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The Effect of Garlic (*Allium sativum* L.) on Some Quality Properties and Shelf-Life of Set and Stirred Yoghurt

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Abstract: This study was conducted to determine some properties of set and stirred type yoghurts containing 0.5% and 1% garlic (*Allium sativum* L.) during storage period of 28 days at 4±1 °C. Some microbiological, physical, chemical, and sensory properties of yoghurts were determined in days 1, 7, 14, 21, and 28 of the storage period. Coliform bacteria were not detected in all samples during the storage period (<1 log cfu/g) and yeast and mould were only detected in the control group (without garlic), except the first day. Sensory analysis indicated that set type yoghurts were more favoured than stirred type yoghurts. Yoghurt samples containing 1% garlic were more favoured than samples with 0.5% in both set type and stirred type. In addition, this study showed that garlic addition had no effect on acidity, fat, protein, and acetaldehyde levels of the yoghurts (P > 0.05) and sensory scores of yoghurts decreased during the storage period. It was also shown that the control group could be safely consumed up to day 7 of storage while garlic groups could be safely consumed up to day 28.

Key Words: Yoghurt, garlic, shelf-life, storage time

Set ve Stirred Tipi Yoğurtların Bazı Kalite Özellikleri ve Raf Ömrü Üzerine Sarımsağın (*Allium sativum* L.) Etkisi

Özet: Bu çalışmada % 0,5 ile %1 oranında sarımsak içeren set ve stirred tipi yoğurtların 4 °C'de 28 günlük depolama süresince bazı özelliklerinin belirlenmesi amaçlanmıştır. Yoğurt örneklerinin bazı mikrobiyolojik, fiziksel ve kimyasal analizleri depolama periyodunun 1., 7., 14., 21. ve 28. günlerinde yapılmıştır. Örneklerin hiçbirinde koliform grubu bakteri bulunmamıştır (<1 log kob/g). Maya ve küf sayısı kontrol grubunda (sarımsak ilavesiz) 7. günden itibaren artarken diğer örneklerde muhafaza süresince bulunmamıştır (<1 log kob/g). Duyusal analiz sonucunda set tipi yoğurtların stirred tipi yoğurtlardan; sarımsak oranları açısından da %1 sarımsak içeren yoğurtların daha fazla beğenildiği tespit edilmiştir. Aynı zamanda sarımsak ilavesinin yoğurtların yağ, protein, asetaldehit içerikleri ile asitlik değerlerini önemli ölçüde etkilemediği (P > 0,05) ve muhafaza süresince genel olarak yoğurtların beğenilirliğinin azaldığı belirlenmiştir. Çalışmanın sonucunda kontrol grubu örneklerin 7 gün süreyle, sarımsaklı örneklerin ise 28. güne kadar güvenli bir şekilde tüketilebileceği ortaya çıkmıştır.

Anahtar Sözcükler: Yoğurt, sarımsak, raf ömrü, depolama periyodu

Introduction

Yoghurt is a fermented milk product, which has gained great popularity throughout the world for its recognized sensorial, nutritional, and health-promoting properties. A large variety of yoghurts, resulting from technologically diversified approaches, as well as various fruits and fruit flavours added, are available on the market today. The historical records report that the origin of yoghurt was Middle East (1) and it was first made by Turkish people when they were in Middle Asia and named it as "yogurt", and many other countries calls as "yoghurt". Its popularity and high consumption is due to its nutritional value and the therapeutic effects of starter bacteria during fermentation. It is an important

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food element because it is a fermented milk product that has preventive and treating effects on most diseases. Recently it was reported by researchers that yoghurt has particularly antimicrobial, anticarcinogenic, anticholesterolemic, and therapeutic effects (2,3)

Throughout the history of civilization, the medicinal properties of garlic have been greatly valued and used to treat a wide variety of human ailments. Garlic is most commonly used to prevent or delay many of the chronic diseases associated with old age, such as atherosclerosis, stroke, cancer, immune disorders, cerebral aging, arthritis, cataract formation, and in promoting general health by increasing energy levels and general blood circulation (4). Today, garlic is widely used in the pharmaceutical and food industry. The interest of using natural antioxidants in protection of foods and its benefits on human health increase the importance of garlic and garlic products (5,6).

In Turkey, garlic is consumed by end-users in various forms: in some dishes, yoghurts, sauces, pickles, and in many local products, such as çemen (a kind of paste containing fenugreek, garlic, and spices), sucuk (Turkish dry-fermented sausage), and pastırma (a dried meat product). In the food industry, it is used primarily for producing meat products, such as sucuk and pastırma (meat products), and in sauces, pickles, and soups. In Turkey, adding garlic to yoghurt and consuming it with traditional meals such as cacık (made of chopped cucumber in garlic-flavoured yoghurt) is very common. However, there is no evident investigation about this subject.

Because of garlic's medical features, it has been recently gaining broad attention of the general public as well as scientists. It has been determined that garlic and garlic products preserve taste and flavour of foods by acting as an antimicrobial (7) and antifungal agent (8). In addition, garlic extract exhibits antioxidant activity (9).

In Turkey, yoghurt can be made more appetizing, usually through seasoning with various herbs and spices. Adding garlic to yoghurt for direct consumption or for preparation of dishes with yoghurt (cacık, Turkish ravioli, vegetable dishes, egg dishes, etc.) is one of the popular seasoning methods in Turkey. Garlic, as a rich nutrition source, makes yoghurt more appetizing and flavoured, but there are no studies in the literature explaining the nutritional value and shelf-life effects of garlic when it is used as an additive in yoghurt. The shelf-life of yoghurt is 1 day at 25-30 °C and 5 days at 7 °C (10) and approximately 10 days at 4 °C in Turkey. In order to extend the shelf-life of yoghurt, some alternative processes are applied in literature.

This research aims to show that garlic helps to improve shelf-life of yoghurt by inhibiting the development of yeast and mould in yoghurt because of its other high-quality characteristics as well as its antimicrobial characteristic. The study also aims to show that garlic stops the bacteria growth, which results in acidity development and thus lowers the quality of yoghurt, and garlic provides better and longer storage opportunities. On the other hand, the study aims to explain some commercial advantages of the combination of these 2 high-quality nutritional elements, such as the improved availability of garlic yoghurt in the market through adding garlic paste during the addition of starter culture and the other aim is to select the best garlic ratio.

Materials and Methods

Materials

Milk used for the production of yoghurt was obtained from the Dairy Factory of Atatürk University. Yoghurt starter cultures (*Streptococcus salivarius* subsp. *thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus*) were obtained from the culture collection of the Food Engineering Department (Atatürk University, Erzurum, Turkey). Bacteria were stored as stock cultures in MRS broth supplemented with 20% (v/v) glycerol at -80 °C (frozen culture). Prior to their use, the strains were grown and maintained in reconstituted (10%, w/w) skimmed milk (Difco) sterilized at 121 °C for 5 min, and incubated at 43 ± 1 °C. Milk for the production of yoghurt was inoculated with this culture at a ratio of 2.5% (1:1). Garlic was purchased from local supermarkets. The dry skins of the garlic bulbs were removed in aseptic conditions before use. The cloves were peeled and crushed finely using a sterile kitchen hand-held grater.

Yoghurt Making

Evaporated and heated milk was used for yoghurt production in this study. Chemical composition of heated milk was 6.25 pH, 0.27% titratable acidity, 16.50% total solids, 4.26% protein, and 4.80% fat. Milk used in

the production of yoghurt was preheated to 50-55°C and homogenized at 160 kg/cm^2, evaporated at 60 °C at 450 mmHg pressure, pasteurized at 90 °C for 20 min and cooled to 44 ± 1 °C, inoculated with starter culture 2.5%, which was then divided into 5 parts. Added garlic amounts for the first part (S1) and the second part (S2) were 0.5% and 1%, respectively. After garlic addition, samples S1 and S2 were filled into sterilized glass jars. Other parts (without garlic) were incubated at 43 ± 1 °C to obtain soft curd, to pH 4.6- 4.7. Following incubation, yoghurts were cooled to 4°C. Then, garlic was added to the third part (ST1) and the fourth part (ST2) at a ratio of 0.5% and 1%, respectively, and mixed thoroughly. The fifth part, (C) (without garlic) was kept as control. In this research, a control sample (C) was used to determine the effect of garlic especially on yeast and mould. Yoghurt samples were stored at 4 °C for 28 days and the experiments were carried out with 2 replications. All measurements in yoghurts were carried out twice at days 1, 7, 14, 21, and 28.

Chemical analysis

Yoghurts were analyzed in duplicate by the oven drying method for total solid (11), by the Gerber method for fat (11), by the Kjeldahl method for total nitrogen (11), and by Kosikowiski's method for volatile free fatty acid content (12). The pH values were measured using a digital pH meter (WTW pH-340, Germany). Titratable acidity was determined according to the Soxhlet-Henkel method (11). Syneresis was determined by the method described by Atamer and Sezgin (13), and the acetaldehyde content was determined by method described by Lees and Jago (14).

Microbiological analysis

The enumeration of Lactobacilli (De Man, Ragosa, Sharpe Agar, Merck) at 37 °C for 72 h under anaerobic conditions (15), Streptococci (M 17 agar, LAB M, UK) at 37 °C for 48 h under aerobic condition (16), total aerobic mesophilic bacteria (Plate Count Agar, Merck) at 30 ± 1 °C for 48 h (16), total coliforms (Violet Red Bile Agar, Merck) at 37 °C for 48 h (17), yeasts and moulds (Potato Dextrose Agar, Merck) at 21 °C for 7 days (18) were performed during the storage.

Sensory analysis

The samples were sensorially assessed by 6 panellists using a sensory rating scale of 1 (poor) to 9 (excellent) for all properties (odour, texture, consistency, syneresis, flavour, acidity, and overall acceptability) as described by Bodyfelt et al. (19). The panel of assessors was an external panel of non-smokers who were very familiar with fermented dairy products and were checked on the basis of sensory acuity and consistency. Water and bread were also provided to the panel members to refresh their palates between samples.

Statistical analysis

Statistical analysis of the data was done using the analysis of variance (ANOVA) of the SPSS program, version 11.5.0. Means with a significant difference were compared by Duncan's multiple range tests. All analyses were performed in duplicate.

Results

Some physical and chemical properties of yoghurt samples are shown in Table 1. The pH values of yoghurt samples varied between 3.92 and 3.99. The pH values of all samples significantly ($P < 0.01$) declined during the storage period. The highest titratable acidity was determined in stirred type yogurts. Dry matter contents of samples ranged between 16.11% and 16.33%. Dry matter content of set type yoghurts was higher than that of stirred type yoghurts. Protein contents of yoghurts changed varied between 4.13 and 4.19% and decreased during the storage period. Acetaldehyde contents of yoghurt samples during the storage are shown in Figure 1. Acetaldehyde amounts ranged from 5.11-5.61 ppm. Fluctuations were observed in acetaldehyde contents during the storage. Syneresis of yoghurts samples during the storage is shown in Figure 2. The highest syneresis (4.34 ml) was detected in ST2 samples on day 7 whereas the lowest one (2.86 ml) was detected in ST1 on day 21. The volatile free fatty acid contents of yoghurt samples during the storage are shown in Figure 3. Volatile free fatty acid content ranged from 6.30 to 6.98 ml NaOH/100 g.

Some microbiological properties of yoghurt samples are shown in Table 2. Counts of total aerobic-mesophilic bacteria changed between 7.62 and 7.88 log cfu/g. Lactobacillus and Streptococcus counts ranged from 7.27-7.87 log cfu/g, 7.52-7.96 log cfu/g, respectively. They showed fluctuations during storage period. Coliform bacteria were not detected in any of the samples (<1 log cfu/g). Total yeast and mould counts in yoghurt samples during the storage are shown in Figure 4. While yeast and

Table 1. Some physical and chemical properties of yoghurt samples.

	pH	Titratable acidity (%)	Dry matter (%)	Fat (%)	Protein (%)	Acetaldehyde (ppm)	Syneresis (ml/25 g yoghurt	Free fatty acids (ml NaOH/100 g)
Yoghurt samples								
Control (C)	3.99 [a]	1.37	16.23 [abc]	4.77	4.14	5.27	3.51 [bc]	6.39 [bc]
Set type 1 (S1)	3.98 [ab]	1.37	16.27 [ab]	4.72	4.13	5.47	3.79 [a]	6.30 [c]
Set type 2 (S2)	3.96 [abc]	1.40	16.33 [a]	4.75	4.18	5.16	3.67 [ab]	6.79 [ab]
Stirred type 1 (ST1)	3.93 [bc]	1.42	16.11 [c]	4.73	4.16	5.61	3.39 [c]	6.58 [abc]
Stirred type 2 (ST2)	3.92 [c]	1.42	16.18 [bc]	4.69	4.19	5.11	3.78 [a]	6.98 [a]
Storage time (days)								
1	4.11 [a]	1.26 [c]	16.29	4.79 [a]	4.37 [a]	5.42 [b]	4.08 [a]	5.50 [b]
7	3.95 [b]	1.35 [b]	16.24	4.77 [a]	4.17 [b]	4.19 [c]	3.65 [b]	7.15 [a]
14	3.90 [c]	1.45 [a]	16.15	4.66 [c]	4.14 [b]	3.87 [c]	3.46 [b]	7.26 [a]
21	3.93 [bc]	1.43 [a]	16.2	4.74 [b]	4.10 [b]	6.55 [a]	3.39 [b]	7.27 [a]
28	3.88 [c]	1.50 [a]	16.23	4.68 [b]	3.99 [c]	6.59 [a]	3.55 [b]	5.85 [b]
Source	D.F.				ANOVA			
Samples (S)	4	*	NS	*	NS	NS	NS	*	*
Period (P)	4	**	**	NS	**	**	**	**	**
S × P	16	NS	NS	NS	NS	NS	**	*	*
Error	25							
Total	49							

Counts shown with different letters were significantly different than each other (Duncan's multiple range test); †*, ** Significant at 0.05 and 0.01 probability levels, respectively. NS: not significant

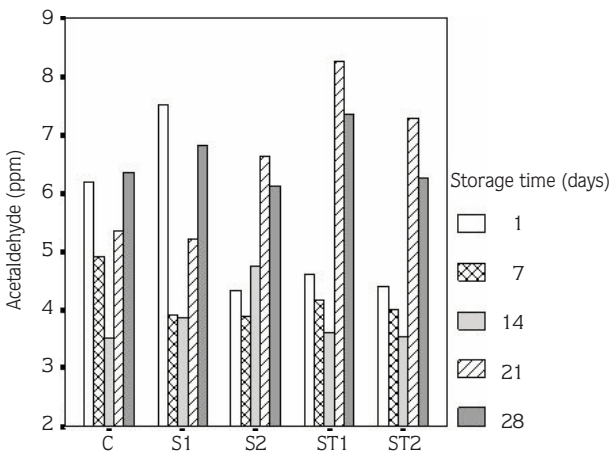

Figure 1. Amount of acetaldehyde of yoghurt samples during the storage.
C: Control (without garlic); S1: Set type 1 (0.5% garlic); S2: Set type 2 (1% garlic); ST1: Stirred type 1 (0.5% garlic); ST2: Stirred type 2 (1% garlic).

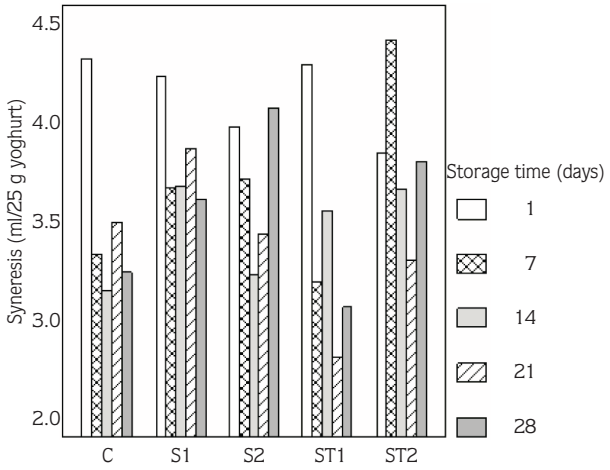

Figure 2. Syneresis of yoghurt samples during the storage.
C: Control (without garlic); S1: Set type 1 (0.5% garlic); S2: Set type 2 (1% garlic); ST1: Stirred type 1 (0.5% garlic); ST2: Stirred type 2 (1% garlic).

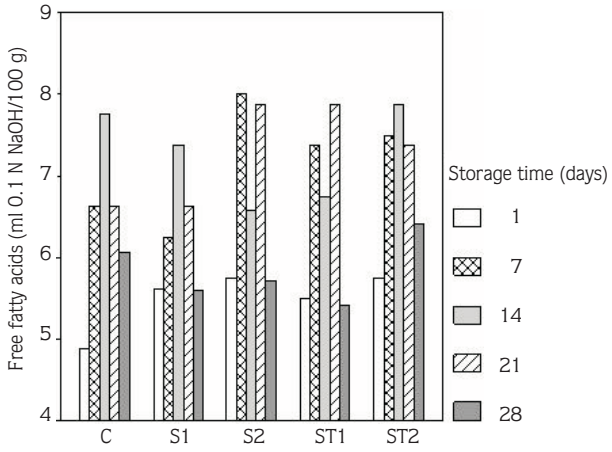

Figure 3. Volatile free fatty acid content of yoghurt samples during the storage.
C: Control (without garlic); S1: Set type 1 (0.5% garlic); S2: Set type 2 (1% garlic); ST1: Stirred type 1 (0.5% garlic); ST2: Stirred type 2 (1% garlic).

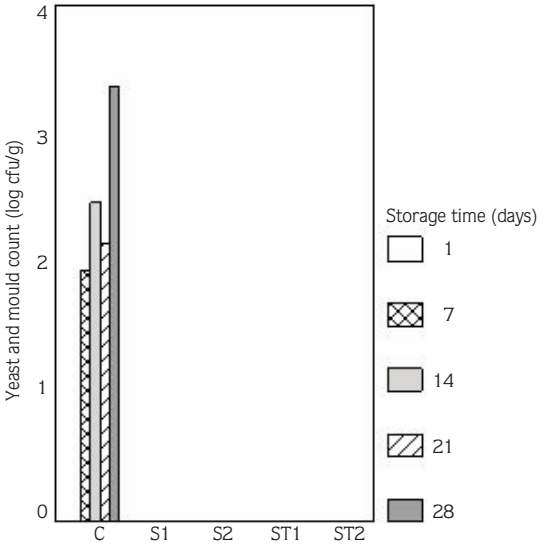

Figure 4. Yeast and mould count of yoghurt samples during the storage.
C: Control (without garlic); S1: Set type 1 (0.5% garlic); S2: Set type 2 (1% garlic); ST1: Stirred type 1 (0.5% garlic); ST2: Stirred type 2 (1% garlic).

Table 2. Some microbiological properties of yoghurt samples.

		Total aerobic mesophilic bacteria (log cfu/g)	Streptococci counts (log cfu/g)	Lactobacilli counts (log cfu/g)	Coliform bacteria (log cfu/g)
Yoghurt samples					
Control (C)		7.88	7.52	7.62	<1
Set type 1 (S1)		7.62	7.52	7.61	<1
Set type 2 (S2)		7.57	7.79	7.27	<1
Stirred type 1 (ST1)		7.62	7.96	7.87	<1
Stirred type 2 (ST2)		7.83	7.60	7.44	<1
Storage time (days)					
1		7.90	7.82	7.69	<1
7		7.44	7.45	7.65	<1
14		7.23	7.65	7.29	<1
21		7.94	8.07	7.40	<1
28		8.01	7.4	7.78	<1
Source	D.F.		ANOVA		
Samples (S)	4	NS	NS	NS	NS
Period (P)	4	NS	NS	NS	NS
S × P	16	NS	NS	NS	NS
Error	25				
Total	49				

NS: not significant

moulds increased continuously from day 7 in control samples, they were not found in others during the storage period.

Results of sensory analysis of yoghurt samples are shown in Table 3. Odour scores of yoghurt samples changed between 6.94 and 7.86. Odour scores in stirred type yoghurts were lower than those of set type yoghurts. Texture and consistency scores of samples ranged from 8.50 to 7.10 and from 7.03 to 8.51, respectively. Aroma scores of control samples were higher compared to the others. The highest overall acceptability score (7.99) was found in set type yoghurt with 1% garlic. Generally, sensory properties of yoghurt samples decreased during the storage period.

Discussion

Yoghurt samples with garlic did not show any significant differences in titratable acidity, fat, protein, and acetaldehyde content with respect to the control yoghurt. The initial pH of set and stirred type yoghurts with garlic was lower than that of control, and the lowest pH was found in stirred type yoghurts with garlic. The pH values of control were significantly ($P < 0.05$) different compared stirred type yoghurts with garlic and it was observed that as the amount of garlic added increases, pH decreases.

Titration acidity of yoghurt samples rapidly increased until day 14 (Table 1). Gandhi and Ghodekar (20) reported that increasing the amount of garlic added decreased titration acidity. However, in this study, the decreasing effect of increasing garlic on the acidity was not observed. It may be due to the use of low garlic ratio in our study.

Effect of garlic ratios on dry matter was found statistically significant ($P < 0.05$). The reason for this may be the differences in garlic ratios. The effect of storage on the fat ratio of yoghurts was found to be statistically significant ($P < 0.01$). Towards the end of the storage, fat ratio decreased. This may be due to the lipolytic activity of microorganisms.

Different levels of protein hydrolysis were obtained depending on the kind of microorganism used during the

Table 3. Some sensory properties of yoghurt samples.

		Odour	Texture	Consistency	Syneresis	Flavour	Acidity	Overall acceptability
Yoghurt samples								
Control (C)		7.79^{a}	8.22^{b}	8.25^{a}	8.25^{a}	7.84^{a}	7.48^{a}	7.86^{a}
Set type 1 (S1)		7.69^{a}	8.44^{a}	8.43^{a}	8.42^{a}	7.66^{a}	7.36^{ab}	7.92^{a}
Set type 2 (S2)		7.86^{a}	8.50^{a}	8.51^{a}	8.28^{a}	7.73^{a}	7.48^{a}	7.99^{a}
Stirred type 1 (ST1)		6.94^{c}	7.10^{c}	7.20^{b}	7.12^{c}	7.24^{b}	7.18^{b}	7.15^{c}
Stirred type 2 (ST2)		7.32^{b}	7.22^{c}	7.03^{b}	7.42^{b}	7.28^{b}	7.33^{ab}	7.57^{b}
Storage time (days)								
1		8.30^{a}	8.63^{a}	8.31^{a}	8.42^{a}	8.37^{a}	7.72^{b}	8.54^{a}
7		8.14^{a}	8.43^{b}	8.55^{a}	8.41^{a}	8.19^{a}	8.23^{a}	8.45^{a}
14		7.26^{b}	7.76^{c}	7.79^{b}	7.89^{b}	7.07^{b}	7.44^{c}	7.27^{b}
21		7.17^{b}	7.51^{d}	7.66^{b}	7.53^{c}	7.20^{b}	7.18^{d}	7.38^{b}
28		6.73^{c}	7.15^{e}	7.11^{c}	7.24^{c}	6.92^{b}	6.26^{e}	6.85^{c}
Source	D.F.				ANOVA			
Samples (S)	4	**	**	**	**	**	*	**
Period (P)	4	**	**	**	**	**	**	**
S × P	16	**	**	**	**	*	**	**
Error	25							
Total	49							

Counts shown with different letters were significantly different than each other (Duncan's multiple range test);
†*, ** Significant at 0.05 and 0.01 probability levels, respectively.

yoghurt fermentation (21). However, because of continuing proteolytic activity, proteins break down to some dipeptides and amino acid and also volatile compounds (22,23). As the storage period progressed, the amount of proteins in all yoghurt samples decreased. However, the protein content of yoghurts with garlic was higher than that of the control in the beginning of the storage. This result may be due to the protein content of garlic.

The highest acetaldehyde amount (8.26 ppm) was observed in ST1 samples on day 21 while the lowest amount (3.52 ppm) was observed in control on day 14. Generally, the acetaldehyde content of yoghurt samples decreased by day 14 and then increased up to the end of the storage period. Bonczar and Regula (24) reported a continuous increase in acetaldehyde content of the yoghurts through 14 days of storage. Bonczar et al. (25) determined that the acetaldehyde contents of yoghurts stored for 14 days increased up to day 7 followed by a decrease. Different results reported for acetaldehyde content could be explained by their use of different starter culture, syneresis effect of microflora, fermentation conditions, proteins used for increasing dry matter, and even with the methods used in determining of acetaldehyde amount.

The syneresis of samples changed between 3.51 and 3.79 ml/25 g yoghurt. While S1 and ST2 samples were not significantly different, S1 and S2 samples and C and ST1 samples were statistically similar. Our result showed that syneresis of set type yoghurts decreased with 0.5% garlic. Set yoghurt with a high level of syneresis on the surface may be regarded as a low quality product, even though this is a natural phenomenon (26). In general, syneresis of yoghurt samples decreased throughout the storage period. A similar result was reported by La Torre et al. (27). Fluctuations observed in duration length were more likely due to decreases in pH, that is increase in acidity (28).

The highest free fatty acid (8.00 ml 0.1 N NaOH/100 g) content was observed in S2 samples on day 7 but the lowest one (4.87 ml 0.1 N NaOH/100 g) was observed in C samples on day 1. The volatile free fatty acid contents in yoghurts with garlic were higher than the control. It may be due to volatile carbonyl components found in garlic. Amounts of volatile free fatty acids of set type yoghurts with garlic were different than those of the stirred type with garlic. This may have originated from different temperature applications during garlic addition (44-45 °C in set type yoghurts and 4 °C in stirred type yoghurts) and from different times of addition.

Volatile free fatty acid contents of all yoghurts were fairly low on day 1. However, this situation changed thereafter and an increase on days 7, 14, and 21 and a decrease on day 28 were observed subsequently. Similar to acetaldehyde content changes, volatile free fatty acid content can be explained by the microorganisms used in yoghurt production (25,29). In this research a different result that is also supported by the findings of Dayısoylu (28) was obtained.

Some microbiological properties of yoghurt samples are shown in Table 2. None of the yoghurt samples had coliform bacteria during the storage. Neither the effect of garlic amount nor the way of garlic addition was found to be statistically significant on TAMB, Streptococci, and Lactobacilli counts of yoghurts ($P > 0.05$). Rees et al. (30) reported that lactic acid bacteria were the least sensitive microorganisms to the inhibitory effects of garlic.

Initially, no yeast and mould were found in any yoghurt types on the first day of the storage (Figure 4). However, towards the end of the storage, yeast and mould count in control constantly increased. Var et al. (31) reported that yeast and mould counts of control samples were higher compared to yoghurt samples containing natamycin. In other samples, there was no yeast and mould growth. It was concluded that the ratio of garlic added in this research was enough to inhibit yeast and mould growth, and these garlic ratios may be preferred by consumers. Therefore, garlic can be considered as a potential antimicrobial agent of natural origin. Rees et al. (30) reported that an aqueous extract of freeze-dried garlic (*Allium sativum*) inhibited many representative bacteria, yeasts, fungi, and a virus. The inhibitory activity of garlic against mould was reported by others (32).

When evaluated in terms of all sensory properties, set type yoghurt with garlic received higher score than both stirred type yoghurts with garlic. Although control samples received slightly higher score, this difference was not statistically significant. All yoghurts at the beginning of storage were superior to the ones at the end of the storage, mainly because of more intensive flavour and better consistency. However, after 14 days, acidity of yoghurt increased, so sensory scores of all the samples

began to decrease. The overall acceptability scores of samples increased during storage for up to 7 days, and then decreased. This could be associated with development of acidity. However all the scores were over 7, until day 28 except for control. According to the results, yoghurts with garlic can be consumed safely (Table 3).

In conclusion, considering other properties of yoghurt (acidity, coliform bacteria, sensory properties, etc.), it was found that garlic has an inhibitory effect on yeast and mould, which limits the shelf-life of yoghurt during 28 days of storage period. Also, the lowest dose of garlic in preventing yeast and mould grow may be determined. In addition, set type yoghurts made with garlic were preferred to stirred yoghurts with garlic. Further, both types of yoghurts with 1% garlic were more favoured than yoghurts with 0.5% garlic. Also, we concluded that the use of these garlic ratios could be used in the set type yoghurt production and this type garlic yoghurt with approximate one month shelf-life could be made available on the market. Furthermore, there may be further growth and innovation in the yoghurt sector on the basis of taste. For example, new products with new flavours could be offered to increase interest. For the first time, to our knowledge, some properties of stirred and set type yoghurts with garlic were presented to make a valuable contribution to prolong the shelf-life of yoghurt. This versatility, together with their acceptance as healthy and nutritionally valuable, has led to their widespread popularity. These observations confirm the concept of using garlic in culinary practices as a means of securing safety and extending the shelf-life of yoghurt. The addition of garlic produced a new type of yoghurt that retains an acceptable quality during storage for at least 4 weeks. The results suggest that the dose of garlic tested in this study have a great potential that will contribute in yoghurt production technology and meet customers' taste expectation.

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