

EVALUATION OF MICROBIOLOGICAL AND CHEMICAL QUALITY OF AYRAN SAMPLES MARKETED IN KARS AND ANKARA CITIES IN TURKEY

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Summary: A ayran samples collected from Kars and Ankara cities in Turkey were investigated for the microbiological quality and for major compositional factors. All samples had high salt level, indicating a general lack of quality and/or extreme diversity of the production conditions. Acidity (lactic acid, %) and crude fat levels were in required limits. Total dry matters were low only in homemade ayran samples. Microbiological analysis revealed the presence of very high numbers of total coliforms, and yeasts and moulds. Bottled ayrans were found to be of higher quality than homemade ayran samples in term of microbiological quality and chemical composition. Samples from Ankara were found to be higher quality than that of Kars. Our findings have public health implications and suggest that improvements are needed in quality assurance procedures for ayran.

Key words: Ayran, microbiological and chemical quality.

Ankara ve Kars'ta Satışa Sunulan Ayrannların Mikrobiyolojik ve Kimyasal Kalite Yönünden Değerlendirilmesi

Özet: Bu araştırmada Kars ve Ankara illerinden temin edilen toplam 100 adet ayran örneği kimyasal ve mikrobiyolojik olarak incelendi. Tuz oranı tüm örneklerde standardın üzerinde bulundu. İncelenen örneklerin asitlik ve yağ değerleri standartlar dahilindeydi. Toplam kuru madde miktarı sadece ev yapımı ayrannlarda düşük bulundu. Mikrobiyolojik ve kimyasal bakımdan ambalajlı ayrannlar ev yapımı ayrannlardan daha kaliteli bulundu. Koliform grubu bakteri ve maya-küf sayıları standardın üzerinde bulundu. Ankara ilinde satışa sunulan ayrannların daha iyi kalitede oldukları, ancak her iki ilde de üretilen ayrannların halk sağlığı bakımından risk oluşturabileceği ve kalitenin artırılması gerektiği sonucuna varıldı.

Anahtar sözcükler: Ayran, mikrobiyolojik ve kimyasal kalite.

INTRODUCTION

Mediterranean diet pyramid, including dairy products principally cheese and yogurt, is a cultural model for healthy eating¹. The Government Planning Agency (Devlet Planlama Teskilati, DPT) of Turkey has reported that the total rate of yogurt consumption is 27% of other total milk and milk products, and approximately 800.000 tons are consumed annually in Turkey². But it should be noted that the homemade yogurt consumption rate is almost equal to the commercial ones.

Although ayran, a traditional Turkish beverage, made from yogurt, it does not have the same compositional status with yogurt, drink yogurt or diluted yogurt³⁻⁵. For instance, dry matters level and fat rates are standardised to required Turkish Standard (TS) limits^{6,7} by addition of pasteurised water whether before or after incubation period. All industrial, traditional, and homemade ayran are marketed in Turkey. Industrial ayran technology resembles to traditional yogurt technology with some differences. Long-life ayran is a version of industrial ayran, which is heated before bottling at 85 °C or at 125 °C for 10 sec.⁶. Homemade ayran is made by

blending yogurt with drinking water containing NaCl and served as fresh and cold on the same day. Rate of water and salt added depends on the consumer choice. Traditional way of ayran making process is very old in Anatolia. Cold yogurt is blended properly with addition of cold water or ice crystals until large particles of fat appeared in ayran, then fat is separated from ayran by filtering from a coarse chesecloth⁸. This type of ayran contains very low milk fat.

Ayran is consumed especially during hot seasons and suggested to provide supportive care in dehydrated people^{9,10}.

With parallel to development of modern life, industrially produced ayran has been more popular than that of traditional ayran and founded to be safer¹¹. However, a high percentage of industrial ayran is still produced in small dairies probably with unhygienic tap water and under poor conditions, especially in the small cities in Turkey. Ayran may be easily contaminated by water and may be a health threatening food vehicle due to its direct consumption¹².

The present study assessed the some compositional

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status and microbiological quality of ayrans sold in Ankara (The capital) and Kars (in the northeast part of the Turkey).

MATERIALS and METHODS

Sample preparation: Total of 100 ayran samples, consisted of plastic bottled and homemade ayran, were analysed. Samples were collected with 20 separate occasions from January to April, 2002. Plastic bottled ayran samples were produced by two companies in Kars (Group A1 and A2, 25 samples each) and by various companies in Ankara (Group A3, 25 samples each). Homemade ayran samples (Group B) made in restaurants in Kars were brought to laboratory in ice cabinet and analysed microbiologically in one h, but chemical analyses were continued throughout the same day. Samples collected from Ankara were analysed after a 16 h of transportation period to Kars. Samples were stored at 4 °C until analyses.

Microbiological analysis: All procedures were applied from FDA-Bacteriological Analytical Manual¹³. In summary, each sample was serially (10-fold) diluted in sterilised phosphate buffer solution (pH 7.0). Subsequently, 1 ml of ayran and each diluents were transferred to two duplicated separate Petri-Dish and two of them poured plated with Violet Red Bile Agar (VRB, Difco; Difco Laboratories, Detroit, MI), and other two with Potato Dextrose Agar (PDA, Difco) for enumeration of coliforms, and mould and yeast population, respectively. After mixing completely, the VRB plates were incubated at 32 °C for 24 h and PDA plates at 20 °C for 5-7 days, respectively. After incubation, all colonies grown on VRB and PDA were enumerated.

Chemical analysis: Determination of total dry matters content with weighing method, total acid content by titration method, crude fat content by Babcock method were performed as stated before and the salt content in ayran samples was determined by Mohr method¹⁴.

The chemical and microbiological results were evaluated within each group and between four groups of ayran and compared with TS guideline⁷. The contaminant microflora was checked. The microbiological results were normalised to an area basis (CFU/ml) and transformed to log₁₀ values. The total acidity, total dry matters, crude fat and NaCl were also measured. Means and standard deviation values were calculated by using Microsoft Excell 97.

RESULTS and DISCUSSION

According to TS guideline⁷ ayran has been divided into three groups based on its crude fat and total solid contents: Full-fat ayran should contain $\geq 1.5\%$ fat and $>6.0\%$ total dry matters, semi-fatty ayran should contain $\geq 0.8\%$ and $\geq 5.2\%$ of these components, respectively. Non-fatty ayran should contain $>0.8\%$ fat and $\geq 4.5\%$ total solids. Acidity (lactic acid, %) should be between 0.6% and 1.6%. The total salt level should not be more than 1% of total weight for all types of ayran. For hygiene criteria, the number of coliforms should not exceed 1 log₁₀ CFU/ml and mould and yeast numbers should not exceed 2 log₁₀ CFU/ml, according to this standard. Microbiological results from each group of samples were presented in Table 1 and chemical analysis results were presented in Table 2.

All of the traditional ayran samples and 19 (76%) of Group A1 and 15 (60%) of Group A2 samples laid down by TS⁷ due to the presence of viable coliform mould and yeast population which was extremely higher than accepted limits. These heavily contamination levels indicate that all traditional and majority of bottled ayran samples collected in Kars city may lead to serious health risk. This must be due to tap water in Kars which is not hygienic enough. Thus, high contamination level may be due to untreated tap water supplementation or inadequate pasteurisation of raw milk prior to yogurt making. Cross contaminations may also have occurred during processing. Samples collected from Ankara were more hygienic than that of Kars, but a 6 (24%) and 2 (8%) of samples were also beyond the hygiene limits in terms of high population of coliforms mould and yeast, respectively. Hygienically unsafe ayran samples have also been stated before in different areas of Turkey^{11,12,15,16}.

Both acidity and total dry matters levels of ayran samples were within the required limits in all samples. But samples highly contaminated with coliform and mould and yeast population did not give acidity ratio more than 1.6%. There was not any direct correlation between acidity and contaminant microorganism population. It may be speculated that both coliforms, and mould and yeast contaminated secondarily to ayran may not have the ability of germination unlike for yeasts and moulds, possibly due to the high acidity. Homemade ayran samples consisted of less total solids than bottled samples. This may possibly be due to the supplementation of yogurt with excess water. Salt level was only one of the chemical parameter which majority of samples contains more than 1% (Table 2). This situation may lead to health threatening results especially for some consumers

Table 1. Sample numbers and ranges (%) which out of standard limits microbiologically.
Tablo 1. Mikrobiyolojik bakımdan standart değerleri aşan örnek sayıları ve oranları (%).

	Coliforms (log10 CFU/ml)				Mould and yeast (log10 CFU/ml)			
	SN (%)*	Min	Max	Mean±SD**	SN (%)*	Min	Max	Mean±SD**
A1	19 (76%)	1,90	5,20	3,09±1,132	19 (76%)	4,20	6,96	5,89±0,99
A2	15 (60%)	2,34	2,90	2,62±0,39	25 (100%)	7,41	8,81	8,04±0,57
A3	6 (24%)	2,51	2,68	2,61±0,08	2 (8%)	1,80	2,21	2,00±0,29
B	25 (100%)	2,20	4,75	3,43±0,82	25 (100%)	3,86	6,45	4,95±0,89

*: Sample numbers (%) laid down by Turkish Standard (TS) in each group.

** : Standard Deviation. A1, bottled commercial ayran in Kars produced by a company; A2, bottled commercial ayran in Kars produced by another company; A3, bottled commercial ayran in Ankara produced by various companies; B, homemade ayran produced and served daily in restaurants in Kars

Table 2. Chemical analysis results and sample numbers and ranges (%) which out of standard limits chemically.
Tablo 2. Kimyasal analiz sonuçları ve standart değerleri aşan örnek sayıları ve oranları (%).

		Sample Groups			
		A1	A2	A3	B
Acidity (% Lactic a.)	Max	0,68	0,77	0,54	0,50
	Max	1,02	0,97	1,05	1,00
	Mean±SD*	0,82±0,94	0,88±0,10	0,67±0,12	0,74±0,19
Total Solids	Max	6,15	5,86	7,26	3,55
	Max	8,64	10,70	9,80	6,44
	Mean±SD	7,75±0,83	8,28±1,98	8,14±0,95	5,45±1,06
Salt	Max	0,93	1,26	0,67	1,05
	Max	1,49	1,54	1,14	1,40
	Mean±SD	1,23±0,13	1,42±0,10	0,88±0,17	1,24±0,13
	** (%)	22(88)	25(100)	7(28)	25(100)
Fat	Max	1,70	2,00	1,00	0,40
	Max	3,00	2,10	2,40	2,00
	Mean±SD	2,09±0,34	2,09±0,04	1,90±0,41	1,08±0,56

* Standard deviation, ** Numbers and percentage (%) of samples with high salt content, SD, standard deviation. A1, A2, A3 and B keys explanations are as in the title of Figure 1.

whom recommended to avoid from excessive salt. Chemically unsatisfactory ayran samples has also been stated in Turkey^{11,15,17}.

Crude fat content in all of the ayran samples were met the TS limits. But, we believe that the absence of any upper limit for fullfat ayran in the TS⁷ and the labels are handicap. Many samples tested consisted of high fat level (3%) (Table 2). Therefore, it should not be recommended to people who should avoid from consumption of that high level of milk fat. As a result of these findings, upper limit of fat content of ayran should be stated on label and we recommend to change the crude fat label from "full-fatty" to exact rate of crude fat (crude fat (% v/v): 2±0.2, i.e.).

It is demonstrated that locally produced products

may be more contaminated and more out of standard limits than that of industrial products^{18,19}. In Kars, both bottled and mostly homemade ayran samples served in restaurants are not safe enough microbiologically and are not in standards chemically. It is known that industrial processes ensures microbiologically safe and chemically standard products¹⁶. Whereas, we detected a high percentage of bottled samples to be unsafe and out of required standards in this study. These findings implicated that industrial ayran especially produced in Kars should be analysed and standardised before marketing. It may be concluded that public health services should control the hygienical and chemical quality of bottled ayrans in Kars and Ankara, especially traditional ayran made in restaurants for daily serving in Kars, routinely.

The results of this study indicate the lack of

satisfactory sanitary conditions and quality control during manufacturing and/or post production handling of the ayran, and a possible health problem. The results clearly indicate that attempts have to be made to standardize the process and improve the sanitary conditions in ayran manufacturing.

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