associated with the microbiological quality of yoghurt may include the bacteriological quality of raw materials, sanitary conditions in the processing plant, purity of the starter culture and post-fermentation contaimination of the product.

The handling conditions during storage, transport and distribution in the retail chain can affect – in general – the quality and shelf – life of yoghurt (Tamime et al. 1987).

On the other hand, whey separation or syneresis is a common defect in yoghurt. Lucey and Singh (1998) reviewed the possible causes of such defect, which included very high incubation temperature, excessive heat treatment of yoghurt mix, rapid rate of acidification, low-total solids content, movement or agitation during or just after gel formation, very low acid production and using containers with sloping walls or an excessive height to

width ratio. However, it was reported that yoghurt manufacturers try to prevent whey separation by increasing the total solids content of milk and or by adding stabilizers (Guinee et al., 1995; Lucey and Singh 1998).

Adding skim milk powder with a level of 3-4% is widely used in this respect, since the addition of higher levels may lead to a powdery taste (Tamime and Robinson, 1985). However, there is a need for functional dairy ingredients for the production of high-quality yoghurt. Therefore the objective of the current study was to follow quality and syneretic properties of full-fat and non-fat yoghurt produced using commercial blend of milk proteins with and without the addition of stabilizing agents.

MATERIALS AND METHODS

A total number of 40 samples representing 8 brands of full-fat and non-fat yoghurt were collected from the local market (5 samples from each brand).

The procedure of Tamime and Robinson (1985) was followed for making the experimental yoghurt. In this respect full-fat fresh cow's milk (FFFCM) of 3.5% fat and non-fat fresh cow's milk (NFFCM) of 0.3% fat were used with and without using skim milk powder (SMP), being imported from Arla Foods Ingredients AB (Sweden), Sup'R Mix 50.3 and a stabilizer FA 502.

Sup'R Mix 50.3 is a commercial name of a spray dried protein blend of dairy origin especially developed by Eurial Poitouraine (France) for yoghurt. As given in the specification sheet it contains protein on total matter 50% (min.), milk fat 1.5% (max.), lactose 37.5%, ash 6% (max.) and moisture 5% (max.).

A meyoprogen stabilizer FA 502 containing agar-agar (Ag-Ag), carrageenan (Carr.) and locust bean gum (LBG) with unknown balanced ratios was obtained from Mehyhall Chemical AG, Kreuzlingen, Switzerland. Their functions are gelling agents for Ag-Ag, gelling agent, thickener and stabilizer for Carr. and thickener only for LBG (Trudso, 1991).

In all cases DVS yoghurt culture (YC-XII) from Chr. Hansen's Lab. (Denmark) was used.

In the first seven treatments FFFCM was divided into equal portions (2 Kg for each) to represent the following treatments: Milk +3% SMP (T_1), Milk +2% Sup'R Mix without (T_2) and with adding 0.15%, (T_3) or 0.2% stabilizer (T_4), Milk +2.5% Sup'R Mix without (T_5) and with adding 0.15% (T_6) or 0.2% stabilizer (T_7).

For making non-fat yoghurt, NFFCM was divided into equal portions (2 Kg for each) to represent the following treatments: Milk + 5 % SMP (T8), Milk + 3 % SMP + 1.5 % Sup'R Mix (T9); Milk + 2.5 % SMP + 2 % Sup'R Mix without (T10) and with adding 0.15 % (T11) or 0.2 % (T12) stabilizer.

For chemical analysis, the total solids content was measured by drying oven method at 120 °C for 3h., the fat, titratable acidity and pH were determined as given in AOAC (1990). Yoghurt curd syneresis at 40 °C for one h. was measured as given by Mehanna and Mehanna (1989) and the data were expressed as percentages.

The prepared yoghurt samples were organoleptically evaluated by 10 panelists as recommended by El-Shibiny *et al.* (1979).

RESULTS AND DISCUSSION

Table (1) reveals that the fat content in the full-fat yoghurt (FFY) samples collected from the local market was a minimum in Juhayna samples (3.2%) and was a maximum in Yoplait and Enjoy samples (4.2%). The values of SNF were 9.1% as a minimum (Yoplait) and 10.6% as a maximum (Enjoy). All these values are in agreement with the legal values of fat and SNF in the Egyptian Standards No 1000/1990 namely not less than 3 and 8.5%, respectively, in FFY made from cow's milk.

The light yoghurt samples produced by Juhayna had the values of 1.8% for fat and 13.5 % for SNF which are in agreement with those given in the Egyptian Standards No. 1000/1990, being not less than 1.5 and 9 % respectively.

Nestle and Labanita brands had non-fat yoghurt(NFY) with 0.05 and 0.5% values for fat and 12.25 and 12.88% for SNF, respectively. Such values of SNF were much higher than the level of 9.5% given in the Egyptian Standards No 1000/1990 for NFY.

The less acidity value (0.95%) was recorded in Yoplait and Enjoy FFY samples and the maximum value (1.25%) was measured in Labanita brand samples. However, all the recorded values were less than the maximum value (1.5%) given in the Egyptian Standards No. 1000/1990. The recorded values of pH were 4.17 as a minimum in FFY of Juhayna and 4.54 as a maximum in the corresponding Enjoy samples

Table (1): Chemical analysis and curd syneresis of some plain yoghurt samples collected from the local market. Values between parenthesis represent data from labels of the containers.

Brand	Fat (%)	SNF* (%)	Acidity (%)	pH	Syneresis (%)	SMP** Added (%)	Stabilizer added (%)
Juhayna	3.2	11.6	1.15	4.17	19.0	-	-
	(3.5)	(8.5)	-	-	-	(25)	-
Juhayna	1.8	13.5	1.10	4.41	20.1	-	-
	(1.5)	(9.0)	-	-	-	(25)	-
Nestle	3.4	10.9	1.07	4.48	24.2	-	-
	(>3)	(>8.5)	-	-	-	(11)	(0.45)
Nestle	0.05	12.25	1.11	4.47	30.1	-	-
	(0.03)	(>9.5)	-	-	-	(100)	(0.5)
Labanita	4.0	10.5	1.25	4.18	33.8	-	-
	(3.5)	(8.5)	-	-	-	(1.5)	-
Labanita	0.5	12.88	1.15	4.32	38.1	-	-
	-	(>9.5)	-	-	-	(1.5)	NRV***
Yoplait	4.2	9.1	0.95	4.39	27.5	-	-
	(3.5)	(8.5)	-	-	-	(3)	-
Enjoy	4.2	10.6	0.95	4.54	24.8	-	-
	(>3)	(>8.5)	-	-	-	(3)	(1.5)

* Solids not-fat (SNF) = Total solids – Fat.
** SMP = Skim milk powder.
*** NRV = Not recorded values.

From data in Table (1), it might be concluded that yoghurt samples of Labanita characterized with a higher rate of syneresis being 33.8 and 38.1% in case of FFY and NFY, respectively. Much less syneresis was recorded for Juhayna samples, being 19.0 and 20.1% in order.

Data recorded on the labels of the containers (In parenthesis, Table 1) revealed that in all the brands SMP was added with the highest value in Juhayna (25%) and the lowest one (1.5%) in Labanita. The NFY of Nestle was completely made from SMP. Addition of stabilizer was given only in some brands.

Such variation in composition and quality of market yoghurt might give an explanation for differences in consumer acceptability which mainly depends on acidity of the product, rate of curd syneresis, body and texture and degree of the powdery taste as a result of using SMP.

Table (2) shows the percentages of syneresis of the prepared fresh yoghurt as affected by the applied treatments. In case of FFY, the maximum syneresis of 34.86% was obtained when made by using SMP (T_1). Such value was decreased when milk protein concentrates (MPC) was used and the greatest decrease was achieved when MPC and stabilizer were applied. Thus, the best values of 16.73 and 15.60% (T_6 and T_7) were recorded when MPC was added at the rate of 2.5% with adding 0.15 and 0.2% stabilizer in order.

Table (2): The percentages of syneresis at 40°C for 1h and scoring of the organoleptic properties of the fresh yoghurt prepared from full-fat cow's milk (T_1-T_7) and from non-fat cow's milk (T_8-T_{12}).

Property	Treatments (T)*											
	1	2	3	4	5	6	7	8	9	10	11	12
Syneresis, %.	34.86	24.66	18.99	17.95	21.98	16.73	15.60	63.0	51.33	37.1	18.2	14.8
Flavour (60)**												
Acid (10)	9	10	10	10	10	10	10	7	8	8	9	9
Bitterness (10)	10	10	10	10	10	10	10	10	10	10	10	10
Flat (10)	9	9	9	9	9	9	9	7	8	8	8	8
Foreign (10)	10	10	10	10	10	10	10	10	10	10	10	10
Unclean (10)	10	10	10	10	10	10	10	10	10	10	10	10
Cooked (10)	10	10	10	10	10	10	10	10	10	10	10	10
Appearance (10)												
Slime (5)	5	5	5	5	5	5	5	5	5	5	5	5
Colour (5)	4	5	5	5	5	5	5	3	4	4	4	4
Consistency(30)												
Wheying-off(10)	8	9	9	9	9	10	10	5	6	8	9	9
Firmness(10)	8	8	9	9	9	10	10	5	8	8	9	9
Smoothness(10)	8	9	9	9	9	9	9	7	8	8	8	8
Total (100)	91	95	96	96	96	98	98	79	87	89	92	92

* Milk + 3% SMP (T_1), milk + 2% Sup'R Mix without (T_2) and with adding 0.15% (T_3) or 0.2% (T_4) stabilizer, milk + 2.5% Sup'R Mix without (T_5) and with adding 0.15% (T_6) or 0.2% (T_7) stabilizer. Milk + 5% SMP (T_8), milk + 3% SMP + 1.5% Sup'R Mix (T_9), milk + 2.5% SMP + 2% Sup'R Mix without (T_{10}) and with adding 0.15% (T_{11}) or 0.2% (T_{12}) stabilizer.

** Values between parenthesis represent the maximum attainable points.

Non-fat yoghurt (Table 2) characterized with great syneresis (63.0%) when made from fresh skim milk and SMP (T8). The different combinations between SMP and MPC decreased syneresis to be 51.33 (T_9) and 37.1% (T_{10}). The best results in this respect was achieved when stabilizer was used at the rate of 0.15% (T_{11}) or 0.2% (T_{12}).

Concerning the organoleptic properties (Table 2), adding MPC and stabilizer improved consistency of both FFY and NFY which reflected on the total score of the product.

The foregoing results suggested that the best quality yoghurt was achieved from T_6 and T_7 for FFY and T_{11} and T_{12} for NFY. Such treated yoghurt samples were stored in refrigerator (4±1°C) for 15 days to follow the quality during storage.

Table (3) shows that in all treated yoghurt the acidity slightly increased and the pH slightly decreased during the storage. The percentages of syneresis in FFY gradually increased with a lower rate in T_7. The recorded values were 16.73, 19.53 and 21.3% for T_6 and 15.6, 16.3 and 16.8% for T_7 during storage for zero, 7 and 15 days respectively. In case of NFY the values for T_{11} were 18.2, 18.93 and 20.0% and for T_{12} were 14.8, 16.66 and 15.9% in order.

Table (3): Some properties of full-fat yoghurt (T_6, T_7) and non-fat yoghurt (T_{11}, T_{12}) during storage at 4±1°C for 15 days.

Property	Treatments (T)*			
	6	7	11	12
Fresh yoghurt				
Acidity, %	0.84	0.83	1.0	1.0
pH	4.60	4.66	4.64	4.60
Syneresis, %	16.73	15.60	18.2	14.8
Flavour (60)*	59	59	57	57
Appearance(10)	10	10	9	9
Consistency(30)	29	29	26	26
7days old yoghurt				
Acidity, %	0.88	0.86	1.18	1.18
pH	4.46	4.48	4.56	4.54
Syneresis, %	19.53	16.30	18.93	16.66
Flavour (60)	58	58	55	55
Appearance(10)	9	10	8	9
Consistency(30)	28	28	23	25
15 days old yoghurt				
Acidity, %	0.92	0.92	1.22	1.26
pH	4.4	4.4	4.50	4.50
Syneresis, %	21.30	16.80	20.0	15.90
Flavour (60)*	56	56	53	53
Appearance(10)	8	9	8	8
Consistency(30)	26	27	21	24

- **See legend to Table (2) for details.**

Such syneresis values were reflected on the appearance and consistency when the organoleptic properties of yoghurt were evaluated. Thus, their corresponding scoring was slightly decreased during storage (Table 3).

In general, the present results are in agreement with those given by Guinee *et al.* (1995), who tested the stabilizing effect of different dairy ingredients on the physical properties of yoghurt and by El-Sheikh (2001) who recommended using whey protein concentrate (WPC) instead of SMP in making yoghurt. Concerning NFY, Mistry and Hassan (1992) successfully used high milk protein powder in making yoghurt, whereas Morris *et al.* (1995) found that yoghurt contained WPC syneresed significantly less than yoghurt fortified with SMP.

The improving effect of MPC is mainly due to its functions rather than its effect on increasing the TS content. In this respect, deWit (1998) and *Korhonen et al.* (1998)
reviewed the functional characteristics of whey proteins, whereas Fox (2001) revealed importances of milk proteins as food ingredient

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دراسة على جودة اليوجورت في السوق المحلى ومحاولة تحسين قـــوام المنتـــج باستخدام بعض الإضافات الوظيفية

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أوضحت نتائج تحليل عدد ٤٠ عينة لليوجورت المنتج محليا والممثلة للعديد مـــن المصانع الحديثة أن محتوى العينات من الدهن تراوح ما بين ٣,٢ ، ٤,٢% ومن الجوامـــد اللبنية غير الدهنية ما بين ٩,١ ، ١١,٦% وذلك فى حالة اليوجورت كامل الدسم فى حيـــن تراوحت قيم الحموضة ما بين ٠,٩٥ ، ١,٢٥% وقيم الرقم الهيدروجينى ما بيـــن ٤,١٧ ، ٤,٥٤. أما النسب المئوية للشرش المنفصل من الخثرة على ٤٠°م لمدة ساعة فتراوحت ما بين ١٩، ٣٣,٨%. هذا ومن بين المصانع المنتجة كانت فقط عينات نسلة ولبنيتـــا ممثلـــة لليوجورت خالى الدسم بنسب جوامد لبنية غير دهنية ١٢,٢٥ ، ١٢,٨٨% على التوالى فى حين كانت حموضتهما ١,١١، ١,١٥% والرقـــم الـــهيدروجينى لـــهما ٤,٤٧ ، ٤,٣٢ وطرد الشرش ٣٠,١ ، ٨,١% على التوالى.
أما عن اليوجورت المحضر معمليا فلقد أوضحت النتائج أن استخدام مركزات بروتين اللبن بدلا من اللبن الفرز المجفف قلل كثيرا من طرد الشرش من خثرة اليوجورت كامل الدســـم فى حين كان لإستخدام هذه المركزات مع اللبن الفرز المجفف نفـــس التـــأثير فـــى حالـــة اليوجورت خالى الدسم وفى كل الأحوال أدت الإضافات المذكورة إلى تحسن واضح فـــى قوام وتركيب اليوجورت وإزداد هذا التحسن بإستخدام المثبت. هذا ولقد استمر هذا التحسن خلال تخزين اليوجورت لمدة ١٥ يوما على حرارة ٤±١°م حيث زادت قليلا قيم الحموضة وطرد الشرش وانخفضت قليلا نقاط التحكيم المعطاه لقوام وتركيب اليوجـــورت ممـــا أدى لجودة عالية أيضا لليوجورت خلال فترة الصلاحية.