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Carrot Yoghurt : Sensory, Chemical, Microbiological Properties and Consumer Acceptance

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Abstract: Plain and carrot yoghurt were prepared in the laboratory scale production from cow's milk obtained from Fayoum district, Egypt. Carrot yoghurt was prepared by blending milk with 5, 10, 15 and 20% carrot juice before fermentation. The sensory, rheological, chemical, and microbiological quality of yoghurt samples were investigated during refrigerated storage at 4°C for three weeks. The Sensory scores increased especially for yoghurt samples with 15% carrot juice. Chemical analysis revealed an increase in acidity, decrease soluble nitrogen /total nitrogen ratio and curd tension with increasing carrot juice. On the other hand, high carrot juice suppressed the growth of mold and yeast, *Coliform* organisms while *Lactobacillus bulgaricus* and *Streptococcus thermophillus* were not significantly ($P>0.05$) affected. Yoghurt with 5, 10, 15 and 20% carrot juice showed a significant decrease ($P < 0.05$) in aflatoxin M1 respectively. The results of the study showed that carrot had significant effect on the acceptability of yoghurt during shelf life. The economic and public health importance of carrot in yoghurt was discussed.

Key words: Carrot yoghurt, fermented milk, carrot juice

Introduction

There has been a phenomenal increase in the production of fermented milks in developed countries. Yoghurt is a very popular flavorful and healthful dairy product in Egypt. Its production and consumption is growing continuously due to its therapeutic properties beside its high nutritive value (Karagul *et al*., 2004).

The health promoting properties of live lactic acid bacteria in yoghurt include protection against gastrointestinal upsets, enhanced digestion of lactose by maldigesters, decreased risk of cancer, lower blood cholesterol, improved immune response and help the body assimilate protein, calcium and iron (Perdigeon *et al*., 1998; Marona and Pedrigon, 2004).

In efforts to offer variety and competition in the market, new research is currently in progress on the use of carrot juice in yoghurt industry (Schieber *et al*., 2002 and Simova *et al*., 2004).

Carrot (*Dascus carota* L.) is one of the more commonly used vegetables of human nutrition. It is rich in beta carotene, ascorbic acid, tocopherol and classified as vitaminized food (Hashimoto and Nagayama, 2004).

Combination of Carrot juice and yoghurt produce a nutritionally balanced food. Carrots are good source of carbohydrate, calcium, phosphorous, iron, potassium, magnesium, copper, manganese and sulphur. It is an excellent source of vitamin A, B1, B2, C, E, thiamin, folic acid and riboflavin but lack in protein and fat. Yoghurt is rich in protein and fat but is deficient in iron and vitamin C. Blending of yoghurt with carrot juice would produce a nutritionally rich food (Ikken *et al*., 1998 and Raum, 2003).

The intake of carrot as potent antioxidants, appear to be associated with better health. It is not only preventing vitamin A deficiency but also cancer and other diet related human diseases. It has greater cytotoxic effect against cancer cell and reducing the enzymes that promote the conversation of precarcinogens to carcinogens. It may also enhance the immune system, protect against stroke, high blood pressure, Osteoporosis, cataracts, arthritis, heart disease, bronchial asthma and urinary tract infections (Beom *et al*., 1998; Sun *et al*., 2001; Seo and Yu, 2003).

Many trials had been made to prolong the shelf life time of yoghurt. The short shelf life is mainly due to mold growth. It causes economic losses by discoloration, poor appearance and off flavor during cold storage. Some molds are capable of producing toxic metabolites known as mycotoxins causing serious public health concern. Aflatoxins have been demonstrated as potent human carcinogenic, mutagenic and teratogenic. They are highly stable during processing and storage of yoghurt (Kivanc, 1992; Egmond, 1994; Roy *et al*., 1996; Shibario *et al*., 1998; Hassanin, 1999; Galvano *et al*., 2000; Mishra and Das, 2003 and Elena *et al*., 2004).

As little works have been cited on the combination of carrot with yoghurt, this investigation has carried out to study:

1. The effect of carrot on sensory, chemical, microbiological properties and consumer acceptance during cold storage of yoghurt.
2. The stability of aflatoxin M1 during carrot yoghurt processing and storage.

Materials and Methods

Preparation of carrot juice: Carrot roots were washed

thoroughly, both ends were removed, peeled by sharp knife and cut longitudinally into halves. These halves were steam blanched for five minutes to inactivate pectinase and peroxidase enzymes, in addition to tenderization the carrot tissues. The juice was obtained by blending in blender with sieves. The obtained juice was analyzed chemically by determined moisture, and total soluble solids "TSS" percent according to the AOAC (1990). The titratable acidity and total sugars content were determined according to Ranganna (1979), Total carotenoids and riboflavin were determined by the method described by Reddy and Sisrunk (1980).

Yoghurt manufacture: Fresh cows milk were obtained from private at Fayoum district, freeze dried culture of *lactobacillus delbrueckii supsp bulgaricus* and *streptococcus salivarious subsp.thermophilus* (1:1) were obtained from Chr. Hansens laboratories Denmark. Yoghurt made from cow's milk after heat treated at 90^{o}C for 10 min, and cooled to 42^{o}C. Starter was added at the rate of 3% and incubated at the same temperature. Standard aflatoxin M1 (Sigma Chemical Company, Irvine, UK) was added to the milk (previously tested for freedom from aflatoxin M1) to obtain a concentration of 100 ng/l according to Blanco *et al*. (1993). The mixture was homogenized and divided into five portion then carrot juice was added (w/w) in a ratio of 0 (plain), 5, 10, 15 and 20% respectively and incubated at 45^{o}C for about 7 hours until coagulation occur. The obtained yoghurt was stored in refrigerator at 4 ± 2^{o}C for 21 days. Samples were taken for organoleptic, chemical and microbiological analysis at zero time (just after manufacture), 1, 3, 6, 10, 13, 17 and 21 days respectively.

Sensory evaluation

***Panelists*:** Ten trained panelists from the staff members of the Dairy Department of Faculty of Agriculture, Cairo University, Fayoum branch were selected on the basis of their training and experience in the use and evaluation of plain and carrot yoghurt. Panelists were between the ages of 21 and 56 years; 4 were female and 6 were male. They evaluated 20 g portions of each yoghurt sample and used a quality rating score card for evaluation of flavor (60 points) and body and texture (30 points) and appearance (10 points) as described by Nelson and Trout (1981).

Consumer acceptance panel: Plain and carrot yoghurt samples were evaluated by 72 member consumer panel that comprised undergraduate, graduate students and staff members of Agriculture Faculty, Cairo university, Fayoum branch.

Chemical analysis: Yoghurt samples were examined for fat%, moisture content and titratable acidity according to AOAC (1990). Total nitrogen % and water soluble nitrogen content using micro-Kjeldahl method were applied according to Kuchroo and Fox (1982) and IDF (1993). Total volatile fatty acids (TVFA) were determined by the distillation method described by Kosikowski (1982). Curd tension and rate of curd syneresis were measured as described by EL-Shabrawy (1973) and Mehanna and Mehanna (1989). Yoghurt pH values were measured during both incubation and storage in both plain and carrot samples by using an Orion Research pH-meter standardized with pH 4 and 7 standard buffer solutions.

Microbiological analysis: Yoghurt samples were prepared according to the method recommended by ICMSF (1996) and analyzed at zero, 1, 3, 7, 10, 14, 17 and 21 days of cold storage at 4^{o}C.

Sterptoccoccus thermophilus. M17 agar (Difco) was used to enumerate Streptococcus in yoghurt samples and incubated aerobically at 37^{o}C for 72 hours according to Torriani *et al*. (1996).

Lactobacillus delbrueckii sbsp. Bulgaricus. MRS Rogosa agar (Difco) was used for enumeration according to Tharmaraji and Shah, (2003). Plates were incubated under anaerobic condition at 37^{o}C for 72 hours.

Coliform count (Most probable number (MPN). On lauryl sulphate broth according to ICMSF (1996).

Total mold and yeast count. Sabauroud agar media was used for enumeration according to APHA (1992) and Pitt and Hocking, (1997).

Stability of AFM1 during manufacture and storage of carrot yogurt

Manufactured plain and carrot yogurt samples contaminated with aflatoxin M1 were placed in the refrigerator at 4^{o}C and examined after 7, 10, 14 and 21 days respectively according to (Blanco *et al*., 1993 and Hassanin, 1999). Aflatoxin M1 content was extracted and determined in triplicate 50 g per sample. Toxin free samples were used as control. Extraction of aflatoxin M1 was applied according to Skrinjar *et al*. (1995) and Pietri *et al*. (1997). Aflatoxin M1 was determined in plain and carrot yoghurt samples using Enzyme linked immunosorbent assay method (ELISA) according to (Riedel de Haen, 1997). The detection limit was 0.02µg/kg and the recovery percentage was 90%.

Statistical analysis: Data were analyzed statistically by running Student t test using Statview 512+ software (1986). Chi square was performed to compare between the plain (control) and carrot yoghurt. Significant effects were declared at $P < 0.05$.

Results and Discussion

Organoleptic examination: Sensory properties of foods offer quality control criteria. With regard to sensory

Table 1: organoleptic examination of plain and carrot yoghurt

Score	Flavour (60 points)	Body & texture (30 points)	Colour and Appearance (10 points)	Total score
0 % Control				
0	56	25	9	90
1 w	48	22	8	78
2 w	40	20	8	68
3 w	Excluded for spoilage			
5%				
0	25	25	9	90
1 w	55	24	8	87
2 w	46	23	8	77
3 w	Excluded for spoilage			
10%				
0	56	25	9	90
1 w	57	24	9	90
2 w	49	23	8	80
3 w	Excluded for spoilage			
15%				
0	57	25	9	91
1 w	58	25	9	92
2 w	57	25	9	91
3 w	55	24	8	87
20%				
0	53	23	9	85
1 w	54	22	9	85
2 w	50	20	7	77
3 w	48	21	7	76

Table 2: Chemical composition of fresh carrot juice

Chemical composition	Values
Moisture % (F.Wt.)	92.85
Total solids% (F.Wt.)	7.15
Total soluble solids% (T.S.S & F.Wt)	6.45
Titratable acidity as citric acid% (T.A and D.M)	2.58
Total sugars% (D.M)	36.80
Total carotenoids (mg/100g)	12.00
Riboflavin mg/g	0.62
PH	5.85

*F.Wt.: Fresh weight. **D.M: Dry Matter.

properties, plain and carrot yoghurt were evaluated for flavor, body texture and color and appearance. The mean flavor scores for plain and carrot yoghurt samples are shown in Table 1. The organoleptic properties in both control and carrot yoghurt samples after manufacture were good. There was no significant differences (P>0.05) observed between plain and yoghurt with 5, 10, 15 and 20% carrot juice at zero time. The flavor and odor were pleasant and sweet, appearance and color were normal. During cold storage the scores increased with increase in the percentage of added carrot juice. This can be attributed to the sweet taste of manufactured carrot yoghurt. After 2 weeks of storage, the organoleptic properties of yoghurt with different carrot juice concentration become even better particularly yoghurt with 15 % carrot juice. On the other hand, during the third week plain, and yoghurt with 5 and 10% carrot juice were rejected as they spoiled. However, yoghurt with 15 and 20% carrot juice can be considered acceptable, and showed better shelf life than the control (Fig. 1 and 2). The addition of 15% carrot juice to yoghurt showed to be the best concentration as it got the highest evaluation marks during the storage period. It implies no unpleasant aftertaste, a pleasant level of acidity and pleasing balance of flavor during the storage period.

Chemical composition: As shown in Table 2 the major component of carrot juice was 92.85% moisture, 7.51% total solids. Total soluble solids, acidity, total sugar, total corotenoids and riboflavin were 6.45, 2.58%, 36.80%, 12 mg/100g and 0.62 mg/g respectively. Concerning the gross chemical composition of carrot yoghurt samples, fat, total nitrogen and total solids % decreased with the increased carrot juice, while the moisture content was increased (Table 3). This may be due to the high moisture content of the added carrot juice. The acidity increased and the pH decreased progressively during the storage period especially for samples with 15 and 20% carrot juice. This may be due to the excessive sugar fermentation and the presence of lactic acid producing organisms. Storage of all

Table 3: Chemical composition of plain and carrot yoghurt

Parameters	Plain	Carrot Juice			
		5%	10%	15%	20%
Total solids%	13.52	12.90	12.25	11.75	11.05
Total nitrogen%	0.65	0.62	0.60	0.55	0.52
Fat%	3.75	3.55	3.35	3.20	3.05
Fat/D.M%*	27.74	27.52	27.35	27.23	27.60
TVFA**	0.27	0.23	0.21	0.18	0.15
Coagulation time (min)	140	165	198	205	205

D.M* Dry Matter, TVFA** Total volatile fatty acids

Table 4: Acidity % of plain and carrot yoghurt during storage period

Storage period (days)	Control	Carrot Juice			
		5%	10%	15%	20%
Fresh	0.52	0.55	0.50	0.52	0.48
1	0.85	0.93	0.98	1.05	1.18
3	0.92	0.97	1.07	1.22	1.28
7	0.98	1.05	1.18	1.32	1.40
10	1.07	1.18	1.27	1.38	1.45
13	1.22	1.35	1.38	1.45	1.52
17	1.37	1.32	1.40	1.42	1.48
21	1.35	1.35	1.35	1.37	1.45

Table 5: pH of flovoured yoghurt during storage period for control and carrot yoghurt samples

Storage period (days)	Control	Carrot Juice			
		5%	10%	15%	20%
Fresh	5.15	5.20	5.10	5.05	4.90
1	4.45	4.35	4.30	4.25	4.15
3	4.30	4.25	4.20	4.10	4.05
7	4.20	4.15	4.10	4.00	3.95
10	4.20	4.10	4.05	3.90	3.85
13	4.10	4.05	3.95	3.85	3.80
17	4.10	4.15	4.00	3.85	3.90
21	4.15	4.20	4.05	3.90	3.90

Table 6: Effect of adding carrot Juice on the WSN/TN% for carrot yoghurt during cold storage

Storage period (days)	Control	Carrot Juice			
		5%	10%	15%	20%
Fresh	27.69	27.41	26.67	27.27	25.98
3	29.23	29.03	28.33	28.07	27.78
6	35.38	33.87	31.67	31.58	31.48
9	41.54	37.10	35.00	33.33	31.48
12	49.23	41.93	38.33	36.84	33.33
15	56.92	46.77	41.67	38.60	35.19
18	64.62	53.23	48.33	43.86	38.89
21	69.23	58.06	53.33	49.12	42.59

examined samples were accompanied with increased acidity and lower pH. This was more pronounced with 20% carrot juice concentration (Table 4 and 5). The water soluble nitrogen and water soluble nitrogen/ total nitrogen % WSN/TN decreased with the increased carrot juice concentration (Table 6). This may be due to the inhibitory effect of carrot juice on proteolytic organisms that could harbour break down of protein. These results

Table 7: Curd tension and curd syneresis of fresh and stored flavoured yoghurt by using carrot juice

Storage period (days)	Parameters	Concentration of add carrot juice				
		0% control	5%	10%	15%	20%
Fresh	Curd tension (g)	21.4	19.7	18.5	17.7	16.8
	Syneresis ml/100ml	3.0	3.8	4.5	6.3	7.2
3	Curd tension (g)	23.7	21.8	19.4	18.8	17.5
	Syneresis ml/100ml	6.5	7.3	8.4	10.4	10.7
6	Curd tension (g)	26.5	23.5	21.7	19.3	18.3
	Syneresis ml/100ml	7.2	8.7	9.8	11.5	11.9
9	Curd tension (g)	27.8	25.3	22.8	20.8	18.7
	Syneresis ml/100ml	7.6	9.6	10.7	12.7	12.5
12	Curd tension (g)	28.6	26.7	23.1	21.4	19.2
	Syneresis ml/100ml	7.8	10.4	11.3	13.8	13.8
15	Curd tension (g)	29.3	27.2	23.9	21.9	19.8
	Syneresis ml/100ml	8.0	10.8	12.5	14.6	15.7
18	Curd tension (g)	29.7	27.5	24.3	22.3	20.3
	Syneresis ml/100ml	8.2	11.4	13.2	15.2	16.4
21	Curd tension (g)	29.7	27.5	24.5	22.5	20.5
	Syneresis ml/100ml	8.5	11.7	13.6	15.8	17.2

Table 8: Effect of different concentration of carrot juice on the mean *Lactobacilus bulgaricus* count during carrot yoghurt storage (Colony forming unit CFU/g)

Carrot juice %	Storage period (days)							
	0 time	1 days	3 days	7 days	10 days	13 days	16 days	21 days
Control	8.71×10^5	8.70×10^5	8.69×10^5	8.73×10^5	8.66×10^5	8.60×10^5	8.58×10^5	7.50×10^5
5%	8.73×10^5	8.73×10^5	8.77×10^5	8.77×10^5	8.78×10^5	8.90×10^5	8.91×10^5	8.93×10^5
10%	8.80×10^5	8.82×10^5	8.86×10^5	8.89×10^5	8.98×10^5	8.98×10^5	9.10×10^5	9.15×10^5
15%	8.82×10^5	8.85×10^5	8.55×10^5	8.90×10^5	9.00×10^5	9.10×10^5	9.77×10^5	9.79×10^5
20%	8.90×10^5	8.85×10^5	8.60×10^5	8.92×10^5	9.00×10^5	9.01×10^5	9.50×10^5	9.90×10^5

Table 9: Effect of different concentration of carrot juice on the mean *Streptococcus thermophilus* count during carrot yoghurt storage

Carrot juice %	Storage period (days)							
	0 time	1 days	3 days	7 days	10 days	13 days	16 days	21 days
Control	2.40×10^4	2.48×10^4	2.49×10^4	2.42×10^4	2.36×10^4	2.35×10^4	2.55×10^4	2.80×10^4
5%	2.50×10^4	2.50×10^4	2.55×10^4	2.58×10^4	2.59×10^4	2.58×10^4	2.59×10^4	2.58×10^4
10%	2.50×10^4	2.51×10^4	2.58×10^4	2.59×10^4	2.58×10^4	2.59×10^4	2.59×10^4	2.60×10^4
15%	2.50×10^4	4.8×10^4	8.50×10^4	15×10^4	32×10^4	45×10^4	69×10^4	75×10^4
20%	3.8×10^4	6.5×10^4	18.0×10^4	22×10^4	35×10^4	50×10^4	55×10^4	68×10^4

were in agreement with data recorded by EL-Dieb *et al*. (1997) and Nyati (2000). There was positive relationship between the added carrot juice and the decreasing rate of curd tension. In all treatments, both syneresis and curd tension increased during the storage period (Fig. 3 and 4). The curd tension of carrot yoghurt was affected by the concentration of carrot juice. It was found that the curd tension rate decreased with the increase of the concentration of added carrot juice, on contrary, the syneresis increased with the increase of the concentration of added carrot juice. In all treatments, both syneresis and curd tension increased with the increase of storage period (Table 7). Nearly similar finding was reported by Galal *et al*. (2003).

Microbiological analysis: Table 8 and 9 showed the growth of *L. bulgaricus* and *S. thermophillus* in both plain and carrot yoghurt at zero time and during three weeks of cold storage. The mean total count of both strains of lactic acid bacteria exhibited approximately the same behavior in plain and carrot yoghurt samples. There were no significant differences ($P<0.05$) between plain and 5, 10, 15 and 20% carrot yoghurt samples. The viability of *L. bulgaricus* and *S. thermophillus* remained

Table 10: Effect of different concentration of carrot juice on the total coliform count (MPN/gm) of carrot yoghurt during storage

Carrot juice %	Storage period (days)							
	0 time	1 days	3 days	7 days	10 days	13 days	17 days	21 days
Control	$50x10^2$	$56x10^2$	$57x10^2$	$64x10^2$	$77x10^2$	$40x10^2$	$90x10^2$	$1.1x10^2$
5%	$50x10^2$	$40x10^2$	$10x10^2$	$6x10^2$	$4x10^2$	$1x10^2$	NA	NA
10%	$46x10^2$	$29x10^2$	150	NA	NA	NA	NA	NA
15%	$30x10^2$	$1.3x10^2$	NA	NA	NA	NA	NA	NA
20%	$30x10^2$	NA	NA	NA	NA	NA	NA	NA

*NA: not available

Table 11: Effect of different concentration of carrot juice on the total mold and yeast count (CFU/gm) in carrot yoghurt samples

Carrot juice %	Storage period (days)				
	0 time	5 days	10 days	17days	21 days
Control	$3.9x10^3$	45×10^3	77×10^4	12×10^5	28×10^7
5%	$20x10^3$	1.8×10^3	1.5×10^3	4.4×10^3	NA
10%	$5.0x10^3$	12×10^2	7×10^2	NA	NA
15%	$4.1x10^2$	$1x10^2$	NA	NA	NA
20%	$1.1\ x10^2$	NA	NA	NA	NA

NA: not available

Table 12: The effect of carrot juice on aflatoxin M1 (ng/kg) during manufacture and storage of yoghurt

Storage period/ day	Carrot concentrations									
	Control (0)		5%		10%		15%		20%	
	M	R %	M	R%	M	R%	M	R%	M	R%
0	100	0	80	20	75	25	60	40	30	70
7	100	0	80	20	75	25	60	40	30	70
10	99	1	78	22	73	27	53	47	28	73
14	97	3	75	25	68	32	49	51	23	77
21	97	3	65	35	63	37	44	56	20	80

*M = Mean aflatoxin M1 concentration (ng/kg). **R= Reduction percent of aflatoxin M1

Fig. 1: Macroscopic appearance of plain (control) and carrot yoghurt (at zero time) after manufacture

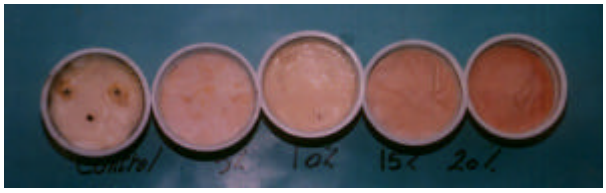

Fig. 2: Effect of different concentrations of carrot juice on shelf life time of yoghurt during 21 days of cold storage

high (> 105cfu/g) during 21 days of storage for the examined plain and carrot yoghurt samples. Carrot juice had no influence on the number of *both L. bulgaricus* or *S. thermophilus*. However, there is no sufficient data relating the effect of carrot on the survival of yoghurt bacteria. The above results were in agreement with Venizelou *et al*. (2000) who reported that the presence of flavoring materials added to yoghurt have little effect on the survival of *L. bulgaricus* and *S. thermophilus*.

Data presented in Table 10 indicated that *coliforms* organisms were detected in plain (control) yoghurt and increased in count along the storage period. *Coliform* counts markedly decreased with increase carrot juice concentration and completely disappeared in yoghurt with 15 and 20% carrot juice respectively. The obtained

results can explain the defects which may appear in plain and yoghurt with 5, 10% carrot juice (Fig. 1 and 2). There were significant differences (P < 0.05) in *Coliform* count between plain and yoghurt with 15 and 20% carrot juice. This may be due to the inhibitory effect of carrot upon *Coliform* organisms. In addition carrot is considered as antibacterial agent against pathogenic microorganisms which may get access into yoghurt either before or even after processing rendering the product unsafe for human consumption (Babic *et al*., 1994; Nyati, 2000).

Data illustrated in Table 11 indicated that *mold and yeast* count were increased along the storage period in plain yoghurt. The count decreased with increase carrot juice concentration and completely disappeared in yoghurt with 15 and 20% carrot juice. The obtained results can explain the defects which may appear in plain and yoghurt with 5 and 10% carrot juice (Fig. 1 and 2). There was significant difference (P < 0.05) in mold and yeast count between plain and yoghurt with 15 and 20% carrot juice. The inhibition of the growth of mold and yeast in carrot yoghurt may be attributed to the action of isocoumarine which naturally present in traces in carrot (Höhn and Künsch 2003).

As shown in Table 12 the reduction % of aflatoxin M1 during manufacture of plain, 5, 10, 15 and 20% carrot yoghurt were zero, 20, 25, 40 and 70% respectively. The storage of all examined samples for 7, 10, 14 and 21 days gave 0, 20, 25, 40, 70% and 1, 22, 27, 47, 73% and 3, 25, 32, 51, 77% and 3, 35, 37, 56, 80% aflatoxin M1 reduction respectively. There was a significant difference in aflatoxin M1 reduction (P<0.05) between plain and carrot yoghurt. In contrast, a high reduction % of AFM1 (77 and 80%) were observed during manufacture and storage of yoghurt with 15 and 20% carrot juice respectively. This high reduction % may be due to the action of riboflavin naturally present in carrot juice. Riboflavin have complementary and overlapping mechanisms of action on aflatoxin M1. The most important function of riboflavin is the nonenzymic oxidation-reduction reaction between flavins and pyridine nucleotides. It can be phsophatized by light to form an electronic excited molecule that may react with the double bond in the terminal dihydrofuran moiety of aflatoxin M1 leading to their transformation of aflatoxin M1 into aflatoxin M2a which is non toxic (Joseph *et al*., 1997; Aman 1998; Yousef, 2000; Pitt (2003) and Martins and Martins, 2004). Nearly similar findings were recorded by Wiseman and Marth (1983); Blanco *et al*. (1993); Gourama and Bullerman, (1995); Salwa and Diekmann, (2000) and Govaris *et al*. (2002) who found that AFM1 was relatively stable in plain yoghurt during manufacture and storage.

Conclusion: The results of the present investigation are of practical value. The use of carrot with yoghurt was advantageous due to its antibacterial and antifungal properties as well as its inhibitory effect on aflatoxin M1. In addition carrot is safe for public health and used as vitaminized food supplement. The results highlighted the possibility of processing yoghurt with 15% carrot juice. The developed product was evaluated and proved to be of good quality, long shelf life and could be kept at 4°C for 21 days without significant microbial growth or loss of the product color & texture as well as 77% aflatoxin M1 degradation during manufacture and storage.

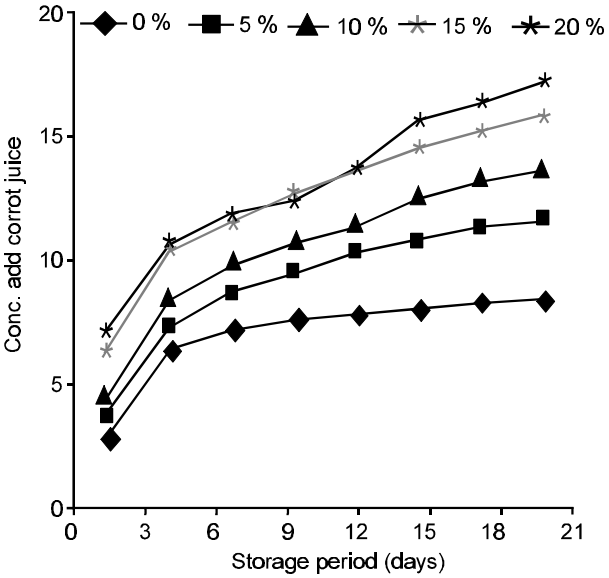

Fig. 3: Syneresis of fresh and carrot yoghurt

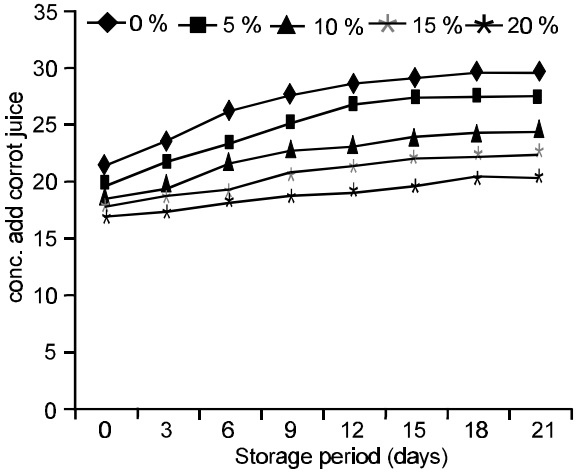

Fig. 4: Curd tension of plain and carrot yoghurt

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