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EFFECT OF SUPPLEMENTING YOGHURT WITH MANGO'S PULP FIBERS POWDER ON ITS QUALITY AND THE SURVIVAL OF BIFIDOBACTERIA BY

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SUMMARY

Five yoghurt treatments were made to study the effect of adding mango's pulp fibers powder (MPFP) on the quality of yoghurt and the survival of bifidobacteria. Yoghurt treatments were supplemented with 0.0, 0.5 , 1.0 , 1.5 and 2.0% MPFP respectively. All treatments were analyzed for chemical composition, microbiological examinations, rheological and sensory properties every 3 days of storage periods. The obtained results revealed that supplementing of yoghurt with MPFP caused a significant increase of titratable acidity, total solids, ash, protein content and the curd tension at zero time. The counts of lactobacilli, streptococci and bifidobacteria, were also raised. While decrease of the pH values, whey seneresis and the total bacterial counts had been conducted. Adding MPFP up to 1.5% increased the total scores of sensory properties of the resulting yoghurt treatments. Total solids, protein, ash and fat content did not change significantly during cold storage , while acidity and curd tention increased. Scores of sensory properties did not change significantly during the first 6 days, then it decreased up to the end of storage period . The counts of total bacteria, streptococci and bifidobacteria increased during the first three days, then they were declined up to the end of storage period. Molds and yeasts were not detected in all yoghurt samples during the first 6 days of storage period.

Key words: mango, pulp fiber, yoghurt, probiotic bacteria, dietary fibers.

INTRODUCTION

Yoghurt is the most popular fermented dairy product in Egypt and worldwide. Yoghurt consumption in Egypt and the world has been markedly increased because of using the pure cultures, applying modern equipments which resulted in contenious processes, introducing wide range of flavoured yoghurt, supplementing the yoghurt with probiotics, prebiotics and cereals to increase the dietetic value and replacing milk fat with fat replacers to produce a low calorie yoghurt. In human nutrition, the yoghurt value is based on not only the nutritive value of milk which is made of, but also the beneficial effects of this yoghurt, such as treated people who are suffering from chronic constipation, diarrhea, colitis, intestenial intoxication, liver and bile disorders. The value of yoghurt in human nutrition is based not only the nutritive value of the milk from which it is made and increased digestilulity and bioavailability because the chemical changes of milk constituents occurring during fermentation, but also the beneficial effects such as, prophylactic and healing effects, healing effects when antibiotic and radiation therapy applied and for people suffering from Also, it can be used for individuals who has lactose intorelance. Better tolerateing of lactose in yoghurt by individulas suffering from hypolactasia (Ayar *et al.*, 2018 and Kebary *et al*., 2018).

Dietary fiber is naturally present in cereals, vegetables, fruits and nuts. It is not digested by enzymes in human intestinal tract, but part of it may be metabolized by bacteria in the lower gut. Dietary fibers are classified into soluble and insoluble fibers (Desmedt and Jacobs, 2001; Behall *et al*., 2006 and Lunn and Buttriss, 2007). Recently dietary fibers have a great attention from researchers and industrial sector to incorporate dietary fibers in different food and dairy products. It owns numerous valuable effects such as reducing

colon and heart related diseases, diabetes, incidence, blood cholesterol and regulating blood glucose levels for diabetes management. As well, it also minimizes the risk of colon cancer, gut neoplasia and preventing constipation and hemorrhoids.

Further more, it produces short chain fatty acids, increasing calcium absorption, stimulating the immune system and acting as prebiotics which enhances the growth of beneficial gut flora. (Kamaly *et al.,* 2017; Ayar *et al.,* 2018 and Kebary *et al*., 2018).

Mango is one of the most cultivated fruit in the world. The world production of mango fruits was 35 million tons, while in Egypt it was 450 thousand tons in 2009 (FAO, 2009). There are several varieties have been grown in Egypt such as alphonse, zebda, mabroka, balady and succary (El-Soukkary *et al.,* 2000). Mango is a seasonal fruit; therefore 20% of fruit are processed for products such as puree, nectar, juice, pickles and canned slices. Peel, which is a major by- product during processing of mango contributes about 15-20% of the fruit (Beerh, 1976). In Egypt mango's peel and pulp fibers are discarded as a waste and become a source of pollution. It has been reported that mango's peel is a good source of polyphenols, carotenoids, vitamin E and C and dietary fibers Also, it exhibited good antioxidant properties (Ajila *et al*., 2007; Kim *et al*., 2010).

It has been stated that mango's pulp fibers contain appreciable amount of beneficial chemical and physiochemical properties, it exhibits high water & oil holding capacity and acting as a prebiotic for bifidobacteria species (Al-Sheraji *et al*., 2012b). Dairy products are not a good source of fibers however, they could prowide an alternative vehicle for the development of fibers enrich foods (Ozcan and Kurtuldu, 2014).

The crucial roles of bifidobacteria which is the most important probiotic bacteria have been reviewed. The beneficial effects of bifidobacteria are showing antagonistic effects towards some pathogens, reducing the risk of diarrhea, normalizing the bowel movement, stimulating the immune system, reducing of blood cholesterol level, the risk of eczema, the incidence of cancer, cardiovascular diseases and osteoporosis, synthizing vitamins and relieving of lactose intolerance symptoms (Prasanna *et al*., 2014 and Martin *et al*., 2015). Because of these health benefits it has been a growing interest to incorporate bifidobacteria in many dairy products. Several factors might affect the growth and viability of bifidobacteria which are growth condition, nutrients, strain, species and oxygen (Shah *et al*., 1995 and Martin *et al*., 2015). It has been suggested to incorporate the dietary fibers in dairy products to improve the growth and viability of bifidobacteria (Manning and Gibson, 2004). In view of the aforementioned the objectives of this study were to evaluate the possibility of making a good quality yoghurt supplemented with mango's pulp fibers powder and monitor the changes of yoghurt quality and survival of bifidobacteria during cold storage.

MATERIALS AND METHODS

Materials:

Bacterial strains:

Active *Streptococcus*. *thermophilus* (EMCC 1043), *Lactobacillus delbrueckii subsp. bulgaricus* (EMCC 1102) *and Bifidobacterium bifidum* (DSM 20082) were obtained from Cario Mircen, Ain Shams University, Egypt . *Lactobacillus delbrueckii subsp bulgaricus* and *Streptococcus thermophilus* were Activated individually by three successive transfers in sterile 10% reconstituted non-fat dry milk. *Bifidobacterium bifidum* was activeted by three successive transfers in modified MRS broth medium (Ventling and Mistry, (1993), followed by three successive transfers in sterile 10% reconstituted non-fat dry milk and incubated at 37^{o}c under anaerobic condition using gas pak (Oxoid Ltd, Basingstoke, Hampshire, England).

Preparation of mango's pulp fibers powder (MPFP):

Fibrous of mango's pulp was obtained by removing the peel and separating the seed from the pulp. The pulp was wet-milled and the juice was separated. The pomace was washed with water, pressed and dried at 50ºc using a conventional air oven for 18 h (Fernandez-Lopez *et al.*, 2004). The dried pomace was then ground carefully to pass through a 250 Mm mesh size sieve. The powder designated, mango's pulp fiber (MPF) was packaged into air tight jars and kept at 4ºC until analysis and use. The composition of mango's pulp fibers (MPF) is presented in Table (1).

Preparation of mango's juice:

Ripe mango fruits were obtained from the local market, sorted and washed with tap water. Mango fruits were peeled by knife. The edible portion (pulp) was carefully separated. The pulp was blended. Mango juice was filtered by clean cheese cloth and heat treated at 85ºC for 3 min. the juice was then cooled and stored in the refrigerator at 6ºC ± 2 in the sterilized bottle until use (Mbaeyi - Nmaoha *et al*., 2017).

Methods:

Manufacture of flavoured yoghurt:

The effect of fortifying yoghurt with mango's pulp fibers (MPF) on the quality of yoghurt and the survival of *bifidobacteria*; was investigate.Therefore five treatments of flavoured yoghurt were made. All yoghurt treatments were made by adding 5.0% sucrose and 10% mango juice (Mbaeyi - Nmaoha *et al*., 2017). Buffalo's milk was standardized to 5.5% fat. Control yoghurt sample was produced without adding MPFP (control), while the other four treatments were fortified with 0.5, 1.0, 1.5 and 2.0 % MPFP. Sucrose and MPFP were added to milk treatments and stirred thoroughly during heat treatments. All milk treatments were heated to 85ºc for 20 min then cooled to 42ºc and incoculated with 1.5 % of yoghurt starter (0.75% *Streptococcus thermophilus* + 0.75% *Lacto- bacillus delbreuckii subsp.bulgaricus*) plus 1.5% of *Bifidobacterium bifidum* DSM (20082). 10% of the prepared mango juice was added to all milk treatments and stirred carefully. The inoculated milk samples were packed in plastic cups and incubated until complete coagulation. All flavoured yoghurt treatments were stored in the refrigerator (6ºc ± 1) for 12 days and were analyzed when fresh and alter 3, 6, 9 and 12 days for microbiological, chemical, rheological analysis and sensory evaluation. The whole experiment was carried out in triplicate.

Microbiological analysis:

Lactobacilli was enumerated on MRS medium (Deman *et al*., 1960), Streptococci was enumerated on yeast lactose agar medium (Skinner and Quensel 1978), The total bacterial count was determined using tryptone glucose yeast extract agar according to the American Public Health Association (A.P.H.A. 1960), Molds and yeasts were enumerated on acidified potato dextrose medium (Difco, 1953), Modified MRS agar was used for enumerating bifidobacteria (Ventling and Mistry, 1993). To each 100 ml of modified MRS 5.0 ml of the following solution was added before pouring plates (Samona and Robinson, 1991).

a. Neomycine sulphate 0.8% w / v.
b. Paromycine sulphate 0.2% w / v.
c. Nalidixic acid 0.3 % w / v.
d. Lithium chloride 6.0 %.

Plates were incubated under anaerobic condition at 37ºc for 72 hr.

Chemical analysis:

PH values**,** were measured using a digital laboratory pH meter. Acidity and fat content were determined according to ling (1963). Total solids (TS), ash content and total protein were determined by A.O.A.C. (2010). Carbohydrate was calculated according to the following equation: Carbohydrate (%) = Total solids(%) – (Fat(%) + Protein(%) + Ash(%).

Rheological properties:

Whey syneresis was conducted according to the method of Dannenberg and Kessler (1988) with slight modification. Hundred grams of yoghurt in plastic cups were cut into four sections and transferred into funnel fitted with 120 mesh metal screen. The amount of whey drained into graduated cycinder was measured after 120 min. At room temperature (20 + 10ºc) for all yoghurt samples stored for 1, 3, 6, 9 and 12 days.

Table (1): The gross composition of mango's pulp fibers powder (MPPP).

Composition	Percentage (%)
Moisture	**9.4**
Protein	**4.9**
Fat	**4.2**
Ash	**2.3**
Total dietary fiber	**67.3**
Carbohydrate	**11.9**

Table (2): Effect of supplementing yoghurt with mango's pulp fibers powderon pH values, titratable acidity (%) ,total solids content (%).

Treat-ments*	pH values					Titratable acidity (%)					Total solids content (%)				
	Storage period (days)					Storage period (days)					Storage period (days)				
	0	3	6	9	12	0	3	6	9	12	0	3	6	9	12
C*	4.8	4.6	4.5	4.3	4.2	.90	.95	1.02	1.08	1.13	19.20	19.20	19.00	18.98	18.92
T1	4.7	4.5	4.4	4.4	4.3	.92	.98	1.07	1.09	1.14	19.50	19.50	19.40	19.30	19.20
T2	4.7	4.6	4.4	4.3	4.2	.92	.98	1.08	1.09	1.18	19.80	19.80	19.50	19.40	19.40
T3	4.6	4.5	4.3	4.2	4.1	.94	.99	1.08	1.09	1.19	20.30	20.30	20.20	20.10	19.90
T4	4.5	4.3	4.2	4.0	3.9	.96	1.09	1.10	1.10	1.19	20.50	20.50	20.30	20.20	20.20

* Each value in the table was the mean of three replicates.

* C: control, chocolate ice milk without any additives.

T1, T2, T3 and T4: chocolate ice milk treatments made by adding 0.5, 1, 1.5 and 2% of mango's peel powder respectively.

Table (3): Effect of supplementing yoghurt with mango's pulp fibers powder on fat content, ash content, protein content and curd tension (kg $_{force}$).

Treatments*	Fat content (%)					Ash content (%)					Protein content (%)					Curd tension (kg$_{force}$)				
	Storage period (days)					Storage period (days)					Storage period (days)					Storage period (days)				
	0	3	6	9	12	0	3	6	9	12	0	3	6	9	12	0	3	6	9	12
C*	5.50	5.50	5.50	5.40	5.30	.85	.90	1.01	1.04	1.09	5.82	5.78	5.79	5.74	5.67	2.50	5.50	5.50	5.40	5.30
T1	5.50	5.40	5.40	5.30	5.40	.85	.90	1.02	1.04	1.04	5.90	5.91	5.79	5.94	5.79, 5.82	2.50	5.40	5.40	5.30	5.40
T2	5.40	5.50	5.40	5.30	5.40	.90	.96	1.01	1.06	1.06	6.10	6.00	5.92	5.89	5.79	2.54	5.50	5.40	5.40	5.40
T3	5.50	5.50	5.40	5.40	5.30	.92	.98	1.04	1.08	1.08	6.10	5.92	5.88	5.84	5.82	2.59	5.50	5.40	5.40	5.30
T4	5.40	5.50	5.40	5.40	5.30	.94	.99	1.05	1.06	1.10	6.40	6.20	6.16	5.97	5.87	2.66	5.40	5.40	5.40	5.30

*See Table (2)

Curd tension of yoghurt samples was assessed using non destructive Effagi firmness measurements (Effagi, Albonsine, Italy). The penetration depth was 50 mm using a stainless steel plunger flat ended with diameter of 5 mm .five readings were taken for each yoghurt treatment.

Sensory evaluation:

Yoghurt samples were judged by panelists from the staff members of Dairy Science and Technology Dept., Faculty of Agriculture, Menoufia University. Results were recorded in score sheet described by (Kebary and Hussein, 1999).

Statistical analysis:

Data were analyzed using the completely randomized block design and 2 x 3 factorial designs. Newman-keuls. Test was used to make the multiple comparisons (Steel and Torrie, 1980) using Costat program. Significant differences were determined at $p \leq 0.05$.

RESULTS AND DISCUSSION

Chemical analysis:

pH values of all yoghurt treatments decreased gradually during the storage period (Tables 2, 6). These results may be due to the activity of fermented milk cultures and supplementation with mango's pulp fibers powder. It also might be due to higher carbohydrate content of mango's pulp fibers powder that stimulates the growth of lactic acid bacteria and subsequently developing the acidity and decreasing pH values. (Al-Sheraji *et al*., 2012a and Al-Sheraji *et al*., 2012b). Treatment T4 which was made by adding 2.0% mango's pulp fibers powder had the lowest pH values and was significantly ($p \leq 0.05$) different from control yoghurt treatment that made without adding mango's pulp fibers powder. Supplementation of yoghurt treatments with mango's pulp fibers powder caused a significant ($P \leq 0.05$) increase in titratable acidity (Tables 2, 6). This increase might be due to the supplementation effect of mango's pulp fibers powder on the growth and acid development by lactic acid bacteria. It has been claimed that fiber enhance the growth of lactic acid bacteria (Kebary *et al*., 2004).The rate of increasing titratable acidity of yoghurt treatments was proportional to the rate of adding mango's pulp fibers powder. Titratable acidity of all yoghurt treatments increased slightly during storage period. Similar results were reported by Kebary *et al*., (2010a).

Total solids content increased significantly ($p \leq 0.05$) by supplementing yoghurt with mango's pulp fibers powder and there was positive correlation between the total solids content of the resulting yoghurt treatments and the rate of adding mango's pulp fibers powder (Tables 2, 6) (El-Batawy *et al*., 2014). On the other hand total solids content of all yoghurt treatments did not change significantly ($p > 0.05$) throughout cold storage period (Tables 2, 6).

Supplementing with mango's pulp fibers powder did not have significant ($p > 0.05$) effect on fat content of the resultant yoghurt treatments (Tables 3, 6). Fat content of all yoghurt treatments did not change significantly ($p > 0.05$) during the cold storage (Tables 3, 6). These results were in agreement with those of (Kebary *et al*., 2018).

Total protein and ash contents of yoghurt treatments increased slightly ($p \leq 0.05$) by increasing the ratio of mango's pulp fibers powder Tables (3, 6). Protein and ash contents of all yoghurt treatments did not change significantly ($p > 0.05$) as storage period progressed (Tables 3, 6). These results were in agreement with those of Kebary *et al*.,(2015) and Kebary *et al.*,2018).

Rhedogical properties:

Whey separation from yoghurt treatments decreased by adding mango's pulp fibers powder. There was negative correlation between whey syneresis and the ratio of mango's pulp fibers powder Table (6) and Fig (1). These results might be due the addition of mango's pulp fibers powder which leads to form a complex with casein micelles and prevent them from excessive fussion during storage and form a fine meshed gel network which is less susceptible to whey separation (Danneberg and Kessler 1988) and ⁄ or increasing the water holding capacity (O'shea *et al*., 2012) and⁄or increasing the total solids content (Kebary *et al*., 2009). Whey separation from all yoghurt treatments decreased gradually ($p \leq 0.05$) as storage period proceeded and reached their minimum values at the sixth day of storage period then increased up to the end of storage period Fig (1), which might be due to the acid development that help the curd to contract and subsequently expel the whey from the curd (Kebary and Hussein 1999). These results were in accordance with those obtained by Kebary *et al*., (2010b).

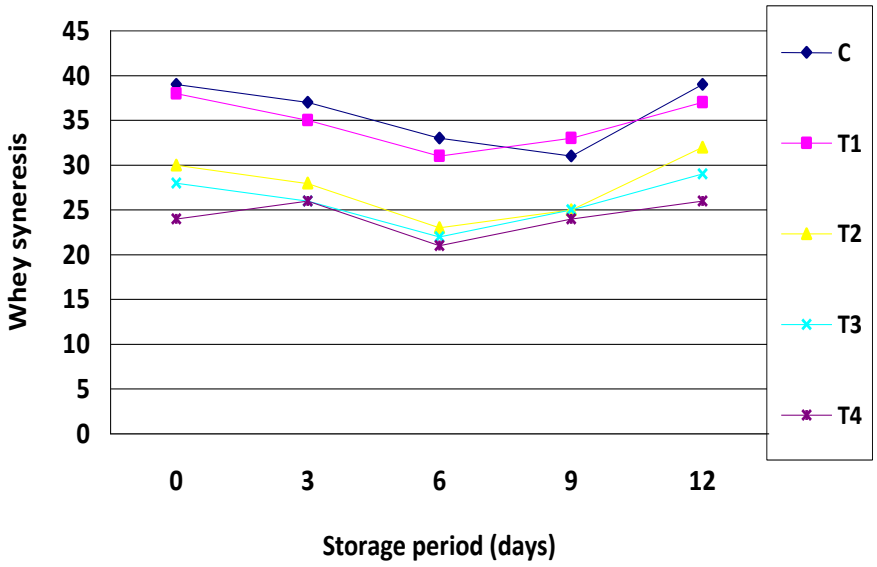

Fig. (1). Effect of supplementing yoghurt with mango's pulp fibers powder on whey syneresis (%) after 2hr.

C: control, yoghurt without any additives.

T1, T2, T3 and T4: yoghurt treatments made by adding 0.5, 1, 1.5 and 2% of mango's pulp fibers powder respectively.

Supplementing of yoghurt treatments caused a significant ($p \leq 0.05$) increase of curd tension and this increase was proportional to the rate of adding mango's pulp fibers powder (Tables 3, 6). Treatment T4 that had 2.0% mango's pulp fibers powder exhibited the highest value of curd tension and was significantly different from other yoghurt treatments (Tables 3, 6). These results might be due to the highest dietary fiber content of mango's pulp fibers powder, which could be used in food products as a texturizing agent (Kebary *et al*., 2012 and O'Shea *et al.*, 2012).On the other hand curd tension of all yoghurt treatments increased gradually ($p \leq 0.05$) as storage period proceeded (Tables 3, 6) (Aly *et al*., 2004 and Ismail 2015).

Microbiological examination:

The counts of total bacteria decreased by increasing the rate of adding mango's pulp fibers powder (Table 4). These results could be attributed to the increase of bifidobacteria counts as a result of increasing the dietary fibers content of MPFP, which consider as a prebiotic and stimulate the growth of bifidobacteria thus producing many antimicrobial agent which may inhibit the growth of bacteria and therefore decrease the counts of total bacterial counts (Table 4). (Kebary *et al*., 2010a and Kebary *et al.*, 2010b).The counts of total bacteria of all yoghurt treatments increased during the first three days of storage period then decreased up to the end of storage period (Table 4), which might be due the effect of cold storage and developed acidity which could suppress the growth of bacteria. These results were in accordance with those reported by Kebary *et al*., (2010a).

Counts of lactobacilli increased by supplementing yoghurt with mango's pulp fibers powder (Table 4).This increase was proportional to the percentage of mango's pulp fibers powder up to 1.5%, which contain higher amount of dietary fibers that might consider as a prebiotic agent and consequently stimulate the growth of bacteria (Kebary and Hussein 1999 and Kebary *et al*., 2010a). On the other hand the counts of lactobacilli of all yoghurt treatments increased as storage period proceeded up to the sixth day of storage period, and then decreased as storage period progressed up to the end of storage (Kebary *et al*., 2009).

Supplementation of yoghurt treatments with mango's pulp fibers powder caused a significant increase of the counts of bifidobacteria and streptococci. This increase was proport-

ional to the rate of adding mango's pulp fibers powder. These results might be due to higher content of dietary fibers in mango's pulp fibers powder, which act as a prebiotic and stimulate the growth of bifidobacteria and streptococci (Al-Sheraji *et al.*, 2012a and Al-Sheraji *et al*., 2012b).Yoghurt treatments T3 and T4 which produced with the highest rate of mango's pulp fibers powder (1.5 and 2.0%) respectively contained the highest counts of bifidobacteria and streptococci and were not significantly different from each other (Table 4). Contents of bifidobacteria and streptococci in all yoghurt treatments increased during the first three days of storage period and reached their maximum content at the third day of storage period then their counts declined gradually as storage period progressed up to the end of storage period. These results might be due to the developing acidity, which subsequently could suppress the growth of bifidobacteria (Shah, 1995). These results were in agreement with those reported by Hussein and Kebary (1999) and Kebary *et al*. (2012). The counts of bifidobacteria in all yoghurt treatments even after cold storage for 12 days were higher than the recommended number that should be present in any food products to achieve their health benefits; therefore this yoghurt will be a good vehicle for delivering this probiotic bacteria to consumer.

Table (4): Counts of total bacteria, streptococci, lactobacilli, bifidobacteria during storage of yoghurt made with adding Mango's pulp fibers powder.

Treatments*	Counts of total bacteria ($CFUx10^7$/gm)					Counts of lactobacilli ($CFUx10^7$/gm)					Counts of streptococci ($CFUx10^7$/gm)					Counts of bifidobacteria ($CFUx10^7$/gm)				
	Storage period (days)					Storage period (days)					Storage period (days)					Storage period (days)				
	0	3	6	9	12	0	3	6	9	12	0	3	6	9	12	0	3	6	9	12
C*	110	150	116	99	83	23	58	76	63	42	201	256	143	104	56	63	98	76	53	40
T1	108	145	113	96	76	31	63	85	77	53	223	273	156	111	77	87	122	93	76	56
T2	101	141	108	93	71	36	71	93	82	59	230	286	171	126	86	88	126	101	93	65
T3	78	131	101	83	68	42	76	95	86	61	236	293	186	133	91	92	140	106	90	61
T4	73	122	98	72	63	41	74	93	84	59	232	291	183	131	89	91	139	104	88	49

*See Table (2)

Table (5): Effect of supplementing yoghurt with mango's pulp fibers powder on organoleptic properties.

Treatments*	Flavor (45)					Body and texture (35)					Appearance (10)					Acidity (10)					Total score (100)				
	0	3	6	9	12	0	3	6	9	12	0	3	6	9	12	0	3	6	9	12	0	3	6	9	12
C*	41	39	38	37	37	28	27	26	26	24	9	9	8	8	7	9	8	8	6	5	87	83	80	77	73
T1	41	40	40	37	36	30	29	28	27	27	9	9	8	7	7	9	8	7	6	5	89	86	83	77	75
T2	45	45	43	41	38	33	32	31	30	29	9	9	8	8	6	9	8	7	6	5	96	94	89	85	78
T3	43	42	42	40	39	32	32	31	29	28	9	9	8	8	7	9	8	7	7	6	93	91	88	84	80
T4	43	42	40	38	37	32	31	30	28	27	9	8	7	6	6	9	8	7	6	5	93	89	84	79	75

*See Table (2)

Table (6). Statistical analysis of yoghurt properties.

Properties of yoghurt	Mean squares	Effect of treatments ❖ Multiple comparisons					Mean squares	Effect of storage (days) Multiple comparisons ❖				
		C•	T1	T2	T3	T4		0	3	6	9	12
pH values	0.2310*	A	A	A	B	C	0.6390*	A	AB	BC	C	D
Titratable acidity	0.0131*	C	C	B	B	A	0.1078*	D	CD	BC	B	A
Total solids	3.082*	C	BC	B	AB	A	0.8742	A	A	A	A	A
Fat	0.0075	A	A	A	A	A	0.044	A	A	A	A	A
Ash	0.0096*	C	BC	B	B	A	0.089	A	A	A	A	A
Protein	0.292*	C	BC	B	AB	A	0.994*	A	A	A	A	A
Synersis	319.2*	A	A	B	C	D	195.3*	A	B	E	D	C
Curd tension	0.034*	D	C	B	B	A	0.287*	E	D	C	B	A
Flavor	124.08*	D	C	B	A	C	70.679*	A	AB	AB	BC	D
Body and texture	7.779*	D	C	B	A	C	37.679*	A	AB	AB	BC	D
Appearance	3.779*	A	A	A	A	B	13.38*	A	A	AB	BC	D
Acidity	1.319	A	A	A	A	A	34.62*	A	AB	BC	CD	D
Total score	523.38*	D	C	B	A	C	573.179*	A	AB	AB	BC	D

•See table (2)

* For each effect the different letters in the same column 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 ($p \leq 0.05$).

All yoghurt treatments were free from molds and yeasts during the first six days of storage period then they appeared up to the end of storage period(12 day). These results might be due to the post contamination. Similar results were reported by Kebary *et al.* (2010a).The counts of mould and yeast decreased by supplementing yoghurt with mango's pulp fibers powder. There was negative correlation between the rate of adding mango's pulp fibers powder and the counts of mold and yeast (Table 4), which might be due to the antimicrobial substances produced by bifidobacteria (Kebary *et al*., 2010a).

Sensory evalution:

Supplementing yoghurt with mango's pulp fibers powder caused a significant increase in the scores of flavour, body & texture and total scores compared with control yoghurt samples (Tables 5, 6). Increasing the amount of mango's pulp fibers powder up to 1.5% increased significantly ($p \leq 0.05$) the scores of flavour, body & texture and total scores (Tables 5, 6). The most acceptable yoghurt treatments was T3that made with adding 1.5% mango's pulp fibers powder followed with those of T2 and then T1 and T4 those made with adding 1.0, 0.5 and 2.0% mango's pulp fibers powder and finally the control yoghurt. These results might be due to the increasing content of dietary fibers which improve the curd tension and decrease the whey syneresis. On the other hand the scores of organoleptic properties of all yoghurt treatments did not change significantly ($p > 0.05$) up to the sixth day of storage period then decreased as storage period proceeded (Kebary *et al*., 2015).

REFERENCES

A.O.A.C. (2010). Official Methods of Analysis of Association of Official Analytical Chemists. 18th Edition,Washington, DC.Vol.6 No.10.

Ajila, C.M.; Bhat, S.G.and Prasada Rao, U. J. S. (2007).Valuable components of raw and ripe peels from two Indian mango varieties. Food Chem., 102:1006.

Al-Sheraji, S. H.; Ismail, A.; Manap, M. Y.; Mustafa, S.; Yusof, R. M. and Hassan, F.A. (2012a). Hypocholesterolaemic effect of yoghurt containing *Bifidobacterium pseudo-catenulatum G4* or *Bifidobacterium longum* BB536. Food Chem., 135:356.

Al-Sheraji, S. H.; Ismail, A.; Manap, M. Y.; Mustafa, S. and Yusof, R. M. (2012b). Via-bility and activity of bifido- bacteria during refrigerated storage of yoghurt containing *Mangifera pajang* fibrous polysaccharides. J. Food Sci., 77:24.

Aly, S.; Elewa, N. and Galal, E.A. (2004). Carrot yoghurt: sensory, chemical, micro-biological properties and consumer Accep-tance. J. Nutr., 3: 322.

American Public Health Association, Inc. (A.P.H.A.) (1960). Standard Methods for the Examination of Dairy Products. (Microbio-logical and Chemical).11th Ed., New York, USA.

Ayar, A.; Sicramaz, H.; Ozturk, S. and Yilmaz, Suzan, O.(2018). Probiotic properties of ice creams produced with dietary fibers from by-products of the food industry.Inter.J. Dairy Technoo., 71: 174.

Beerh, O.P.; Raghuramaiah, B.; Krishnamurthy, G.V. and Giridhar, N. (1976).Utilization of mango waste: recovery of juice from waste pulp and peel. J. Food Sci. and Techno., 13 : 138.

Behall, K. M.; Scholfield, D.J. and Hallfrisch, J. (2006). Whole-Grain diets reduce blood pressure in mildly Hyper- cholesterolemic men and women. J. Am.Diet Assoc., 106: 1445.

Danneberg, F. and Kessler, H. G. (1988). Effect of danaturation of B-lactoglobulin on texture properties of set-type non-fat yoghurt 1.synersis. Milchwissenschaft., 43: 632.

Deman, J.C.; Rogosa, M. and Sharpe, M.E. (1960). A medium for the cultivation of lacto-bacilli. J. Applied Bacteriol., 23: 130.

Desmedt, A. and Jacobs, H. (2001). "Soluble fibre," in Guide to functional food ingredients Surrey, England: Food RA Leatherhead Publishing., 18:112.

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

El-Batawy, O.I.; Ashoush, I.S. and Mehanna, Nayra. S.h. (2014). Impact of Mango and Pomegranate peels supplementation on quality characteristics of yoghurt with or without whey Powder.World J. Dairy and Food Sci., 9:57.

El-Soukkary, F.A.H.; EL-Sahn, M.A. and Mohamed, H.M.A. (2000). Physico-chemical and nutritional evaluation of mango seed kernel and its utilization for pan bread supplementation. Zagazig J. Agric. and Res., 27:1319.

FAO (2009). Annual production of mango fruits in Egypt, at the web page: http://www. fao.org/faostat/

Fernandez-Lopez, J.; Fernández-Ginés, J.M.; Aleson-Carbonell, L.; Sendra, E.; Sayas-Barberá, E. and Pérez-Alvarez, J.A. (2004). Application of functional citrus by-products to meat products. Trends in Food Sci. Techno., 15: 176.

Hamed, A.I.; Kebary, K.M.K.; Badawi, R.M. and Omar, Nevein, S. (2010). Manufacture of low fat prebiotic yoghurt. Minufiya J. Agric., 35: 157.

Hamed, A.I.; Kebary, K.M.K.; Badawi, R.M.; Salem, O.M. and Omar, Nevein S.(2014). Manufacture of low fat prebiotic ice milk. Menoufia J.Agric. Res., 39: 1317.

Ismail, M.M. (2015). Improvement of nutria-tional and healthy values of yoghurt by fortification with rutub date. J.Food Sci., 4: 398.

Kamaly, K.M.; Kebary, K.M.K.; El-Sonbaty, A.H. and Badawi, Khadega, R. (2017). Quality of low fat prebiotic frozen yoghurt. Menoufia J. Food and Dairy sci., 2: 23-35.

Kebary, K.M.K. and Hussein, S. A. (1999). Manufacture of low fat Zabady using different fat substitutes. Acta Alimentaria 28: 1.

Kebary, K.M.K.; Badawi, R.M.; Hamed, A.I. and Omar, Nevein S. (2010a). Preparation and properties of novel functional yoghurt from buffalo milk. proc. 11th Egyption Conf. Dairy Sci. and Techno., 463-478.

Kebary, K.M.K.; El-Sonbaty, A.H.; Kamaly, K.M. and Badawi, Khadega, R.M. (2018). Evaluation of quality attributes of low fat low sucrose symbiotic frozen yoghurt. Egyptian J. Dairy Sci., 46:119.

Kebary, K.M.K.; El-Sonbaty, A.H.; kamaly, K.M. and Badawi, Khadega, R.M. (2012). Effect of using normal and ropy strains of yoghurt starter in the manufacture of yoghurt from cow's milk fortified with different levels of inulin and non-fat dried milk. Egyptian. J. Dairy Sci., 40:99.

Kebary, K.M.K.; Farag, Seham, I.; Badawi, R.M.; Badran, I.I. and Said, Afaf (2010b). Manufacture of yoghurt from cow's milk fortified with butter milk. Minufiya J.Agric. Res., 35: 127.

Kebary, K.M.K.; Hamed, A.I.; Badawi, R.M.; Salem, O.M. and Omar, Nevein, S. (2015). Preparation and properties of low-fat ice milk fortified with inulin. Egyptian J. Dairy Sci., 43: 169.

Kebary, K.M.K.; Hamed, A.I.; Badawi, R.M.; Salem, O.M. and Omar, Nevein, S. (2015). Preparation and properties of low-fat ice milk fortified with inulin. Egyptian J. Dairy Sci., 43: 169.

Kebary, K.M.K.; Hamed, A.I.; Badran, I.I.;Hussein, S.A. and Gaber, A.M.(2009). Manufacture of yoghurt from cow's milk fortified with trypsin modified whey proteins. Minufiya J. Agric. Res., 34: 1525.

Kebary, K.M.K.; Hamed, A.I.; Salem, O.M. and Yousef, E.T.A. (2004). Impact of frozen yoghurt ingredients its quality and survival of bifidobacteria. proc.the 9th Egyption conf. for dairy Sci. Tech. milk and dairy products for a healthy future, Dokki, 9-11 October, Cairo, Egypt.

Kim, H.; Moon, J.Y., Lee, D.S., Cho, M., Choi, H.K., Kim, Y.S., Mosaddik, A. and Cho, S.K. (2010) Antioxidant and antiproliferative activities of mango (*Mangifera Indica L.*) flesh and peel. Food Chemistry, 121: 429.

Ling, E.R. (1963). A Text Book of dairy Chemistry, Vol.2 practical 3rd ed. Chapman & Hall, Ltd., London.

Lunn, J. and Buttriss, J. L. (2007). Carbohydrates and dietary fibre. Nutr. Bulletin., 32: 21.

Manning, T. S. and Gibson, G. R. (2004). Microbial-gut interactions in health and disease. Prebiotics. Best Pract .Res.Clin Gastroenterol., 18:287.

Martin, M.J.; Lara-Villoslada, F.; Ruis, M.A. and Morales, M.E. (2015). Microencapsulation of bacteria: A review of different Technoogies and their impact on the probiotic effects. Innovative Food Science and Emerging Technoo., 27: 15.

Mbaeyi-Nwaoha, I. E.; Umeh, L. C.; Igbokwe, C. J., Obodoechi, C. M. and Okoronkwo, N. C. (2017). Production and quality evaluation bush mango 'ugiri'(Irvingia gabonensis) juice and pulp. Food Sci.and Techno., 5: 56.

O'shea, N.; Arendt, E.; K. and Gallagher, E. (2012). Dietary fiber and phytochemical characteristics of fruit and vegetable by-products and their recent applications as novel ingredients in food products. Innovative Food Sci. Emerging Technoo., 16:1.

Ozcan, T. and Kurtuldu, O. (2014).Influence of dietary fiber addition on the properties of probiotic yogurt. Inter.J. Chem. Eng. and Applica., 5:397.

Prasanna, P.H.P.; Grandison, A.S. and Charalampopoulos, D. (2014). Bifidobacteria in milk products: An overview of physiological and biochemical properties, exopolysaccharid production, selection criteria of milk products and health benefits. Food Res. Inter., 55: 247.

Samona, A. and Robinson, R. K. (1991). Enumeration of bifido- bacteria in dairy products.J. Soc.Dairy Tech.,44:64.

Shah, N.P.; Lankaputhra, W.E.V.; Britz, M. and Kyle, W.S.A. (1995). Survival of *L.acidophilus* and *Bifidobacterium bifidum* in commercial yoghurt during refrigerated storage. Inter. Dairy J., 5: 515.

Skinner, F. A. and Quesnel, L. B. (1978). Streptococci. A cademic press, New Work, p.390.

Steel, R.G.D. and Torrie, J. H. (1980). Principles and Procedures of Statistics. A biometrical approach. 2nd Ed. McGraw-Hill Book Co., New York.

Ventling, B. L. and Mistry, V.V. (1993). Growth characteristics of bifidobacteria in ultrafiltered milk. J. Dairy Sci., 76: 962.

تاثير تدعيم الزبادي بالياف لب المانجو المجففة على خواصه وحيوية بكتريا Bifidobacteria

نظرا لانتشار استهلاك الزبادي فى مصر والعالم وذلك لفوائده الصحية والغذائية المتعددة ونظرا للأهمية الصحية والغذائية للالياف لذلك فان هذا البحث يهدف لدراسة تاثير تدعيم الزبادي بالياف لب المانجو المجففة حيث تم تصنيع خمس معاملات من الزبادي بالمانجو واضافة صفر، 0.5، 1.0، 1.5، 2.0 % من الياف لب المانجو المجففةعلى الترتيب ولقد اخذت عينات وهى طازجة ثم بعد 3، 6، 9، 12 يوم وذلك لاجراء التحليلات الكيميائية والريولوجية والميكروبيولوجية والحسية ولقد اظهرت النتائج المتحصل عليها مايلى:

- أدى إضافة ألياف لب المانجوالمجففة الى زيادة الحموضة وقوة الخثرة ونسب كل من الجوامد الصلبة الكلية، البروتين والرماد وكذلك زيادة اعداد بكتريا Lactobacilli، Streptococci و Bifidobacteria.
- أدى إضافة ألياف لب المانجوالمجففة للزبادي الى خفض قيم pHوانفصال الشرش والعدد الكلى للبكتريا.
- أدى إضافة ألياف لب المانجوالمجففة حتى نسبة 1.5% الى تحسين الخواص الحسية وزيادة درجات التحكيم ثم انخفضت بزيادة نسبة اضافة الياف لب المانجو اعلى من هذه النسبة.
- ازدات الحموضة وقوة الخثرة اثناء التخزين فى كل المعاملات فى حين انخفضت قيم pH بينما لم تتاثر قيم الجوامد الصلبة الكلية والدهن والبروتين والرماد.
- لم تتغير درجات التحكيم فى كل المعاملات معنويا حتى اليوم السادس من التخزين ثم انخفضت درجات التحكيم بعد ذلك بتقدم فترة التخزين.
- ازدادت اعداد البكتريا فى كل المعاملات حتى اليوم الثالث ثم انخفضت بعد ذلك بتقدم فترة التخزين.
- اتضح ان كل المعاملات وحتى بعد التخزين لمدة 12 يوم احتوت على عدد من البيفيدوبكتريا اعلى من العدد المفروض تواجده فى اى منتج لتحقيق فوائدها الصحية.