SOME QUALITY PROPERTIES OF KURUT, A TRADITIONAL DAIRY PRODUCT IN TURKEY[1]

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ABSTRACT

Kurut is a sun-dried fermented milk product, traditionally consumed by the people of Turkey.The aim of this study was to investigate some chemical and microbiological properties and the mineral content of kurut. A total of 43 kurut samples produced from buttermilk by churning of cream (TG; n=27) or by yoghurt (YG; n=16) were collected from Erzurum and Bingöl provinces of Turkey. The samples of TG and YG groups contained aerobic mesophilic bacteria (3.1±2.20 log cfu/g, 0.25±0.89 log cfu/g), coliform bacteria (1.04±1.61 log cfu/g, <10), *lactobacillus* (2.71±2.49 log cfu/g, 0.29±1.05 log cfu/g), *staphylococcus-micrococcus* (0.25±0.99 log cfu/g, 0.45±1.32 log cfu/g), *lactococcus* (2.87±2.02 log cfu/g, 0.20±0.71 log cfu/g), yeast and mould (2.14±2.27 log cfu/g, 0.85±1.63 log cfu/g), respectively. Microbial content of TG group was significantly higher than that of YG group contents.

Average levels of moisture, total ash, salinity, acidity, fat, pH, protein of TG and YG groups were (15.48±4.48%, 12.4±2.33%); (10.76±4.90%, 14.31±3.23%); (8.62±3.92%, 9.73±1.30%); (1.34±0.51%, 2.13±0.38%); (22.56±9.08%, 16.69±2.43%); (4.22±0.58, 4.01±0.13); (51.15±10.73%, 56.01±10.84%), respectively. Minerals in samples were scanned by WDXRF.

Kurut is a product making possible the evaluation of buttermilk.The drying method will allow extended storage times for yogurt, which has a shelf life of about 1 week. Kurut has a very low moisture ratio, minimizing bacterial growth and bacterial spoilage of the product. Yogurt will turned into a long-life product in the form of kurut. Therefore, to increase the consumption of kurut is expected to positively affect public health. There is need in scientific studies towards determining the quality of kurut, modernizing its production and keeping conditions and making consumption widespread.

Keywords*:*Kurut; Turkey, chemical composition, microbiological composition, WDXRF

INTRODUCTION

Kurut is a dry fermented - dairy product produced traditionally in Turkey (1,2,3) . Kurut is included in the scope of concentrated fermented milk and traditional products in Turkish Food Codex Communiqué in Fermented Milk (4). In Turkey many products similar to kurut are produced with different names, such as kes (5), pestigen (6), peskuten (7), gesk, kesk, corten, torak or terne (1). There are also products similar to kurut which are produced especially in the Middle East under the names, sucha as labneh, shankalish, madeer, oggt and kishk are dealed as kurut-like products (8).

In some regions of Turkey, kurut is traditionally produced by yoghurt. Yoghurt is produced from full-fat milk boiled and cooled up to 43-44˚C by adding yoghurt of the day before for fermentation.The yoghurt obtained at the end of this process is placed in the refrigerator and kept for 24- 48 h and then poured onto a cloth bag and filtered for 1-3 day to remove water. The concentrated yogurt is poured into a pot and cut into small pieces with spons or hand to give 4 –8 cm in diameter and 40–80 g round, oval or conical shapes. Salt (1–3%) and cream (5–10%) are optionally added before the shaping process. These shaped pieces are then placed on a tray, and dried in a shady, airy place for 7-10 days after being covered with a cloth. These shaped pieces are then dried in the sun for 10–15 days (1, 2, 10).

In some regions (e.g. Erzurum) buttermilk is gained by churning of cream. Kurut is produced from the gained from buttermilk and drying in the sun after filtration as mentioned above. Some producers add rennet into buttermilk during the heat treatment to accelerate the coagulation (11) . Kuruts are kept in convenient conditions (e.g. cool, dry and clean). Kuruts are used for preparing various traditional meals, after they are dissolved in water (1).

Kurut is a remarkable food stuff because it has a high protein content, can be kept without spoiling for a long time and is produced from buttermilk, which is a by product of butter production (2). However there are limited studies on the chemical and microbiological quality of kurut. To our knowledge there is no study on the mineral content of kurut. Therefore we aimed to investigate some chemical and microbiological properties and the mineral content of kurut samples collected from Erzurum and Bingöl provinces of Turkey.

MATERIAL AND METHODS

In this research 43 kurut samples were collected from Erzurum and Bingöl provinces of Turkey in aseptic conditions and kept in refrigerator (4±1˚C) until they were analysed. The kurut samples (TG; cream buttermilk group, n=16) collected from the villages of Erzurum were prepared from buttermilk gained by churning of cream. The kurut samples (YG; yoghurt buttermilk group, n=27) collected from Bingöl were produced from buttermilk gained by churning of yoghurt.

Microbiological analysis

Ten grams of kurut sample was homogenized in 90 ml sterile saline solution and 1/10 dilutions of the homogenates were prepared (12). Pour plate method was used for microbiologic analysis. 1 ml of the homogenates was used for inoculation.

Plate Count Agar (PCA, Merck) was used for counting of total aerobic-mesophilic bacteria. Colonies were counted after incubation for 72±1 hours at 30±1˚C. For counting coliform bacteria Violet Red Bile Agar (VRBA, Merck) was used. After incubation at 37˚C for 24–48 h under anaerobic conditions, the red coloured colonies of diameters > 1 mm were counted. Rogosa Acetate Agar (RAA, Merck) was used for counting *Lactobacillus* bacteria. The plates were incubated at 30±1˚C for 5 days under anaerobic conditions. For counting *Staphylococcus-Micrococcus*, Mannitol Salt Agar (MSA, Merck) was used. After the plates were incubated for 36-48 h at 37±1°C, the forming colonies were counted. M17 Agar (Merck) was used for counting *Lactococcus* type bacteria. The colonies were counted after incubation for 48-72 hours at 30±1˚C. For yeast and mould counting, Potato Dextrose Agar (PDA, Merck) culture of which pH was reduced to 3.5 by using 10% tartaric acid. After the plates were incubated for 5 days at 21±1°C, the colonies were counted [(13)]. After incubation, 30-300 the colonies per plate were counted. Numbers of bacteria were expressed as unit forming logaritmic colony (log cfu g^{-1}).

Chemical analysis

Moisture contents of samples were determined by using the reference method reported in British Standard 770 (14). The salt contents were measured by using the Mohr method (15). Acidity of samples was determined by according to the method reported in TSE 591 (16). Fat amount of samples were determined by applying the Gerber method. pH values of samples were measured at 20±1˚C by using a pH meter (wtw inoLab) (17). Protein amounts of samples were determined by using Kjeldahl method according to the method reported by IDF (18). Analyses of the samples were carried out in duplicate.

Mineral analysis

For the determination of mineral contents of the kurut samples, Wavelength Dispersive X Ray Fluorescent (WDXRF) method reported by Demir et al.(19) was used. Kurut samples were dried in an incubator at 85–90˚C for 24-26 hours and they were kept in an air proof plastic pochettes until they were analysed. Kurut samples were pulverized by using a mill and sifted with sieves of 150µm and 75 µm provide particle homogeneity. After sifted samples were pelleted by using a press machine (Spex Cat. B25, USA) by applying a pressure of 15-18 tons. The pellets had diameters of about 30 mm and hight of 0.2-0.3 mm. Mineral contents of the pellets were determined by using a sequential spectrometer equipped with a Rh X-ray tube (ZSX 100e, Rigaku, USA).

Statistical analysis

The effect of raw material on quality of kurut samples were analysed with independent-samples *T*-test. SPSS software package program was used for statistical analyses (20).

RESULTS

Microbiological analysis

The numbers of total aerobic mesophilic and coliform bacteria, *Lactobacillus, Staphylococcus-Micrococcus* and *Lactococcus*, yeast and mould determined in the kurut samples examined were shown in Table 1. The numbers of the microorganisms were expressed as log cfu/g.

Table 1. The microbiological properties of the kurut samples (mean±standart deviation)

Kind of kurut	Total aerobic mesophilic bacteria (log cfu/g)	Coliform (log cfu/g)	Lactobacillus (log cfu/g)	Staphylococcus -micrococcus (log cfu/g)	Lactococcus (log cfu/g)	Yeast and mould (log cfu/g)
TG	3.01±2.20	1.04±1.61	2.71±2.49	0.25±0.99	2.87±2.02	2.14±2.27
YG	0.25±0.89	ND	0.29±1.05	0.45±1.32	0.20±0.71	0.85±1.63
Significance	**	**	**	NS	**	*

TG= cream buttermilk group; YG= yoghurt buttermilk group; NS= Not significant; ND= Not detected; *, ($p<0.05$); ** ($p<0.01$)

Chemical analysis

The results of chemical analysis were shown in Table 2.

Table 2. The chemical composition of the kurut samples (mean±standart deviation)

Kind of kurut	Moisture (%)	Total ash (%)	Salinity (%)	Acidity[a] (%)	Fat	pH	Protein
TG	15.48±4.48	10.76±4.90	8.62±3.92	1.34±0.51	22.56±9.08	4.22±0.58	51.15±10.73
YG	12.14±2.33	14.31±3.23	9.73±1.30	2.13±0.38	16.688±2.43	4.01±0.13	56.01±10.84
Significance	**	**	NS	**	**	NS	NS

TG= cream buttermilk group; YG= yoghurt buttermilk group;*, ($p<0.05$); **, ($p<0.01$); NS= Not significant; [a], Lactic acid unit

Mineral analysis

The contents of mineral substances in the kurut samples examined were given in Table 3.

Table 3. Contents of some mineral substances in the kurut samples.[χ] (mean±standart deviation)

Mineral	TG	YG	Significance
Sodium	16.760±5.294	20.114± 2.331	**
Magnesium	0.304±0.091	0.319±0.121	NS
Aluminium	0.129±0.064	0.034±0.013	**
Silicon	0.204±0.141	0.088±0.03	**
Phosphorus	3.561±1.286	4.424±0.494	**
Sulphur	3.890±1.453	3.654±0.584	NS
Chlorine	52.13±5.270	56.555±1.646	NS
Potassium	9.905±3.476	7.395±1.219	**
Calcium	7.634±3.337	6.673±1.081	NS
Iron	0.314±0.220	0.118±0.085	**
Nickel	0.031±0.039	0.015±0.003	*
Copper	0.034±0.038	0.019±0.006	*
Zinc	0.109±0.182	0.406±0.533	*
Bromine	0.066±0.049	0.036±0.007	**
Rubidium	0.006±0.011	0.007±0.003	*
Barium	0.164±0.074	0.093±0.022	**
Lead	0.074	ND	
Stronsium	0.024±0.030	0.007±0.001	NS
Tin	ND	0.051±0.015	
Aurum	0.036	ND	
Selenium	ND	0.009	
Titanium	0.052	ND	
Lantan	0.127	ND	

TG= cream buttermilk group; YG= yoghurt buttermilk group; [χ], indicates percentage;
NS= Not significance; ND= Not detected; *, ($p<0.05$); **, ($p<0.01$)

DISCUSSION

Microbiological analysis

The number of total aerobic mesophilic micro-organisms (Table 1) determined in TG and YG group was lower than that reported by Patir and Ates (3) and Kamber (21). The differences might result from raw material used, production and keeping conditions.

Coliform bacteria number of samples was 1.04±1.61 log cfu/g in TG group, however in YG group coliform bacteria could not be detected (Table 1). The number of coliform bacteria determined in TG group was lower than that (2.45 log cfu/g) reported by Patir and Ates (3). The absence of coliform bacteria in YG group is in accordance with the results of Kamber (21) who did not observe coliform bacteria in the kurut samples. The numbers of Lactobacillus species detected in TG (2.71±2.49 log cfu/g) and YG group (0.29±1.05 log cfu/g) (Table 1) were lower than those reported by Patir and Ates (3) and Kamber (21).

The number of Staphylococcus and Micrococcus sp. determined in TG group and (0.25±0.99 log cfu/g), in YG group (0.45±1.32 log cfu/g) was lower than that (3.38 log cfu/g) reported by Patir and Ates (3).

The number of Lactococcus species determined in TG group (2.87±2.02 log cfu/g) and in YG group (0.20±0.71 log cfu/g) (Table 1) was lower than that (4.04 log cfu/g) reported by Patir and Ates (3). Yeast and mould number determined in TG group (2.14±2.27 log cfu/g) and in YG group (0.85±1.63 log cfu/g) was lower than that (4.04 log cfu/g) reported by Patir and Ates (3).

The number of total aerobic mesophilic micro-organism, Lactobacillus, Lactococcus species ($p<0.01$), yeast and mould ($p<0.05$) determined in TG group were significantly higher than in YG. This might be due to high moisture content and low acidity determined in TG group.

Chemical analysis

Average moisture content was 15.48±4.48% and 12.14±2.33% in TG and YG group, respectively. The difference in the moisture contents between two groups was statistically significant ($p<0.01$). These values were higher than the value of 10.96±3.56% reported by Patir and Ates (3). The moisture content of YG group was similar to that reported by Kamber (21) (12.10±1.66%). Ash contents of the kurut samples in TG and YG groups were similar to those reported by Kamber (21) (9.98±1.70%) and Patir and Ates (39) (12.99±4.25%), respectively. Salt contents of the samples in TG and YG groups were lower than those reported by Patir and Ates (3) (12.85±4.33%) and higher than those reported by value of Kamber (21) (6.65±1.35%). The differences observed might be due to the addition of salt in different amounts by the producers to increase the taste, aroma and strength of kurut. Acidity of samples (% lactic acid) was lower in TG group, and similar in YG group than those reported by Patir and Ates (3) (2.40±1.08%) and Kamber (21) as (2.91±0.21%).

Fat content of the samples in TG group were significantly higher than that in YG group ($p<0.01$). The differences observed might be due to usage of fatless yoghurt by some producers to used for kurut production. Fat contents of the samples in both groups were lower than those reported by Patir and Ates (3) (32.90±14.10%), Kamber (21) (45.88±3.28%). The differences observed might be due to addition of cream by some producers to fatless yoghurt used for kurut production.

It was determined that the examined samples' pH values were 4.22±0.58 in TG group, 4.01±0.13 in YG group Patir and Ates (3) declared this value as 4.26±0.27 and Kamber (21) as 4.15±0.14. pH value got in this study is in accordance with the results of these researchers.

Protein ratio of kurut samples was determined as 51.15±10.73% in TG group, as 56.01±10.84 % in YG group (Table 2). These data show that kurut is very rich in protein. Protein ratio determined in this study was found out quite higher than the value (25.53±2.20%) Kamber (21) determined.

Significant differences in moisture, acidity, ash, and fat contents between TG and YG groups were observed while differencees in salinity, pH and protein content between the two groups were statistically not significant (Table 2). It can be said that these differences are sourced from the differences in raw material, production and keeping conditions. Moreover it is considered that there is not a standard technique from kurut's raw material to production and keeping conditions causes the given differences

Mineral analysis

Mineral substances in milk body are separated into two groups as macro and trace elements in terms of their amounts. Macro elements (calcium, phosphor, magnesium, sodium, potassium, chloride, sulphur and nitrogen) are indispensable elements for growth and development of the organism. Trace elements taking place in milk are aluminium, gold, copper, barium, bismuth, silver, tin, lead, lantan, nickel, iron, zinc, brome, chrome and selenium (24,25,26). Some elements such as Al and Pb are of actual importance because of their correlation to environmental pollution, and others as Al, Cu and Fe for their release from alloys of material and tools utilized for milking to dairy productions (27,28,29). The aluminium found in kurut samples might originate from milk and the aluminium pots used during for production and keeping of the kurut samples examined.

Moreover in kurut samples the elements of Zn, Sn, La, Au, Sr, Ti, Pb, Ru, Br, S, and Si were met as well (Table 3). While percentage Na, Al, Si, P, K, Fe, Br, Ba content TG and YG groups in the samples were found out different in very important level ($p<0.01$)

and Ni, Cu, Zn, Rb were found out different in important level ($p<0.05$), it wasn't observed a difference with Mg, S, Cl, Ca, Sr ratios (Table 3).

CONCLUSIONS

Kurut is a product making possible the evaluation of buttermilk and providing more durable yoghurt which has less durability by drying it. In the present study we determined the content of nutritional and mineral substances in kurut on which there was little knowledge. Especially because of its low moisture content bacterial spoiling was limited. However among kurut samples, significant differences in terms of microbial and chemical properties were observed. The results suggested that the differences resulted from raw material, production and keeping conditions, which were not standard. Therefore further studies are required to determine the quality of kurut, as well as for modernizing and standardizing its production and keeping conditions in order that it is widely consumed.

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