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CHEMICAL, PHYSICAL, MICROBIOLOGICAL AND SENSORY CHARACTERISTICS OF SOME PLAIN AND FLAVORED YOGHURT IN EGYPT

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ABSTRACT

Fifty one samples of plain and flavored yoghurts were collected from four native firms (A, B, C and D). All samples were kept at 4^{o}C/14 days. Samples were chemically, rheologically, microbiologically and organoleptically analyzed when fresh and periodically after 7 and 14 days of storage. Main chemical components such as T.S, fat and total sugars were determined in fresh samples. The obtained results revealed that total solids and total sugars were higher in flavored yoghurts than that of plain yoghurts while fat content of flavored yoghurt was lower. In general, it was found that the pH of collected flavored yoghurt samples was higher than that of its correspondence plain yoghurt. Upon storage the pH in both collected yoghurts was decreased. Regarding the acetaldehyde content, the obtained results generally indicated that collected flavored yoghurt samples contained higher acetaldehyde as compared with their plain correspondents. Upon storage, the acetaldehyde content of some plain and flavored yoghurt samples was increased and decreased in some other yoghurt samples. Viscosity of collected flavored yoghurt when fresh and during storage was lower than that of plain one. Microbiological analysis exhibited that the total bacterial count (TBC) was affected by the type of flavoring material added. In general, the use of blackberry led to increase the TBC of the resultant product. The TBC of collected samples was decreased upon storage. Referring to the starter culture (Streptococci and Lactobacilli) it was seen that the count of Streptococci was significantly higher than that of Lactobacilli. Both the two organisms were decreased upon storage. No coliform and Salmonellae bacteria were detected in all yoghurts while, few colonies of moulds and yeasts were detected during the storage period. The percentage of positive samples was 47% out of 51 samples. Sporeformers were detected in all collected fresh samples and significantly decreased during storage. Whereas, psychrotrophics were detected in 58.82% out of 51 samples and insignificantly increased during storage. The present work delineated that marketed plain and flavored yoghurts produced by large scale firms were highly acceptable and no changes in organoleptic properties were noticed during its shelf-life.

INTRODUCTION

During the last few decades there has been a phenomenal increase in the production and consumption of fermented milks all over the world for use as nutritious and refreshing diet or as therapeutic agents in the treatment of chronic diseases. Owing to the recent dietetic recommendations to increase consumption of fruits and vegetables as good sources of major antioxidants (kaur and kapoor, 2001 and shi *et. al*., 2002), increasing demand of consumers for fruit and flavored yoghurt gained major importance in the dairy industries world-wide. Supplementation of fruit and flavored yoghurt with probiotic bacteria confers unique therapeutic characteristics. Maintaining

yoghurt organisms in viable and active case before consumption under the presence of different fruits or vegetables or different proportions of them is a great target. Recently, fruit and flavored yoghurt production and consumption are enormously increased. However, there are not sufficient data relating the effect that fruits may have on the survival of yoghurt bacteria as well as different properties of resulted products.

Therefore, this study focus on surveying physical, chemical, microbiological and sensory properties of the fruit flavored yoghurt produced in Egypt.

MATERIALS AND METHODS

A total of fifty one samples of plain and fruit flavored yoghurts manufactured by four Egyptian companies were collected in their containers. All samples were taken for analysis when fresh, 7 and 14 days of storage at 5°C.

Total solids, fat were determined according to A.O.A.C. (2002). Total sugars were determined calorimetrically using Barnett and Abd El Tawab (1957) method. pH was measured using a laboratory pH meter (Type WTW, Inolab720, Germany). Viscosity was estimated using Brookfield viscometer LTV with spindle RV5 at 150 rpm in 200 ml sample at 25^{o}C. Acetaldehyde content was estimated as described by lees and Jago (1969).

Total bacterial count (TBC), Lactobacilli count, Molds & yeasts count, Coliform count and psychrotrophic count were determined according to the methods of A.P.H.A. (1990). Salmonellae were determined using the method of International Committee on Microbiological Specification of Foods *(ICMSF, 1982)*. Streptococci count was enumerated using M17 agar (Terzaghi and Sandine, 1975). While, sporeformers bacterial count was estimated as described by El-Sadek and Mohamed (1967).

Organoleptic assessment was carried out as mentioned by El-Senaity (1999).

Statistical analysis was performed by running the MSTAT-C (Ver. 2.10, Michigan State Univ., USA) programme.

RESULTS AND DISCUSSION

The main chemical components of fresh flavored yoghurt produced by four native Firms as compared with their plain correspondence are presented in Table (1). It is clear that the total solids of all flavored yoghurts were considerably higher than those of their correspondence of plain yoghurts. Moreover, it can be seen from Table (1) that the total solids of plain yoghurts analyzed were different depending only upon the milk solids used by the produced firms. While in case of flavored yoghurt, the total solids depended upon the total solids in milk, percentage of fruit or vegetable included as flavoring ingredient and percentage of added sugar. The total solids of plain yoghurt ranged from 14.1% (firm D) to 17.7% (firm B) whereas that of flavored yoghurt ranged from 21.5% (firm C) to 27.9 (firm B). These

figures are in accordance with those reported by Uraltas and Nazl (1998) who found that the dry matter contents of 50 samples of fruit yoghurt produced in Turkey ranged from 22.2 to 25.7%. Similarly Sahan *et. a*l., (1999) indicated a range of 19.37-25.8% for 74 samples of flavored yoghurt produced by 3 Turkish firms. Taha *et. al*., (2007) showed that total solids contents of flavored yoghurt like products ranged from 22 to 23%.

Regarding the fat and total sugars contents of plain and flavored yoghurts as shown in Table (1), it is clear that values for fat ranged from 3.0 to 3.5% and 1.6 to 3.3% for plain and flavored yoghurts, respectively. While values for total sugars ranged from 3.54 to 4.7% and 7.8-15.8% for plain and flavored yoghurts produced by the four different firms, respectively. This might be due to chemical composition of manufacturing milk, types and amount of fruits used, percentage of added sugar and legislations standards verifications (low fat or full fat produced). These results are in agreement with those reported by Mehanna *et. al*., (2000).

Table (1): Main chemical components of fresh plain and flavored yoghurt collected from the Egyptian market.

Yoghurt sample	Sample source	Total solids %	Fat %	Total Sugars %
Plain	A	15.90	3.50	4.70
	B	17.70	3.40	3.60
	C	14.80	3.20	3.75
	D	14.10	3.00	3.54
Strawberry	A	25.30	1.60	11.40
	B	27.80	3.00	13.90
	C	21.50	2.20	11.80
	D	24.30	3.30	7.80
Peach	A	25.70	1.90	10.30
	B	27.90	2.70	11.40
	C	21.70	2.60	11.60
	D	25.40	2.90	8.90
Blackberry	A	26.00	2.20	12.90
	B	27.50	2.80	15.80

	C	24.90	3.30	12.40
Mango	A	25.30	2.30	13.20
	B	24.80	2.60	12.50

A, B, C and D are four different native firms producing yoghurt.

As shown in Table (2) the pH values of plain yoghurts ranged from 4.09 to 4.41, while it was 4.09 to 4.34 for flavored yoghurts. It appears from the results that the pH values of plain yoghurts were lower than that of flavored yoghurts except for that of firm C which might be due to the type of cultures used in processing. Fresh flavored yoghurt samples containing Blackberry had lower pH as compared with other flavored yoghurts produced by the same firm.

Statistical analysis showed that storage had a significant effect ($P<0.05$) on the pH values. pH values of all samples were decreased after 7 days of storage after which the pH of the overall samples decreased at 14 days of storage except for some samples where their pH values were increased at the end of storage and this might be due to the growth of molds and yeasts as shown in Table, 4. The present results with respect to pH during storage of yoghurt samples are in line with the results of Mehanna *et al.* (1988 & 2000).

Table (2) show the acetaldehyde content of collected plain and flavored yoghurt samples. Acetaldehyde content of fresh plain yoghurt ranged from 12.28 to 17.90 ppm while it ranged from 10.52 to 32.31 ppm for fresh flavored yoghurt from the different native firms under investigation. The data presented in Table (2) also delineated that acetaldehyde content of fresh flavored yoghurts was higher in general than that of plain yoghurts except for some flavored yoghurts such as strawberry (Firm B). Moreover, it is clear that Mango, Peach and Strawberry flavored yoghurts contained higher acetaldehyde than that of their correspondents containing Blackberry. Upon storage for fourteen days at 5^{o}C it was noticed that the acetaldehyde content was increased as in case of plain yoghurt (Firm A and C), Blackberry yoghurt (Firm A and D) and Peach and Strawberry yoghurts (Firm B), respectively. This is in accordance with the results obtained by Salem *et. al.,* (2006) for probiotic milk beverages fortified with antioxidants (Strawberry, Blackberry, Tomato, Red grape, Pumpkin and Carrot juice). On the other hand, the acetaldehyde content of the same types of yoghurts from other firms was either gradually decreased upon storage which is in line with the results reported by Abd El-Aziz *et. al.,* (2004) or slightly decreased during the first weak of storage then insignificantly increased after 14 days of storage being in accordance with the results obtained by El-Baz and Zommara, (2007). The overall change in acetaldehyde content was significantly affected by storage period at 5^{o}C especially during the first 7 days as indicated in the same table.

Table (2):Chemical and rhiological properties of collected plain and flavored yoghurt from Egyptian market during storage at 5 ºC.

A, B, C and D are four different native firms producing yoghurt.

It can be noticed that fresh control samples (plain yoghurt) had higher viscosities as compared with that of flavored samples produced from the same firm. The viscosity values ranged from 1093.67 to 1285 cp. for controls and 341 to 1145 cp. for flavored samples from the different firms. This might be due to the common reduction in viscosity of fruit yoghurts (Akyüz and Coskum, 1995) as a result of the decrease in the consistency of the products due to reduction in water-binding capacity of proteins.

The viscosities of most collected yoghurt samples were gradually increased till the end of storage period at different rates being highest in plain yoghurt samples and lowest in peach flavored yoghurt sample (Firm C). On the other hand, viscosity of some other samples increased during the first seven days of storage at 5 ºC then decreased as seen in case of plain (Firm A, B and C), strawberry (Firm A) and mango (Firm B).

The variation in viscosity of the experimented samples might be due to variations in their chemical composition, type of culture used, etc. This is in line with the results of Rohm and Schmid, (1993) who reported that viscosity differences between products with different protein content were probably caused by structural phenomena.

Table (2) indicated also that the effect of storage period on the viscosity of collected plain and flavored yoghurts was highly significant ($P<0.05$) at 14 days than that of 7 days.

Total bacterial count (TBC) of yoghurt samples collected from local markets was presented in Table (3). A decrease in TBC of all samples during storage was noticed till the end of storage with some fluctuations except for plain and blackberry yoghurt samples from B and D firms which behaved differently. It could be also observed that, changes in values of TBC in yoghurt samples from B and C firms were significantly higher ($P<0.05$) than those of A and D samples. This is obviously due to the expected lower microbial activity at the higher levels of acidity as confirmed from data presented in Table (2).

Yoghurt sample	Sample source	pH			Acetaldehyde (ppm)			Viscosity (cp.)		
		Storage period (5 ºC / 14 days)								
		Fresh	7	14	Fresh	7	14	Fresh	7	14
Plain	A	4.21	4.14	4.21	12.28	14.87	16.52	1285.00	1522.00	1413.00
	B	4.10	4.02	4.05	17.90	15.32	9.87	1123.00	1357.67	1273.33
	C	4.41	4.30	4.48	12.76	12.81	13.53	1145.00	1244.00	1131.67
	D	4.09	3.97	4.02	17.58	15.75	15.25	1093.67	1296.00	1349.67
Strawberry	A	4.32	4.16	4.15	22.20	18.75	16.23	1251.67	1389.00	1310.67
	B	4.19	4.16	4.23	10.52	11.14	21.94	650.00	699.00	1275.00
	C	4.33	4.33	4.08	14.30	12.62	11.77	776.00	1091.00	1220.00
	D	4.16	4.12	4.19	19.02	14.63	16.48	1045.00	868.00	692.67
Peach	A	4.24	4.18	4.13	15.40	15.29	14.50	859.67	788.67	974.67
	B	4.33	4.33	4.07	16.32	20.05	24.48	776.00	1080.00	1370.00
	C	4.25	4.24	4.20	23.53	13.67	11.40	439.00	501.00	600.33
	D	4.20	4.16	4.13	32.31	17.55	15.73	452.33	485.67	617.67
Blackberry	A	4.31	4.28	4.26	17.59	25.80	32.81	341.00	440.00	677.00
	B	4.12	4.02	4.02	14.00	13.46	19.76	915.00	1150.67	1329.33
	C	4.09	4.04	3.96	15.17	17.96	18.12	1067.00	1285.00	1929.00
Mango	A	4.34	4.33	4.20	22.31	14.21	14.30	926.00	944.00	990.00
	B	4.31	4.22	4.26	26.47	20.78	19.59	424.00	766.00	666.00
Mean		**3.60** ^{b}	**3.55** ^{a}	**3.53** ^{c}	**15.03** ^{a}	**13.73** ^{b}	**14.61** ^{a}	**728.47** ^{b}	**845.38** ^{a}	**941.00** ^{a}

Statistical analysis showed that storage period had a significant effect (P<0.05) on the total bacterial count. Data indicated that the total bacterial

Yoghurt sample	Sample source	Streptococci ($\times10^7$)			Lactobacilli ($\times10^6$)			T.C ($\times10^6$)		
		Storage period (5 ºC / 14 days)								
		Fresh	7	14	Fresh	7	14	Fresh	7	14
Plain	A	91.00	65.70	1.18	153.50	3.63	8.74	54.40	8.60	11.50
	B	138.00	84.13	101.00	0.43	0.79	4.67	47.60	600.00	321.00
	C	92.00	45.10	38.00	50.00	0.08	0.10	284.00	256.20	68.42
	D	77.30	130.00	71.00	0.54	16.28	14.07	119.00	59.00	141.00

count was decreased significantly (P<0.05) as the storage period progressed.

As observed in Table (3) the counts of viable streptococci was markedly higher than that of lactobacilli in all collected yoghurt samples either when fresh or during storage and these results are in agreement with those of Dave and Shah, (1997) and Birollo *et. al.*, (2000). The obtained results also illustrate that the presence of flavoring materials such as strawberry and peach led to increase the viable count of streptococci in yoghurt samples produced by C and D firms as compared with that of the plain yoghurt samples (control) which is in agreement with Taha *et. al*., (2007).

The opposite was true in yoghurt samples produced by A and B firms which might be due to different factors such as type of starter used,

Table (3): Counts of Lactic acid bacteria in collected plain and flavored yoghurt from Egyptian market during storage at 5 ºC.

Strawberry	A	72.33	43.53	26.76	0.09	0.01	0.82	109.50	0.30	0.82
	B	61.67	75.33	40.33	1.29	0.39	0.05	194.00	99.00	3.70
	C	158.33	119.53	41.02	0.18	0.51	0.30	0.78	3.60	62.00
	D	118.17	50.10	10.72	20.59	1.19	0.45	0.60	4.95	0.18
Peach	A	67.33	70.00	30.00	8.00	1.30	6.02	323.00	262.00	32.00
	B	145.33	95.67	43.83	0.20	10.50	3.90	1.28	67.22	35.00
	C	152.50	73.40	95.50	5.85	0.28	0.80	17.00	11.25	17.00
	D	80.50	60.25	66.50	8.00	0.06	0.06	20.00	3.03	2.48
Blackberry	A	28.50	43.87	96.30	3.20	0.24	1.46	31.82	29.00	17.00
	B	127.67	53.00	105.00	0.29	53.90	26.77	343.00	266.00	310.00
	C	98.00	90.00	133.00	2.15	0.47	0.08	700.00	200.00	480.00
Mango	A	113.33	71.00	51.28	19.33	0.60	3.19	0.46	0.44	0.26
	B	120.00	67.17	84.05	0.70	7.80	1.00	7.82	4.00	4.44
Mean		**87.1** [a]	**72.8** [b]	**60.9** [c]	**13.7** [a]	**4.9** [a]	**3.6** [a]	**112** [a]	**93.7** [b]	**75.3** [b]

A, B, C and D are four different native firms producing yoghurt.

Fermentation and storage conditions…etc. The viable count of lactobacilli is greatly affected by the presence of flavoring materials. It is clearly noticed that flavoring materials depressed the growth of lactobacilli. The analysis of variance indicated that the viable count of streptococci or lactobacilli was significantly affected by storage period. It was clearly noticed that the counts of streptococci was gradually and significantly ($P<0.05$) decreased till the end of storage. The counts of lactobacilli showed a non significant decrease during storage.

In normal fermentation, a final pH of < 4.5 is developed in cultured milk products. This low pH generally prevents the growth of most spoilage and pathogenic bacteria. Although, interference with acid development may allow growth of undesirable microorganisms (APHA, 1992).

No coliform and salmonellae could be isolated from the examined samples. Similar results were recorded by Ahmed, (1991) and Uraltas and Nazl., (1998).

The low pH of yoghurt creates undesirable environment for the growth of most spoilage microorganisms other than yeasts and Molds (Al-Hawary *et al.,* 2005). Moreover, Tamime *et al*., (1993) indicated that any yoghurt sample contains over a 100 CFU/g of Molds and yeasts were unacceptable.

Table (4) shows that Moulds and yeasts counts were detected in (52.94%) out of 51 samples of plain and flavored yoghurt (9 samples of plain yoghurt and 21 of flavored yoghurt). Data presented showed that Moulds and yeasts were not present in most of fresh samples but appeared at day 7 of storage in some collected samples with counts ranged from 27 CFU/g to 33.33×10^3 CFU/g and appeared in some other samples at the end of storage period and increased significantly ($P<0.05$) till the end of storage and these results are in accordance with Çon *et al*., (1995), Salwa *et al.*, (2004) and TarakÇi and KÜcÜköner (2003) except for some of samples, where the counts were decreased at the end of storage and this may be due to the increase in the pH as shown in Table (2). It is remarkable that plain samples

had lower Moulds and Yeasts as compared with flavored one which is in agreement with the results obtained by Taha *et al*., (2007).

Table (4): Counts of contaminants in collected plain and flavored yoghurt from Egyptian market during storage at 5 ºC.

A, B, C and D are four different native firms producing yoghurt.

Results in Table (4) also illustrate that the sporeformers were detected in all collected fresh samples in very few numbers ranged from 0.7 to 8.3 CFU/g and significantly decreased during storage. These findings are in agreement with that of Al-roubaiya, (2005) who observed that the sporeformers numbers of cultured milk (Rayeb) were decreased upon storage and disappeared after 20 days of storage and reported that this decrease is most likely due to the effect of acidity.

Yoghurt sample	Sample source	Sporeformers (CFU/g)			Molds&Yeasts × 10^3			Psychrotrophics ×10^2		
		Storage period (5 ºC / 14 days)								
		Fresh	7	14	Fresh	7	14	Fresh	7	14
Plain	A	2.00	0.33	0.33	0.00	11.66	1.00	0.33	1.00	1.67
	B	5.00	1.67	1.00	0.00	0.00	0.00	0.10	0.40	0.00
	C	1.33	1.00	1.33	0.03	0.07	0.17	0.00	0.00	0.00
	D	2.33	2.33	1.67	0.00	0.00	0.00	0.07	0.33	0.00
Strawberry	A	0.67	1.67	1.33	0.00	0.00	50.00	0.00	0.00	0.00
	B	1.00	1.67	1.00	0.00	26.66	14.00	0.47	4.67	0.63
	C	3.00	3.00	1.33	0.00	0.03	33.30	0.00	0.00	0.00
	D	4.00	2.33	1.33	0.00	0.00	0.00	0.00	0.00	0.00
Peach	A	1.00	1.67	2.00	0.00	0.00	0.00	0.03	1.00	1.00
	B	2.67	2.67	1.00	13.30	33.33	30.00	6.67	0.00	16.67
	C	2.33	0.67	2.33	0.00	0.00	0.00	1.73	5.73	8.83
	D	8.33	1.33	3.67	0.00	0.00	0.00	0.07	1.50	4.17
Blackberry	A	4.00	2.00	0.33	0.00	0.00	0.00	20.00	16.67	26.67
	B	4.00	4.33	0.33	0.00	1.00	10.00	0.00	0.00	0.00
	C	0.77	0.22	0.77	0.00	0.00	0.00	0.00	0.00	0.00
Mango	A	1.00	1.33	0.67	0.00	0.00	0.04	0.00	0.00	0.00
	B	1.00	0.67	1.00	0.02	0.03	0.03	2.33	0.00	0.00
Mean		**2.22 [a]**	**1.44[b]**	**1.07[b]**	**0.67 [c]**	**3.64 [b]**	**8.14 [a]**	**6.87 [a]**	**1.59[a]**	**1.57[a]**

The psychrotrophic bacteria may produce proteolytic and lipolytic enzymes leading to decrease the keeping quality of the product. Furthermore, individual numbers of these bacteria have been implicated as causal agents of food poisoning (Hobbos, 1975). The present work exhibited that psychrotrophic bacteria were detected in (58.82%) out of 51 samples of plain and flavored yoghurt (9 samples of plain yoghurt and 21 of flavored yoghurt) with counts ranged from 7 to 30 CFU/g in plain samples and 0.03-20 ×10^2 for flavored as shown in Table (4). Statistical data indicated that the psychrotrophic bacterial counts were increased not significantly ($P<0.05$) till the end of storage. Similar results were recorded by Ali *et al*., (2004) who

found psychrotrophic bacteria in strawberry yoghurt in similar numbers 3 $\times 10^2$ to 4 $\times 10^2$ in the first and last day of validity, respectively.

The results recorded in Table (5) illuminated that all fresh plain and flavored yoghurts were highly acceptable and scored more than 80 out 100. The most acceptable fresh plain yoghurts were those produced by firms D and B which scored 91.75 and 90.37, respectively. While the most acceptable fresh flavored yoghurts were those containing Strawberry, Peach and Mango as flavoring materials which scored 91.75 (Firm D), 91.15 (Firm C), and 89.36 (Firm B), respectively.

Upon storage, the total score for plain yoghurts was slightly and insignificantly decreased during the first 7 days of storage, and then increased to the same level of the fresh state.

Regarding the effect of storage period on the sensory properties of flavored yoghurts, it was noticed that the overall trend is a slight increase in the total score at the 7^{th} day of storage at $5^{O}C$. Thereafter the improvement of the sensory properties of the flavored yoghurts continued scoring either slightly higher levels than that of the fresh state or almost the same level. It is worthy to note that this effect was found to be insignificant from the statistical point of view.

In conclusion, the marketed plain and flavored yoghurts produced by large scale firms are highly acceptable and no changes in organoleptic properties were noticed during its shelf-life. But more sanitation is needed to avoid the presence of Moulds and yeasts as well as psychrotrophic bacteria.

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الخواص الفيزيائية والكيميائية والميكروبيولوجية والحسية لبعض عينات الزبادى الساده والمطعم فى مصر.

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تهدف هذه الدراسة الى عمل مسح لأنواع الزبادى الساده والمطعم الموجود فى السوق المصرى من حيث خواص هذا المنتج الفيزيائية والكيميائية والميكروبيولوجية مع عمل تحكيم حسى لهذه الأنواع حيث تم تجميع ٥١ عينة زبادى سادة ومطعم من أربع من الشركات المصرية الكبرى.

وقد تم حفظ كل العينات مبردة على ٤°م/١٤ يوم وتم تحليل العينات كيميائيا ، فيزيائيا ، ميكروبيولوجيا ، حسيا عندما كانت طازجة وبعد ٧ ، ١٤ يوم تخزين كما تم التقدير لكل من الجوامد الكلية ، الـ % للدهن ، الـ % للكربوهيدرات الكلية فى عينات الزبادى الطازجة. ودلت النتائج المتحصل عليها على أن الـ % للجوامد الكلية ، الـ % للكربوهيدرات الكلية للزبادى المطعم أعلى من مثيلتها فى الزبادى السادة بينما كانت الـ % للدهن فى المطعم أقل.

وبصفة عامة وجد أن درجة الـ pH للزبادى المطعم أعلى من مثيلتها فى الزبادى السادة مع ملاحظة حدوث انخفاض له فى كلا النوعين أثناء التخزين. أما عن محتوى الزبادى من الأسيتالدهيد فقد إتضح أنه أعلى فى الزبادى المطعم عن مثيله فى الزبادى السادة مع ملاحظة حدوث زيادة فى محتوى الأسيتالدهيد فى بعض عينات الزبادى السادة والمطعم وانخفاضه فى البعض الآخرأثناء التخزين. هذا وقد لوحظ أن لزوجة الزبادى المطعم سواء كان طازجا أو مخزنا أقل من الزبادى الساده.

وميكروبيولوجيا فقد وجد أن العدد الكلى للبكتيريا قد تأثر بنوع المطعم المضاف. فبصفة عامة أدى وجود التوت الأسود فى الزبادى الى زيادة العدد الكلى للبكتيريا وكذلك لوحظ انخفاض فى الأعداد أثناء التخزين. أما بكتيريا حامض اللآكتيك فقد وجد أن أعداد البكتيريا الكروية منها Streptococci كان أعلى من العصوية Lactobacilli وقد لوحظ انخفاض فى حيوية كل منهما أثناء التخزين بدليل انخفاض الأعداد. لم يتم العثور على أى من مجاميع الكوليفورم والسالمونيلا بينما تم العثور على عدد قليل من مستعمرات الفطر والخميرة أثناء التخزين وكانت نسبة العينات الموجبة ٥٢,٩٤% من ٥١ عينة. أما البكتيريا المتجرثمة فقد وجدت فى كل العينات وانخفضت انخفاض معنوى أثناء التخزين وحتى نهاية المدة. بينما تم العثور على البكتيريا المحبة للبرودة فى ٥٨,٨٢% من العينات وزادت أثناء التخزين ولكن هذه الزياده غير معنوية.

وقد أوضحت الدراسة أن عينات الزبادى سواء كان ساده أو مطعم كانت عالية القبول حسيا على طول مدة الحفظ ولم تطرأ عليها أى تغيرات غير مرغوبة .

Table (5): Average sensory evaluation score of collected plain and flavored yoghurt from Egyptian market during storage at 5 ºC.

Yoghurt sample	Sample source	Storage period (5 ºC / 14 days)														
		Fresh					7					14				
		Fl. [45]	Con. [30]	Acid. [10]	App. [15]	Total [100]	Fl. [45]	Con. [30]	Acid. [10]	App. [15]	Total [100]	Fl. [45]	Con. [30]	Acid. [10]	App. [15]	Total [100]
Plain	A	40.30	28.00	9.00	11.57	88.90	40.00	27.33	8.33	12.00	87.67	41.10	28.67	9.00	13.33	92.10
	B	40.75	28.25	8.00	13.37	90.37	37.00	26.50	7.00	13.00	83.50	40.75	28.25	8.00	13.50	90.50
	C	38.85	27.50	9.00	10.00	85.35	37.50	26.00	6.50	11.50	81.50	39.75	27.00	9.00	10.00	86.42
	D	41.42	27.50	9.25	13.25	91.75	34.50	24.50	7.50	13.00	79.50	41.30	27.50	8.85	12.65	90.30
Strawberry	A	38.68	27.83	7.17	11.47	85.50	35.67	27.00	7.67	12.00	82.33	40.20	27.43	8.67	13.43	86.40
	B	38.40	27.35	9.00	10.43	83.40	40.00	28.00	8.00	11.00	87.00	38.20	26.50	9.00	11.00	84.70
	C	39.90	27.57	8.95	12.50	88.78	41.50	24.00	9.50	10.00	85.00	40.65	28.25	9.00	14.25	92.98
	D	41.75	28.50	9.50	12.00	91.75	39.00	28.00	7.50	12.50	87.00	41.75	28.00	9.00	13.75	92.50
Peach	A	40.03	27.47	8.80	11.00	86.60	38.00	26.67	6.67	12.67	84.00	41.17	28.33	8.67	14.67	92.83
	B	39.37	28.25	8.50	11.40	87.77	42.00	28.00	8.50	12.00	90.50	42.00	29.00	9.00	14.00	94.00
	C	42.15	28.50	9.50	12.00	91.15	42.00	28.00	9.00	13.50	92.50	43.10	28.50	9.50	13.75	94.85
	D	37.90	26.50	10.00	10.00	84.40	42.00	28.00	8.00	13.50	91.50	39.35	28.50	9.50	13.00	90.35
Blackberry	A	39.65	26.00	9.35	9.55	82.70	39.00	28.00	8.00	11.50	86.50	40.25	28.00	9.00	13.50	90.75
	B	38.87	27.45	8.45	12.33	86.95	38.00	26.50	9.00	12.00	87.00	42.15	28.30	9.50	14.25	92.20
	C	38.60	27.80	7.10	11.46	85.50	38.40	27.30	9.00	10.40	83.40	39.00	28.00	8.00	11.50	86.50
Mango	A	39.50	27.67	7.43	10.43	85.73	39.67	27.00	7.67	11.67	86.00	39.60	27.67	8.67	13.83	89.37
	B	40.21	27.50	9.35	12.35	89.36	41.00	28.00	9.50	12.00	90.50	39.90	27.50	9.50	12.75	89.65
Mean		33.8[b]	23.4[a]	7.42[a]	9.76[b]	74.3[b]	33.2[b]	22.9[b]	6.87[b]	10.2[b]	73.2[b]	34.5[a]	23.7[a]	7.59[a]	11.1[a]	76.8[a]

A, B, C and D are four different native firms producing yoghurt.
Fl. = Flavour, Con. = Consistency, Acid. = Acidity, App. = Appearance