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EFFECT OF TWO TYPES OF FAT REPLACERS ON THE QUALITY PROPERTIES OF LOW-FAT PROBIOTIC YOGHURT

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ABSTRACT : The influence of different levels of both simplesse and Novagel on the quality of low fat probiotic yoghurt production was investigated. Simplesse and Novagel were added to milk containing 1% milk fat at levels of 0.1, 0.2, 0.3, 0.4 and 0.5%. 2% of yoghurt starter and probiotic culture (1 : 1) were added to both experimental yoghurts and control yogurt produced from milk containing 3% milk fat. Results showed that addition of fat repalcers did not significantly affect the chemical composition, pH, and titratable acidity and increased the soluble nitrogenous compounds, formation of acetaldehyde, diacetyl and volatile fatty acids contents. Addition of fat replacers showed rheological improvements in the low-fat yoghurt, they reduced product syneresis and increased the viscosity properties so that their quality characteristics were similar to control yoghurt. With respect to the organoleptic quality of experimental yoghurts, both simplesse and Novagel addition caused an increase in orgnaoleptic scores; the control yoghurt had the highest score, and the lowest score was obtained in yoghurt samples containing 0.5% of simplesse and Novagel. Overall, the yoghurt containing 0.2% of Novagel was similar in quality characteristics to control yoghurt made with 3% fat. The effect of carbohydrate-based fat replacer Novagel on the organoleptic quality and rheological properties of yoghurt was more pronounced than simplesse.

Key words : Fat replacers, probiotic, simplesse, novagel, organoleptic, rheological.

INTRODUCTION

Yoghurt is the most popular fermented dairy product in Egypt and worldwide. The importance of yoghurt in human diet is determined by its nutritive value and health effects (Rasic and Kurman, 1998; Buttriss, 1997). Many health benefits have been attributed to yoghurt such as improved lactose tolerance, protection against gastrointestinal improved immunity, cholesterol reduction and protection against cancer (Agerback *et al.* 1995 and Buttriss, 1997).

During the last few decades low calorie foods have been recommended for limit caloric intake from fat not more than 30% of total calories to reduce the risk of cancer (A.C.S, 1984) or heart diseases (A.H.A, 1986).

Reduced fat dairy products are the most widely consumed as low fat foods which have some nutritional and economic advantages.

Several investigators have tried to produce several low fat dairy products with acceptable quality by incorporating certain additives (e.g. various fat mimetics e.g. sucrose polyester (olestra), microparticulated protein-based fat substitute (simplesse), carbohydrate-based fat replacer (Novagel), emulsifying agent (soy lecithin) and whey protein concentrate (Kjaergard *et al.* 1987; Bernhardt, 1988 and Anonymous, 1990).

The comparison of different types of fat mimetics on probiotic yoghurt have not been reported. Therefore, the objective of this study is to produce a probitoic low fat yoghurt with improved quality by using two types of fat mimetics and probiotic bacteria.

MATERIALS AND METHODS

Milk

Fresh whole buffaloe's milk was obtained from Dairy Technology Unit, Food Science Department, Faculty Agric. Zagazig Univ.

Starter Cultures

Streptococcus salivarius subsp. *thermophilus* EMCC104 and *Lactobacillus delbrueckii* subsp. *bulgaricus* EMCC1102 were obtained from (The Microbiological Resources Center (MIRCEN), Faculty of Agric. Ain Shams Univ., Egypt).

Probiotic Cultures

Lactobacillus acidophilus La5, *Bifidobacterium bifidium* (D1) and *Bifidobacterium lactis*

Bb12 were obtained from Chr. Hansen, Copenhagen, Denmark.

Fat Replacers

Two types of fat replacers have been used in the manufacture of set type yoghurt :

1. Protein-based fat replacer Simplesse $^{(R)}$100" consists of microparticulated whey protein concentrate was obtained from the Nutra Sweet Company, California, USA.
2. Carbohydrate – based fat replacer "Novagel $^{(Tm)}$ CAN-15" blend of microcrystalline cellulose plus guar gum was obtained from FMC Crop, Philadelphia, PA.

Manufacture of Probiotic Yoghurt

Fresh bulk buffaloe's milk was standardized to 3 and 1% fat. Milk containing 3% fat was used in the preparation of yoghurt and served as control. Low fat buffaloe's milk having 1% fat was divided into two main parts. The first part was divided into 6 portions. The first portion was left without additive. Simplesse was added to the other five portions at the rate of 0.1, 0.2, 0.3, 0.4 and 0.5%. The second part of low milk fat (1%) was also divided into 6 portions. The first portion was left without additive. Novagel was added to the other five portions of milk at the same rate as in the first part. Both control milk and low fat milk containing different level of both simplesse and Novagel were heated to 90° C for 15 min. Milk was cooled to 42 ± 1 °C, inoculated with 2% of mixed (1:1) of yoghurt starter cultures and probiotic cultures, packed in plastic cups and inocubated at 42°C untile a uniform coagulation was obtained. The probiotic yoghurt samples from all batches were stored at 6 ± 1 °C and analysed after at 1, 3, 6 and 12 days of storage. This experiment was triplicated.

Methods of Analysis

Chemical composition

Probiotic yoghurt was chemically analysed for total solids, fat, titratable acidity and pH value as described by Ling (1963). Total and soluble nitrogen percentages of yoghurt were determined by semi-micro Kjeldahel method as described in the AOAC (1980).

Flavour compounds

Acetaldehyde and diacetyle in yoghurt treatments were determined as described by Less and Jago (1969). Acetaldehyde reacts with semi-carbazide to form semi-carbazone which has absorption value at wave length of 224 nm meanwhile diacetyle has an absorption value at wave length of 270 nm.

Total volatile fatty acids (T.V.F.A.) of probiotic yoghurt were estimated according to Kosikowski (1978).

Rheological measurements

Syneresis

The released whey in yoghurt sample was measured according to the method of Aryana (2003). The quantity of whey collected from 100 gm of yoghurt in graduated cylinder after 2 h of drainage at 20 °C was used as index of syneresis.

Viscosity

Viscosity of yoghurt samples was determined by the method of Aryana (2003) using Rotational Viscometer Type Lab. Line Model 5437. Results were expressed as CPS.

Sensory Evaluation

Probiotic yoghurt samples were organoleptically examined after refrigerated storage for 1, 3, 6 and 12 days according to (Hamdy *et al.* 1972).

Statistical Analysis

Statistical analysis for the obtained data was carried out according to the methods described by Clarke and Kempson (1997). Experiments were repeated in triplicates and each analysis in duplicates and average results were tabulated.

RESULTS AND DISCUSSION

Chemical Composition

Table 1 showed that low fat probiotic yoghurt made with added either Simplesse or Novagel had slightly lower total solids (TS). This decrease in TS was due to the fat separation from milk yoghurt treatments. The TS content of low fat probiotic yoghurt fortified with fat replacers e.g. Simplesse (R) 100 and Novagel (Tm) slightly increased gradually by increasing the percentage added. However, the TS content of yoghurt from all treatments slightly increased during the storage period similar results were reported by Abd El-Salam *et al.* (1996), Omar and Abou El-Nour (1998), Kebary and Hussein (1999) and Hussein *et al.* (2004). The protein-based fat replacer (Simplesse) had the same

Table 1. Chemical composition of low fat probiotic yoghurt fortified with fat replacer.

Yoghurt sample	Total solids%				Total protein %				Fat %			
	Storage period (days)				Storage period (days)				Storage period (days)			
	1	3	6	12	1	3	6	12	1	3	6	12
						Simplesse						
C1	11.50	12.10	12.61	13.06	3.49	3.67	3.82	4.12	3.10	3.10	3.10	3.10
C2	9.91	10.65	11.10	11.42	3.75	4.02	4.20	4.32	1.10	1.10	1.20	1.2
T1	10.01	10.75	11.18	11.44	3.79	4.07	4.24	4.33	1.10	1.10	1.20	1.20
T2	10.11	10.82	11.26	11.48	3.83	4.10	4.26	4.35	1.10	1.10	1.20	1.20
T3	10.22	10.90	11.38	11.56	3.88	4.14	4.32	4.39	1.10	1.10	1.20	1.20
T4	10.35	11.02	11.50	11.67	3.94	4.19	4.37	4.44	1.10	1.10	1.20	1.20
T5	10.44	11.10	11.71	11.88	3.98	4.22	4.46	4.52	1.10	1.10	1.20	1.20
L.S.D	0.319	0.0665	0.2739	0.0210	0.0210	0.0210	0.0201	0.0201	0.0210	0.210	0.210	0.210
						Novagel						
C1	11.75	12.24	12.81	13.31	3.57	3.71	3.89	4.04	3.20	3.30	3.30	3.40
C2	10.11	10.78	11.31	11.76	3.82	4.07	4.27	4.44	1.20	1.20	1.30	1.30
T1	10.23	10.98	11.34	11.80	3.81	4.13	4.27	4.44	1.20	1.20	1.30	1.30
T2	10.35	11.02	11.43	11.86	3.89	4.21	4.29	4.45	1.20	1.20	1.30	1.30
T3	10.48	11.08	11.54	11.96	3.93	4.16	4.29	4.48	1.20	1.20	1.30	1.30
T4	10.61	11.12	11.63	12.04	3.97	4.16	4.34	4.50	1.20	1.20	1.35	1.35
T5	10.71	11.20	11.80	12.20	4.00	4.18	4.40	4.55	1.20	1.20	1.35	1.35
L.S.D	0.0664	.0664	0.0939	0.0664	0.0210	0.0210	0.0210	0.0210	0.0210	0.0210	.0210	0.0201

- Each value in the Table is the mean of three riplicates.
- C1, C2 = Control probiotic yoghurt from buffaloe's milk containing 3, 1 fat resp.
- T1, T2, T3, T4 and T5 : probiotic yoghurt made from low fat buffaloe's milk fortified with fat replacer at the rate of 0.1, 0.2, 0.3, 0.4 and 0.5% resp.

L.S.D : Least significant difference. Significant at 0.05 level. N.S. : Not significant.

effect of carbohydrate-based fat replacer (Novagel) on the TS content of low fat probiotic yoghurt treatments.

The same Table 1 showed that the lowering fat content in low fat yoghurt milks slightly increased the total protein in (C_2) about the full fat yoghurt (C_1). The total protein of low fat probiotic yoghurt fortified with fat replacers slightly increased by increasing the percentage of added fat replacers especially when the protein-based fat replacer (Simplesse) was used. On the other hand, the total protein of all treatments was not significantly changed throughout the storage periods. Similar results was obtained by (Barrantes *et al.*, 1994, Kebary and Hussein, 1999 and Mehana *et al.* 2000).

The obtained results also showed that the fortification of low fat milk with any fat replacers did not affect the fat content of the resultant yoghurt. The fat content of all treatments was not changed as storage period proceeded.

The rate of proteolysis expressed as SN/TN % was given in Table 2. The rate of proteolysis slightly decreaseed in low fat probiotic yoghurt. This result agrees with data of Mehanna *et al.* (2000). However, yoghurt treatments fortified with Simplesse gradually increased this parameter with increasing the percentage of Simplesse added and during the storage period (Omar and Ahou El-Nour, 1998 and Zedan *et al.* 2001). Fortification of low fat milks with Novagel was less effective on the proteolysis of the resultant yoghurts. During storage, the proteolysis increased in all treatments, this may be due to the limited proteolysis of milk protein protenases produced by lactic acid bacteria (Rasic and Kurmann, 1978a). These results are in agreement with those reported by Kebary and Hussein (1999) and Hussein *et al.* (2004).

Slightly differences were observed in acidity of probiotic yoghurt from different treatments. Reduced fat slightly increased acidity but fortification of yoghurt milk with fat replacers (Simplesse or Novagel) with different concentration did not affect in this respect Table 2. Changes in pH values of yoghurt containing fat replacers followed almost opposite trend to acidity during storage period Table 2. These results are in agreement with those reported by Kebary and Hussein (1999), Zedan *et al.* (2001), Kebary *et al.* (2004) and Hussein *et al.* (2004).

Table 2. Proteolysis, Titratable acidity% and pH value of low fat probiotic yoghurt fortified with fat replacers.

Yoghurt sample	SN/TN%				Titratable acidity%				pH value			
	Storage period (days)				Storage period (days)				Storage period (days)			
	1	3	6	12	1	3	6	12	1	3	6	12
						Simplesse						
C1	5.88	7.18	7.38	7.93	0.90	0.91	0.93	0.96	4.43	4.27	4.10	3.96
C2	4.32	5.08	5.42	5.78	0.92	0.95	0.97	1.10	4.37	3.99	3.96	3.72
T1	4.73	5.40	5.97	6.56	0.92	0.95	0.97	1.10	4.37	3.99	3.96	3.72
T2	5.46	6.19	6.80	7.49	0.92	0.95	0.97	1.10	4.37	3.99	3.96	3.72
T3	6.36	7.28	7.65	8.71	0.92	0.95	0.96	1.10	4.37	3.99	3.96	3.72
T4	7.88	8.22	8.42	9.20	0.92	0.95	0.97	1.10	4.37	3.99	3.96	3.72
T5	8.14	8.79	9.26	10.05	0.92	0.95	0.97	1.10	4.37	3.99	3.96	3.72
L.S.D	0.5101	0.4460	0.4320	0.5201	0.0210	0.0210	0.0210	0.1329	0.0210	0.0210	0.0664	0.1329
						Novagel						
C1	5.99	7.31	7.41	8.00	0.89	0.92	0.93	0.96	4.44	4.28	4.10	3.96
C2	4.45	5.10	5.46	5.66	0.91	0.95	0.97	1.10	4.38	3.99	3.91	3.47
T1	4.45	5.14	5.52	5.70	0.91	0.94	0.96	1.10	4.38	4.08	3.91	3.72
T2	4.58	5.20	5.58	5.80	0.91	0.94	0.96	1.10	4.38	4.08	3.96	3.72
T3	4.60	5.24	5.58	5.82	0.91	0.94	0.96	1.10	4.38	3.99	3.96	3.72
T4	4.75	5.26	5.60	5.82	0.91	0.95	.97	1.10	4.38	3.99	3.96	3.72
T5	4.75	5.28	5.62	5.84	0.91	0.95	0.96	1.10	4.38	3.99	3.96	3.72
L.S.D	0.2040	0.2040	0.2701	0.2280	0.0210	N.S	N.S	0.1329	N.S	0.0210	0.0664	N.S

- Each value in the Table is the mean of three riplicates.
- C1, C2 = Control probiotic yoghurt from buffaloe's milk containing 3, 1 fat resp.
- T1, T2, T3, T4 and T5 : probiotic yoghurt made from low fat buffaloe's milk fortified with fat replacer at the rate of 0.1, 0.2, 0.3, 0.4 and 0.5% resp.

L.S.D : Least significant difference. Significant at 0.05 level. N.S. : Not significant.

Flavour Compounds

Some flavour compounds of yoghurt treatments were assessed by the determination of some volatile compounds e.g. acetaldehyde, diacetyle and total volatile fatty acids (T.V.F.A.) which have been reported as flavour contributers in yoghurt (Tamine and Deeth, 1980). It is evident from Table 3 that, decreasing the fat content in yoghurt treatments significantly decreased these flavour compounds than in full fat yoghurt fortification of probiotic yoghurt with fat replacers (Simplesse or Novagel). Addition of fat replacers at higher levels slightly affected the formation of these compounds. In addition, the concentration of acetaldehyde values decreased during the storage period. Also, the level of diacetyle increased until 3 days of storage, then it decreased until the end of storage. This may be due to transformation of both acetaldehyde and diacetyle to acetone. Similar results have been reported by Laye *et al.* (1993) and Zedan *et al.* (2001).

The same table illustrate that total volatile fatty acids (T.V.F.A.) increased in all treatments of low fat probiotic yoghurt and during storage periods. It could be attributed to proteolytic and lipolytic action of yoghurt starter cultures during making and storage of yoghurt (Rasic and Kurmann, 1978, Bourioux and Pochart, 1998 and Mehanna *et al.* 2000). However, addition of Simplesse was more affective than Novagel in this respect. This effect may be due to higher proteolysis in Simplesse treatments which stimulate the lipolitic activity of LAB in yoghurt treatments.

Rheologicla Properties

Syneresis

The syneresis values were presented in Fig. 1 and 2. Separation of whey increased by decreasing the fat content in yoghurt but fortification of yoghurt with fat replacers (Simplesse or Novagel) significantly reduced whey syneresis compared with low fat yoghurt without additives and the rate of whey reduction was proportional to the concentration level of added fat replacers Figs 1 and 2. Similar results were reported by Kebary and Hussein (1999), Omar and Abou El-Nour (1998). These results might be due to increasing the water holding capacity brought by fat replacers in the resultant yoghurt and reduced the ability to syneresis. Separation of

Table 3. Flavour compounds of low fat probiotic yoghurt fortified with fat replacer.

Yoghurt sample	Acetaldehyde (µg/100ml) Storage period (days)				Diacetyle (µg/100ml) Storage period (days)				Total volatile fatty acids (ml 0.1 N NaOH /100g) Storage period (days)			
	1	3	6	12	1	3	6	12	1	3	6	12
Simplesse												
C1	29.50	29.00	26.50	25.00	59.00	67.00	53.00	52.00	6.50	8.70	9.80	11.18
C2	24.00	23.00	21.00	19.0	42.00	46.00	45.00	41.00	2.30	3.20	4.10	4.62
T1	24.00	23.00	21.00	19.00	42.00	47.00	43.00	41.00	2.58	3.60	5.24	6.40
T2	24.00	23.00	21.00	19.00	43.00	47.00	43.00	42.00	2.80	41.12	5.40	6.50
T3	24.00	23.0	21.00	20.00	43.00	47.00	44.00	43.00	3.10	4.58	5.94	6.92
T4	25.00	24.00	22.00	20.00	44.00	47.00	44.00	43.00	3.60	5.20	6.68	7.66
T5	25.00	24.00	22.00	20.00	44.00	47.00	43.00	42.00	3.62	5.26	6.70	7.70
L.S.D	0.5559	0.6232	0.3186	0.4698	0.0210	0.7458	2.782	2.091	0.2201	0.2660	0.6021	0.5210
Novagel												
C1	25.00	23.00	22.00	20.00	56.00	64.00	47.00	46.50	6.90	9.14	10.30	11.54
C2	19.00	19.00	15.50	15.00	38.00	43.00	36.50	36.00	2.52	3.22	3.88	4.20
T1	18.50	18.0	17.00	16.00	38.00	42.00	37.00	37.00	2.60	3.40	4.08	4.64
T2	18.00	17.50	17.00	16.50	39.00	43.00	39.0	38.00	2.76	3.50	4.28	4.86
T3	19.00	18.00	17.00	16.00	40.00	43.00	39.00	38.00	2.94	3.78	4.48	5.06
T4	19.00	18.50	18.00	17.00	40.00	45.00	39.00	38.00	3.30	4.12	4.82	5.32
T5	19.00	18.50	18.00	17.00	40.00	45.00	39.00	38.00	3.40	4.20	4.90	5.34
L.S.D	0.4698	0.5590	1.704	0.7458	0.0210	0.3388	1.757	3.065	0.2120	0.6610	0.5200	0.4411

- Each value in the Table is the mean of three riplicates.
- C1, C2 = Control probiotic yoghurt from buffaloe's milk containing 3, 1 fat resp.
- T1, T2, T3, T4 and T5 : probiotic yoghurt made from low fat buffaloe's milk fortified with fat replacer at the rate of 0.1, 0.2, 0.3, 0.4 and 0.5% resp.

L.S.D : Least significant difference. Significant at 0.05 level. N.S. : Not significant.

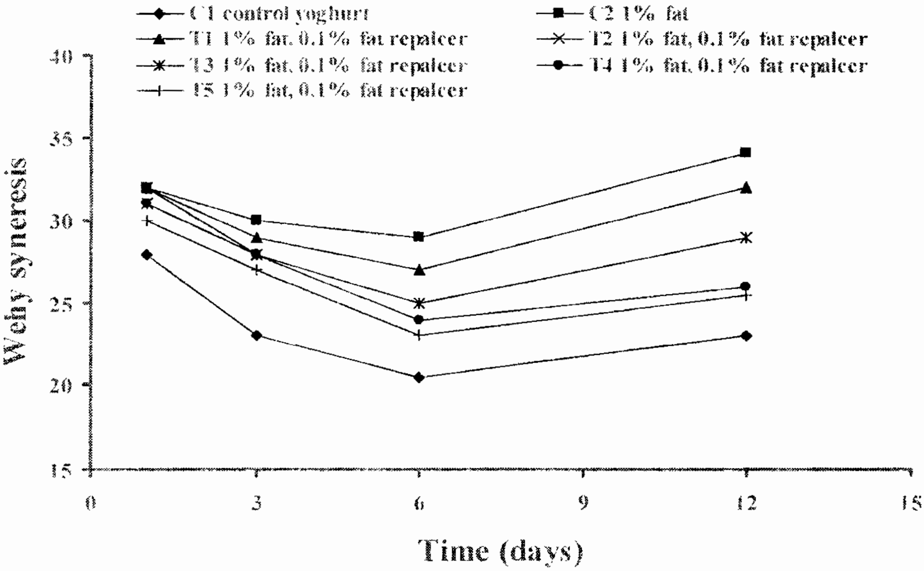

Fig. 1. Whey synersis of low fat yoghurt (1% fat) fortified with simplesse as fat replacer during storage.

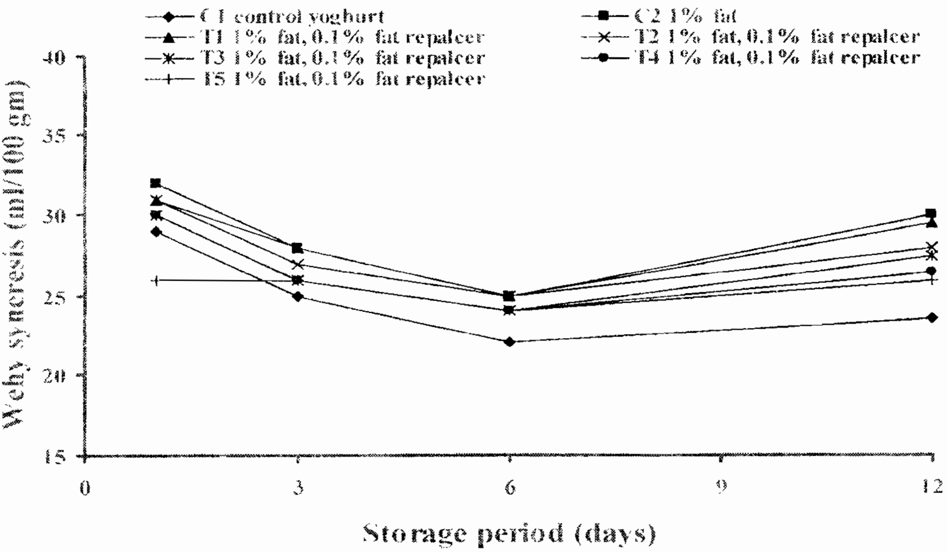

Fig. 2. Whey synersis of low fat yoghurt (1% fat) fortified with novagel as fat replacer during storage.

whey (syneresis) from all yoghurt treatments decreased gradually as storage period advanced and reach their minimum values at sixth day of storage then increased up to the end of storage period. These result are in agreement with those reported by Kebary and Hussein (1999), Zedan *et al.* (2001) and Hussein *et al.* (2004).

On the other hand, Novagel was found to be more effective on reduction of yoghurt synersis of all yoghurt treatments.

Viscosity

Viscosity of low fat probiotic yoghurt made with fat replacers (Simplesse or Novagel) is shown in Figs 3 and 4. Non fortified low fat probiotic yoghurt was significantly less viscous than full fat probiotic yoghurt (control) but fortification of yoghurt milk with fat replacers (Simplesse or Novagel) increased significantly ($P<0.05$) the viscosity of the resultant yoghurt. The increase was slightly proportional to the rate of additives. This increase could be attributed to the water hydration of Simplesse or Novagel. Similar results were reported by (Thomopoulos *et al.* 1993, Omar and Abou El-Nour, 1998, Kebary and Hussein, 1999 and Hussein *et al.* (2004). Viscosity of all treatments increased gradually with the storage periods. However, yoghurt containing Novagel showed higher viscosity than Simplesse.

Sensory Evaluation

Scores of organoleptic properties of low fat probiotic yoghurt without additives or with added fat replacers (Simplesse or Novagel) are shown in Table 4. It is evident from these results that low fat probiotic yoghurt, gained the lowest scores for organoleptic properties. Fortification of low fat milk with fat replacers (Simplesse or Novagel) improved the organoleptic properties of low fat treatments and this improvement was proportional to the fortification ratio up to 0.2% for C_2 low fat probiotic fortified with Novagel 0.2% or 0.1% was similar to the full fat yoghurt (control), but low fat Simplesse treatments gained less scores compared with Novagel treatments. These results might be due to the egg odour of Simplesse. The scores of all probiotic yoghurt treatments decreased gradually up to the end of storage period. These results are in agreement with those reported by Omar and Abou El-Nour (1998), Kebary and Hussein (1999), Hassan *et al.* (1999), Zedan *et al.* (2001), Kebary *et al.* (2004) and Hussein *et al.* (2004).

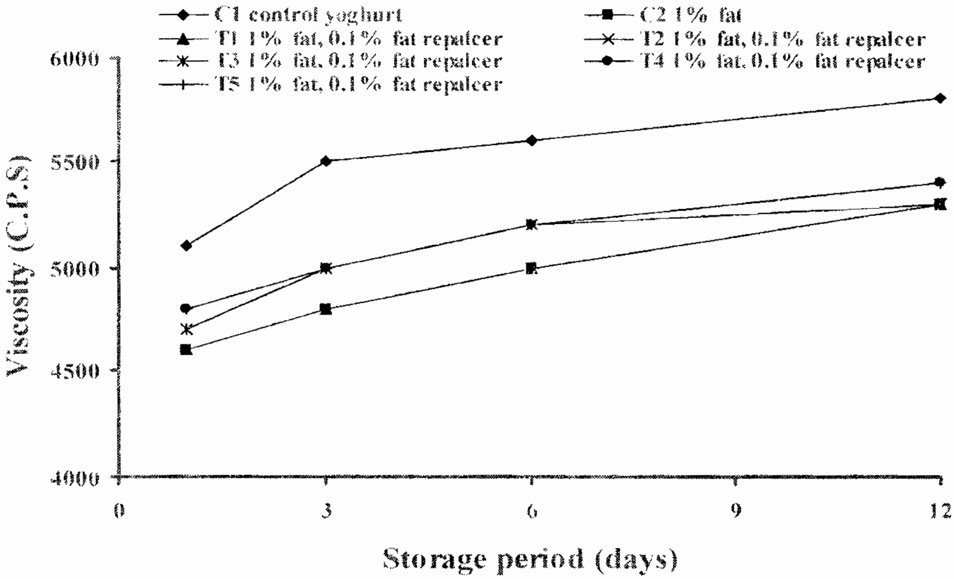

Fig. 3. Effect of simplesse as fat replacers on viscosity of low fat yoghurt (1% fat).

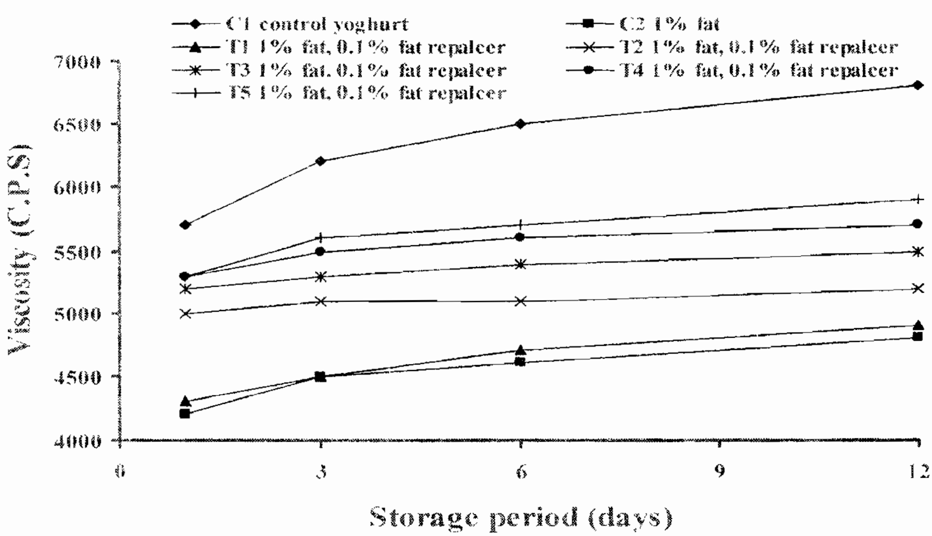

Fig. 4. Effect of novagel as fat replacers on viscosity of low fat yoghurt (1% fat).

Table 4. Scores of sensory evaluation of low fat probiotic yoghurt fortified with fat replacer.

Yoghurt sample	Flavour (45)				Body and texture (35)				Appearance (10)				Acidity (10)				Total score (100)			
	Storage period (days)				Storage period (days)				Storage period (days)				Storage period (days)				Storage period (days)			
	1	3	6	12	1	3	6	12	1	3	6	12	1	3	6	12	1	3	6	12
										Simplesse										
C1	44.50	44.00	43	40	34.5	34	33	32	9	9	9	8	9	8	7	6	97	95	92	86
C2	43.00	42.00	40	36	33	32	28	28	8	8	7	7	8	7	6	5	92	89	81	78
T1	43.00	43.00	42	36	32	33	29	30	8	8	8	7	8	7	6	5	91	91	85	78
T2	43.00	43.00	42	36	33	33	30	30	8	8	8	7	8	7	6	5	.92	91	86	78
T3	42.00	43.00	40	35	33	32	30	28	8	8	8	7	8	7	6	5	91	90	84	75
T4	42.00	43.00	40	35	32	32	28	28	8	7	8	7	8	7	6	5	90	89	82	75
T5	42.00	43.00	40	35	31	32	28	28	8	7	8	7	8	7	6	5	89	89	82	75
L.S.D	0.3388	0.0270	0.0210	0.0210	0.7458	0.0216	0.6808	0.0210	n.s	0.3388	0.0210	0.0210	n.s	0.0210	0.0210	0.0210	0.0401	[illegible]	0.1302	0.0334
										Novagel										
C1	44.50	44	43.5	339	34.5	34.50	33	32	9	9.50	8	8.5	9	8	7	6	97	96	91.5	85.5
C2	43.00	40	41	36	34.5	32.00	31	30	9	8.0	8	7.0	9	7	6	5	95.5	87	86	78
T1	43.00	42	41	37	34.5	32.0	32	31	9	8.0	8	7.0	9	7	6	5	95.5	89	87	80
T2	44.00	41	42	37	34.5	33.0	31	31	9	8.0	8	7.0	9	7	6	5	97.0	89	87	80
T3	42.00	40	41	36	34.5	32.0	30	27	9	7.0	7	5.0	9	7	6	5	94.50	86	84	73
T4	42.00	40	40	36	34.5	31.0	31	30	9	7.0	7	5.0	9	7	6	5	94.50	85	84	76
T5	42.00	40	40	36	34.5	31.0	31	30	8	7.0	7	5.0	9	7	6	5	93.50	85	84	76
L.S.D	0.6710	0.0210		0.0210	0.6710	0.3388	n.s	3.408	0.0270	0.7368	n.s	0.3388	0.0210	0.0210	n.s	0.0210				

- Each value in the Table is the mean of three riplicates.
- C1, C2 = Control probiotic yoghurt from buffaloe's milk containing 3, 1 fat resp.
- T1, T2, T3, T4 and T5 : probiotic yoghurt made from low fat buffaloe's milk fortified with fat replacer at the rate of 0.1, 0.2, 0.3, 0.4 and 0.5% resp.

L.S.D : Least significant difference. Significant at 0.05 level. N.S. : Not significant.

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دراسة تأثير نوعين من بدائل الدهن على جودة اليوغورت الحيوى منخفض الدهن

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تم دراسة تأثير إضافة نسب مختلفة من كلا من الـ Simplesse والــ Novagel كبدائل دهون على جودة اليوغورت الحيوى منخفض الدهن. وتم إضافة الـــ Simplesse أو الــ Novagel إلى اللبن المحتوى على ١% دهن بمعدلات ٠,١ ، ٠,٢ ، ٠,٣ ، ٠,٤ ، ٠,٥% ، وتم إضافة بادئ الزبادى والبادئ الحيوى (١ : ١) بمعدل ٢% لكل عينات الزبادى وعينة الكنترول المصنعة من لبن يحتوى على ٣% دهن. ولقد أوضحت النتائج أن إضافة بدائل الدهون أثرت تأثير طفف على التركيب الكيماوى والــ pH والحموضة الكلية بينما زاد محتوى النيتروجين الذائب وكذلك محتوى الأسيتالدهيد والداى استيل والأحماض الدهنية الطيارة ، وكذلك فإن إضافة بدائل الدهون أظهرت تحسن فى الخواص الريولوجية للزبادى الحيوى منخفض الدهن حيث قللت من انفصال الشرش وزادت من خواص اللزوجة وهذه النتائج كانت مقاربة لعينة الكنترول ، ومن حيث الجودة الحسية لعينات الزبادى المصنعة فلقد أعطى إضافة كلاً من الــ Simplesse والــ Novagel زيادة فى معدلات الخواص الحسية وكان أعلى معدل للخواص الحسية هو الكنترول وكانت أقلها عينات الزبادى المحتوية على ٠,٥% Simpless و Novagel. وعموماً فإن عينات الزبادى الحيوى المحتوية على ٠,٢% Novagel كانت مقاربة لخواص الجودة فى الكنترول المصنع من ٣% دهن. وكان البديل الكربوهيدراتى (Novagel) أفضل من البديل البروتينى (Simplesse) من حيث الجودة الحسية والخواص الريولوجية.