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THE PRODUCTION AND QUALITY PROPERTIES OF LIQUID KASHKS

Mostafa Soltani*, Nuray Güzeler

Department of Food Engineering, Agriculture Faculty, Cukurova University, Adana, Turkey

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Abstract

Liquid kashk is a fermented dairy product produced under two types of traditional liquid kashk and industrial liquid kashk in Iran. The basic raw material of both liquid kashks is yogurt. Dried Kashk-a traditional concentrated yogurt type dairy product- is used for traditional liquid kashk production. Industrial liquid kashk is produced by concentration of yogurt produced industrially. This research was designed to introuduce the production methods and to determine quality properties of liquid kashks. For this purpose, 30 traditional liquid kashks and 30 industrial liquid kashks were randomly collected from 10 provinces of Iran and their chemical, microbiologic and sensory properties were analysed. Results showed that the quality properties of both traditional liquid kashk and industrial liquid kashk samples were in compliance with the standards set by Institute of Standard and Industrial Researchs of Iran (ISIRI).

Keywords: Liquid Kashk, traditional liquid Kashk, industrial liquid Kashk, quality properties, Iran

SIVI KASHK ÜRETİMİ VE KALİTE ÖZELLİKLERİ

Özet

Sıvı kashk fermente bir süt ürünü olup, endüstriyel sıvı kashk ve geleneksel sıvı kashk olmak üzere iki şekilde üretilmektedir. Her iki sıvı kashk'ın temel hammaddesi yoğurttur. Geleneksel sıvı kashk üretiminde kashk-geleneksel olarak üretilen yoğurdun konsantre edilmesiyle elde edilen bir süt ürünü- kullanılmaktadır. Endüstriyel sıvı kashk endüstriyel olarak üretilen yoğurdun konsantre hale getirilmesiyle üretilmektedir. Bu araştırma sıvı kashklerin üretim yönteminin tanıtılması ve kalite özelliklerinin belirlenmesi üzerine planlanmıştır. Bu amaçla, 30 adet geleneksel sıvı kashk ve 30 adet endüstriyel sıvı kashk İran'ın 10 eyaletinden tesadüf olarak toplanmış ve kimyasal, mikrobiyolojik ve duyusal özellikleri incelenmiştir. Elde edilen sonuçlara göre, geleneksel sıvı kashk ve endüstriyel sıvı kashk örneklerinin kalite özellikleri, İran Standart ve Endüstriyel Araştırmalar Enstitüsü (ISIRI) tarafından belirtilen standartlar ile uyumlu olduğu belirlenmiştir.

Anahtar Kelimeler: Sıvı kashk, geleneksel sıvı kashk, endüstriyel sıvı kashk, kalite özellikleri, İran

** Yazışmalardan sorumlu yazar / *Corresponding author* ;
msoltani1981@yahoo.com, (+90) 532 558 2360, (+90) 322 338 6614

INTRODUCTION

The importance of consumption of fermented dairy products such as yogurt, yogurt drink, labneh and kefir for human health is confirmed by different researches (1-3). Drying is one of the most known ways applied in order to improve the shelf life and preserve foodstuffs for a long time. In this context, dried yogurts are dairy products produced by drying concentrated skim or buttermilk in the sun (4). Kashk is a fermented dairy product manufactured traditionally in dried form and produced industrially in liquid form in Iran. Dried kashk is a concentrated yogurt-type product produced with dehydration of homemade yogurt by sun-drying in summer months by nomads and villagers in the different regions of Iran (5, 6). The genesis origin of dried kashk belongs to Middle-East and have different names such as kurut in Turkey (7, 8), kishk in Lebanon, jub-jub in Syria and kushuk in Iraq (9). This product can be kept for long time at ambient temperature without losing of nutritional value or spoiling (8). Some chemical composition of dried kashk is shown in Table 1 (10).

Table 1. Chemical composition of dried kashk (10)

	Mean (X±Sx)
pH	4.27±0.24
Acidity (LA %)	1.40±0.29
Moisture (%)	14.21±2.54
Fat (%)	9.17±3.10
Protein (%)	51.74±3.57
Salt (%)	9.77±1.44
Ash (%)	12.25±1.50

Dried kashk is a nutritious food adjunct and can be recommended for use in diets of children, pregnant and lactating women due to containing high quality proteins and high calcium (5). But microbial contamination may be occured in dried kashk due to unsuitable conditions of manufacture and storage (10). So in order to presentation of this product to consumers in a healthier way, liquid kashk is produced under two types of traditional liquid kashk and industrial liquid kashk in industrial dairy units. These dairy products have significant share in dairy products consumption in Iran and specific standards are determined for them by Institute of Standard and Industrial Researches of Iran (11, 12).

The Production of Traditional Liquid Kashk

Traditional liquid kashk is produced by milling, dilute, addition of salt and pasteurization of kashk (11) (Figure 1). Kashk is produced traditionally, used for traditional liquid kashk production. Kashks are poured into a large tub and washed by pressurized water that is given inside from the one side of the tub. This process is repeated several times. Then kashks are grinded in mill and mixed with drinking water, edible salt and some spices such as mint and garlic powder. The amount of drinking water used is 4-5 times of the kashks and the rate of edible salt is 0.5-1 %. The mix is then passed through a two-phase filtre and transferred to the separator in order to standardization of fat rate and separation of small particles. At the later stage, the mix is passed through the homogenizer (50-55 °C, 2 bar). Then heat treatment (85 °C, 15s) is applied to mix and after cooling, the mix is filled in glass jars and the cover of it is closed. In the final stage jars are placed in special boxes and stored at 4±1 °C. 250-300 grams of kashk are used approximately for the production of 1 kilogram of traditional liquid kashk. According to the ISIRI the final product should have 4.50 pH, 75 % moisture, 13 % protein, 1 % fat, 3 % salt and 3 % ash. Also it should contain 10 cfu/g Coliform, 100 cfu/g yeast and mold and no *Escherichia coli* and *Staphylococcus aureus* (11).

Dried kashk ⇒ Washing ⇒ Milling ⇒ Adding drinking water (4-5 times of the kashks) ⇒ Adding edible salt (0.5-1 %) ⇒ Filtration ⇒ Fat standardization (~2%) ⇒ Homogenization (50-55 °C, 2 bar) ⇒ Heat treatment (85 °C, 15s) ⇒ Cooling (50-55 °C) ⇒ Packing ⇒ Storing (4 °C)

Figure 1. The flowchart of the traditional liquid kashk production.

The Production of Industrial Liquid Kashk

Industrial liquid kashk is a dairy product that is produced from yogurt in industrial units (12) (Figure 2). Fresh cow milk is used for industrial liquid kashk production after checking it's chemical and microbiological properties. After standardization of milk fat rate to 0.4-0.6 %, heat treatment is applied to milk (90-95 °C, 5 min).

Then milk is cooled to 43±1 oC and incubation (37 °C) is continued for 6-7 hours after adding 1-2 % of starter culture (*Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus*) to milk. At the later stage, yogurt produced is homogenized (50-55 °C, 2 bar) and the dry matter of the product is increased to 18-19 % by using quark separator. Then edible salt (0.8-1 %) and whey powder (1-2 %) are added and heat treatment (88 °C, 10 min) is applied to mix. After falling temperature to 55±5, final product is packaged and stored at +4 °C. 3-4 kilograms of cow milk approximately are used for the production of 1 kilogram of industrial liquid kashk. According to ISIRI, the final product should have 3.9 pH, 1.3-2.0 acidity (l.a %), 82.0 % moisture, 8.0 % protein, 2.0 % fat, 2 % salt and 2.5 % ash. Also it should contain 10 cfu/g Coliform, 100 cfu/g yeast and mold and no *Escherichia coli* and *Staphylococcus aureus* (12).

Raw cow milk ⇒ Fat standardization (0.4-0.6 %) ⇒ Heat treatment (90-95 °C, 5 min) ⇒ Cooling (42-43 °C) ⇒ Adding starter culture (1-2 %) ⇒ Incubation (37 °C, 6-7 h) ⇒ Homogenization (50-55 °C, 2 bar) ⇒ Concentration (dry matter: 18-19%) ⇒ Adding edible salt (0.8-1 %) and whey powder (1-2%) ⇒ Heat treatment (80-85 °C, 10 min) ⇒ Cooling (50-60 °C) ⇒ Packing ⇒ storing (4 °C)

Figure 2. The flowchart of the industrial liquid kashk production.

In addition to increasing the product variety expansion, the introduction of industrial dairy products with traditional base to food sector can provide a appropriate field for more consumption of traditional foods. Although few studies were carried on the dried kashk, there is no study about the various aspects of liquid kashks. In this context, the main objectives of this research were to introduce the traditional liquid kashk and industrial liquid kashk and to assess the quality properties of them. Also, the compliance of their chemical, microbiological and sensory properties with the standards set by ISIRI were evaluated.

MATERIALS AND METHODS

Traditional Liquid Kashk and Industrial Liquid Kashk Samples

30 traditional liquid kashks and 30 industrial liquid kashks were randomly collected from 10 provinces of Iran in July, August and September. In this stage, production on different dates and by different dairy units were taken into account. The samples collected were then taken to the laboratory as a group and stored at +4 °C prior to analysis.

Chemical Analysis

Traditional liquid kashks and industrial liquid kashks were analysed at 1 day for moisture by the oven drying method at 102 °C (13). Fat, protein, salt and ash were determined according to the methods described by (14) and (15). The titratable acidity and pH of diluted samples with an equal volume of water were measured by titration with NaOH and using a pH meter (Testo, Gmbh&co, Germany) respectively.

Microbiological Analysis

10 grams of traditional liquid kashks and industrial liquid kashks were homogenized before used. Then samples were diluted tenfold using 0.1 % peptone water and cultured in Petri dishes by the surface plate method (16). Coliform group microorganisms in Violet Red Bile Agar (37 °C, 24-48 h), *Escherichia coli* in Lauriyel Sulfate Tryptose Broth (37 °C, 24 h), yeasts and moulds in Yeast Extract Dextrose Chloramphenical Agar (25 °C, 5 days) and *Staphylococcus aureus* in Baird Parker Agar (37 °C, 48 h) were cultured and then counted (17).

Sensory Analysis

Sensory Properties of traditional liquid kashk and industrial liquid kashk samples were evaluated by seven expert members who consumed these dairy products heavily in their diets for appearance and color, consistency, taste and odour (Scale 1-5/unacceptable-excellent) by using a evaluation form developed according to (18).

Statistically Analysis

The results obtainde from chemical and sensory analysis are presented as means ±SD. Analyses of the samples were carried out in duplicate.

RESULTS AND DISCUSSION

In this study 30 traditional liquid kashks and 30 industrial liquid kashks were randomly selected from 10 provinces of Iran and some chemical, microbiological and sensory properties of them were evaluated. In addition to the results obtained in this study, products analysed were compared with dairy products are similar to analysed samples as their chemical and sensory properties. In this context, traditional liquid kashk was compared with salted yogurt and labneh. Industrial liquid kashk was also compared with strained yogurt.

Traditional Liquid Kashk

The results of chemical analysis for traditional liquid kashk samples are presented in Table 2. The chemical properties of traditional liquid kashk are generally depended on the chemical properties of kashk used in production of it. The mean pH value of samples was found 4.15±0.07 that is lower than the value (4.23) of labneh (19) and higher than the values (4.00 and 3.96) reported for salted yogurt (20, 21). The pH values obtained may affected by heat treatments applied to product during traditional liquid kashk production. Acidity (% of lactic acid) in the examined traditional liquid kashk samples was found at an average of 1.82±0.13. The obtained mean acidity value is lower than the values (1.90 and 2.41) reported for labneh (22) and salted yogurt (21).

Table 2. The chemical composition of traditional liquid kashk and industrial liquid kashk samples (n:30).

	traditional liquid kashks Mean (X±Sx)	industrial liquid kashks Mean (X±Sx)
pH	4.15±0.07	3.78±0.05
Acidity (l.a %)	1.82±0.13	1.54±0.10
Moisture (%)	74.56±0.19	81.41±0.15
Fat (%)	1.99±0.07	1.65±0.06
Protein (%)	13.66±0.22	8.59±0.22
Salt (%)	2.54±0.06	1.69±0.07
Ash (%)	2.83±0.06	2.30±0.08

The average percentage of moisture in the traditional liquid kashk samples was found 74.56±0.19 %. The mean moisture content in examined samples is lower than labneh (23) and higher than salted yogurt (21). The moisture content of traditional liquid kashk is depended on the amount of water added during the production. The fat content of traditional liquid kashk samples was found at an average of 1.99±0.07 % that is close to the fat content (2.30± 0.09 %) of salted yogurt (24) and significantly lower than the fat content (6.42-9.03 %) of labneh (25). Due to industrial production, the fat content of traditional liquid kashk samples was set by separators during manufacture. Therefore, the fat contents of samples analysed were close to each other.

The mean protein value of traditional liquid kashk samples was found 13.66±0.22 %. The protein content of final product is depended on the mean value of protein content of the kashk which used as raw material for traditional liquid kashk production. Protein content determined is higher than that in salted yogurt (20, 21) and labneh (22). The average percentage of salt in the traditional liquid salt samples was found 2.54±0.06 % that is lower than the value (3.06 %) of salted yogurt (26). The amount of salt added during the production and the salt rate of the kashk have significant effect on the salt rate of the traditional liquid kashk. The ash content of traditional liquid kashk samples was found at an average of 2.83±0.06 % that is higher than values determined for labneh (0.79 %) and salted yogurt (2.69 %) (21, 23). The large part of the rate of ash may be due to the salt rate of product.

Microbiological analysis of traditional liquid kashk samples showed that coliform bacteria and *Escherichia coli* could not found in all samples (30/30). Fecal coliform can be present in foods because of the post-sanitization or post-process contamination, often caused by a lack of hand hygienization on the part of food handlers (27). Because of suitable hygiene conditions in industrial units, no fecal coliform bacteria, specially *Escherichia coli*, was determined in the samples analysed.

Moulds and yeasts in 86.66 % of traditional liquid kashk samples (26/30) were established <10 cfu/g, while 13.33 % of samples (4/30) contained 10-10^2 cfu/g of them. The detection of high number of mould and yeast in labneh (26, 28) may be explained by storage conditions. In labneh despite the low pH, a selective environment for the growth of moulds and yeasts constitutes even under refrigeration (25). The low presence of

mould and yeast in traditional liquid kashk samples is an expected result for products are produced under heat treatment with high temperature and controlled hygienic conditions.

Dairy products are a known source of staphylococcal poisoning. *Staphylococcus aureus* contamination can occur through the presence of it in the raw milk itself or during it's processing (29). *Staphylococcus aureus* was not found in all traditional liquid kashk samples. It may possible to say that hygienic procedures were applied correctly during production.

The results of sensory assessment of traditional liquid kashk samples showed that the mean values for appearance and color, consistency, taste and odour were 4.45±0.49, 4.35±0.49, 4.38±0.18 and 4.36±0.16 out of 5, respectively. Also the mean total score of sensory properties of traditional liquid kashk samples was found 17.55±0.83 out of 20. Furthermore, the vision of panelists about the general sensory properties of traditional liquid kashk samples was positive.

Industrial Liquid Kashk

The results of the chemical analysis for industrial liquid kashk samples are given in Table 2. The mean pH value of samples was 3.78±0.05 that is higher than the values (3.67 and 3.77) for strained yogurt (30). The titratable acidity (lactic acid %) in the examined industrial liquid kashk samples was found at an average of 1.54±0.10. Different values such as 1.16 (31) and 2.04 (32) for acidity of strained yogurt were recorded. The titratable acidity in the industrial liquid kashk may affected by the acidity of yogurt and heat treatment used during production.

The moisture value of industrial liquid kashk samples was found so close to each other with the mean value of 81.41±0.15 %. The concentration of yogurt used is the main parameter that affected the moisture value of the product. It seems that controlled production is the main factor for achieving similar results in the moisture values of samples analysed. The obtained value is similar to that found in strained yogurt (33). The average percentage of fat content in industrial liquid kashk samples was 1.65±0.06 % that is lower than values determined for strained yogurt (22.5 % and 6.55 %) (32). The use of milk with low fat rate in industrial liquid kashk production may lead to manufacture a product with lower fat rate than similar products.

The protein content of industrial liquid kashk samples was found at an average of 8.59±0.22 %. This rate was lower than the protein rate of strained yogurt (12.6 %) (30). The protein content of industrial liquid kashk is sourced from the concentration process applied during the production that is depending on the protein rate of raw milk. The mean salt value of industrial liquid kashk samples was found 1.69±0.07 %. The salt is added during the manufacture of industrial liquid kashk formed the source of salt rate in the final product. The average percentage of ash content in industrial liquid kashk samples was found 2.30±0.08 % that is higher than ash rate (0.7 %) detected in strained yogurt (30). The salt added to product during production, may constitute the large portion of the ash rate.

The obtained results of microbiological analysis for industrial liquid kashk samples showed that coliform bacteria and *Escherichia coli* could not be found in all samples (30/30). While the presence of coliform and *Escherichia coli* in stained yogurt have been reported (31, 34), the absence of them in industrial liquid kashk samples can be connected to implementation of suitable hygiene rules during the production and prevention of post-process contamination. Moulds and yeasts in 96.66 % of industrial liquid kashk samples (29/30) were established <10 cfu/g, while 3.33 % of samples (1/30) contained 10-10^2 cfu/g of them. This result is so lower than that determined (33) for strained yogurt. It may be related to hygienic conditions of production, packaging and storage locations.

Staphylococcus aureus could not be determined in all samples (30/30). It is proved that irregularities in storage time and temperature and failures in the hygienic procedures during the production of dairy products are factors that may lead to contamination with *Staphylococcus aureus* (35). The results have shown that the appropriate conditions were dominated in both production and storage stages.

According to the results of sensory assessment of industrial liquid kashk samples, the mean values for appearance and color, consistency, taste and odour were 4.57±0.49, 4.51±0.50, 4.47±0.09 and 4.49±0.09 out of 5, respectively. The mean total

score of sensory properties of industrial liquid kashk samples was found 18.05±0.77 out of 20. In addition, all samples were appreciated by the panelists in terms of the general sensory properties.

Comparison of Results

The chemical properties of traditional liquid kashk and industrial liquid kashk samples analysed are presented in table 2. Although yogurt is the basic raw material used for production of traditional liquid kashk and industrial liquid kashk samples, different production methods may cause to differences observed between chemical properties of them (Table 2). Appropriate hygiene conditions dominated during production and storage stages of both products could play an important role in the absence of microbial contamination in them. Sensory points of traditional liquid kashk and industrial liquid kashk samples were high and too close to each other. Nevertheless, kashk was not used in industrial liquid kashk production and therefore the aroma of kashk was feeling less in it. So, the production of specific starter culture for feeling the kashk aroma can be an important step in this field.

CONCLUSIONS

Traditional liquid kashk and industrial liquid kashk are two concentrated yogurt-type dairy products produced in industrial dairy units in Iran. The results of this study displayed that all traditional liquid kashk and industrial liquid kashk samples were compliance with the standards set by ISIRI. Kashk used for traditional liquid kashk production is manufactured traditionally and because of inappropriate conditions of the production may contain microbial contamination. So, it seems that elimination the microbial risk is the main reason for production of traditional liquid kashk. Although kashk produced traditionally under non-standarded and unhygienic conditions is used for traditional liquid kashk production, the chemical, microbiological and sensory properties of samples analysed were satisfactory. Therefore, it may be possible to transfer a dairy product from traditional production to industrial production and produce a standard and more safer product for consumers. High total sensory points of these products may show the consumer interest for using them as supplemented and flavouring foods in their diet. Finally, production of traditional liquid kashk and industrial liquid kashk may creat an example for different evaluations from milk products.

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