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Sensory and Microbiological Quality of Khoa Sold in and Around Hyderabad City

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Abstract:

The present study was carried out to evaluate sensory and microbiological quality of khoa sold in and aroundHyderabad city, India. The overall sensory score of the khoa samples collected from organized, semi-organized and unorganized sector was 95.25,88.8 and 79.5 respectively under 100point score card. The standard plate counts were 8.82×10^3CFU/g,1.73×10^4 and 4.81×10^6 CFU/g,the coliform count were1.51×10^1 CFU/g,5.25×10^2 CFU/g and6.21×10^3 and the Yeast and mould counts were3.53×10^2CFU/g, 6.85×10^3CFU/g and5.35×10^4CFU/g,for the samples from organized,semi-organized and unorganized sectors respectively.The incidence of *E.coli* was 10%,25% and 100%,*staphylococcus* was 10%,35% and 90%,*salmonella* was 55%, 40% and 5%and the*listeria*was 50%,25%and 5% and counts of *E. coli* were 3.52×10^1CFU/g,8.51×10^2CFU/g and 8.68×10^4CFU/g, *staphylococcus* were 5.23×10^2CFU/g, 3.68×10^3CFU/g and8.68×10^4CFU/g counts of *salmonella* were1.52×10^1CFU/g,5.65×10^2CFU/g and 8.36×10^3CFU/g and the *listeria* were 0.31×10^1CFU/g, 2.86×10^1CFU/g and 3.86×10^2 for the samples from organized,semi-organized and unorganized sectors respectively. The microbiological incidence and counts were high in unorganized sector, least in organized sector and in between in semi-organized sector.

Keywords— Khoa, Sensory quality, Microbiological quality.

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INTRODUCTION:

Themilk production in India is 221.1 million tonnes out of which 45 % is used as a liquid milk and remaining as different milk products.Approximately 6.5% of milk is converted into khoa (27).Khoa is partially desiccated traditional indigenous milk product which is used in the preparation of variety of indigenous sweets like peda,burfi,gulabjamun,pantoa etc.Khoa has high commercial significance because of its usages in several types of sweets preparation.As the milk is boiled for long time in khoa preparation most of vegetative bacteria destroyed.The keeping quality of khoa is adverselyeffected by thermoduric organisms acquired during post preparation and storage.In India larger share of khoa is prepared under unorganized sector, wherein hygienic conditions are poor, poor storage conditions and selling openly without packing (15).Even though the khoa prepared under hygienic conditions in organized sector, the product is prone for microbial contamination at different stages after post processing till reaches consumer.Since mould spores are transmitted through air their contamination is quite natural. Khoa is a perishable product with limited shelf life and so the initial quality of khoa effects the quality of final khoa based sweets wherein it is used.

Certain pathogens like *Staphylococcus aures*,*Escherichia coli*,*Salmonella*,*Listeria* are the regular contaminants through handlers,equipments and environment during post processing and selling without packing.The khoa and khoa based milk sweets provide a good means of conserving and preserving surplus milk solids during flush season. The high nutritive value,the water activity of khoa is conductive to growth of microorganisms (29).

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Microbiological quality of market khoa samples testing relatively high and alarming figures(24).The microbial contamination producesundesirable effects in color,odor,taste and texture of the product besides pathogens causing food borne disease outbreaks.Many studies carried out in India reported presence of pathogens such as*Staphylococcus, Bacillus,Escherichia coli,Salmonella* etc.(6,24,7).Keeping in view the high microbial contamination and public health issue,the present study was undertaken to evaluate the sensory and microbiological quality of khoa sold in and around Hyderabad by local Vanders as well as organized sectors.

MATERIALS AND METHODS:
Khoa samples were collected from three sourcesi.e.organized,semi-organized and unorganized sectors. Twenty each khoa samples from three sources were collected from the markets in and around the Hyderabad.The samples were packed in polythene bags kept in ice box to maintain low temperature,transported to the laboratory of department of veterinary public health and epidemiology and stored in the refrigerator till samples are analyzed.

Sensory evaluation:
The sensory evaluation of the khoa samples arecarried out using(100) point score cardi.e. flavour-45,body and texture-35,colour and apperence-15 and package-5(9). A panel of 5 selected judges who are experienced were selected for sensory evaluation.

Microbial analysis:
The standard plate count was done as per method cited (12) using nutrient agar,coliform count as per the method (4)using Mac Conkey's agar broth medium and yeast and mould(13)by using potato dextrose agar medium.
Various pathogenic microorganisms were estimated i.e.,*staphylococcus* usingBaird parker agar and mannitol salt agar,*Escherichia coli* using Macconkey'sagar,*salmonella* using xylose lysine deoxycholate agar,listeria using *listeria* agar purchased from high media following standard procedures.
Serial dilutions were prepared by mixing 1 gram of product (khoa)in 10 ml of sterilized distilled water and mixing thoroughly that makes 1:10 dilution, 1ml of this was transferred into 9ml of distilled water and so on to make further dilution upto 10^7. One ml of diluted sampleswere transferred into sterilized petridish and enough quantity of respective liquid media was poured on the dispersed sample. After proper solidification of the media, petridishes were incubated at 37°C for 24 to 48 hours for SPC,coliform and pathogens and 5to7 days for yeast and mould.The number of colonies in each plate were counted using colony counter and multiplied by dilution factor to get microbial count.

Results and discussion:
Sensory evaluation
Sensory evaluation of khoa samples from different sources was presented in table:1
Table:1 Sensory scores of khoa samples collected from different sources.

Parameter	Organized sector	Semi-Organized sector	Unorganized sector
Flavour(45)	43.75	40.25	38.50
Body and texture(35)	32.5	30.75	28.75
Colour and appearance(15)	14.5	13.8	11.75
Package(5)	4.5	4.0	0.5
Total	95.25	88.8	79.5

The overall sensory score was 95.25 for the khoa samples from organized sector,88.8 for the samples from semi-organized sector and 79.5 for the samples from unorganized sector. All the sensory parameters had high score with organized sector, least with unorganized sector and moderate with the samples from

semi-organized.The overall acceptability of khoa in the present study was 88.8 in the sample from semi-organized sector which,was almost similar to the acceptability score in the khoa sample from Bhandara district, Maharashtra(32). The overall acceptability in the samples from organized sector in the present study was similar to the samples collected from Nagpur(17) and Washim districts (23)of Maharashtra. The overall acceptability of khoa samples from unorganized sector in the present study was 79.5, which was similar to the reports for the Risod khoa from Washim district (23).The overall acceptability was 8.0-8.1 on 9point hedonic scale for khoa samples from kamareddy,Telangana state (19).

The flavour of the khoa samples was pleasant for the samples from organized sector and semi-organized sectors, whereas it was little smoky and sour with the samples from unorganized sector.The body and texture was smooth and soft for the samples from organized and semiorganized sectors,whereas it was little hard,coarse and girty texture for theunorganized sector.The body and texture of the khoa samples collected from organized and semi-organized sector in the present study was in close agreement (20). The body and texture score in the present study for the khoa samples from organized sector was 32.5, which was almost similar to the score for Washim khoa(23).

The colour and appearance was slightly brown and normal from organized and semi-organized sector,where as it was dark brown and leaky surface for the samples from unorganized sector. The colour and appearance scores from the organized and semi-organized sector in the present study was almost similar to the findings (1). The package was good for the organized and semi-organized samples,whereas was no packaging or simple paper for the samples from unorganized sector.

Microbiological counts:
The standard plate count, coliform, yeast and mould counts of khoa samples presented in table:2
Table:2 microbiological counts of khoa samples 7.3×10^4 collected from different sources.

Parameter	Organized sector		Semi-Organized sector		Unorganized sector	
	count	Range	count	Range	count	Range
SPC	8.82×10^3	4.1×10^5 to 7.3×10^4	1.73×10^4	8.4×10^3 to 4.2×10^5	4.81×10^6	5.5×10^5 to 8.1×10^7
COLIFORM	1.51×10^1	0 to 3.5×10^2	5.25×10^2	3.5×10^1 to 7.3×10^3	6.21×10^3	2.8×10^2 to 8.9×10^4
Y& M	3.53×10^2	4.2×10^1 to 3.8×10^3	6.85×10^3	4.3×10^2 to 6.8×10^4	5.35×10^4	3.5×10^3 to 6.8×10^5

The standard plate counts were 8.82×10^3 CFU/g in the samples from organized sector,1.73×10^4 from semi-organized sector and 4.81×10^6 CFU/g from unorganized sector. Counts of 2×10^4 CFU/g from Kanpur city (33)and 1.3×10^4 CFU/g from Madhya Pradesh (3)were almost similar to the counts observed in the present study from organized sector. Very low counts of 4.65CFU/g (5) was reported from Kanpur city in the samples from organized sector. A count of 1×10^1 to 2×10^2 CFU/g (16)in the samples from organized sector were also less than the counts in the present study. High count of 1.87×10^4 CFU/g in the samples from organized sector was reported from Kamareddy(19). A count of 2×10^2 to 5×10^2 CFU/g in the samples from semi-organized sector(16)was less than the counts $(1.73 \times 10^4$ CFU/g) observed in the present study,whereas higher count of 69×10^5 CFU/g was also reported (26). The SPC count of 1.67×10^5 CFU/g to2.25×10^7 CFU/g in the samples from unorganized sector from Marathwada region (18) was almost similar to the counts of 5.5×10^5 to 8.1×10^7 in the present study from unorganized sector. A count of 3×10^3 to 1.7×10^4 CFU/g in the samples from local vendors reported (16) was less than the count observed in the present study from semi-organized sector $(1.73 \times 10^4$ CFU/g).The counts from the samples from semi-organized sector in the present study was almost similar to the counts reported from Maharastra(28)and Madhya Pradesh (3). Higher counts of 23×10^5 CFU/g in the samples from semi organized sector reported from Bhokar region (26)was higher than the counts observed in the present study.

The coliform count was least (1.51×10^1CFU/g) in the samples from organized sector, the highest 6.21×10^3 CFU/g from unorganized sector and moderate 5.25×10^2CFU/g from semi organized sector. The counts from the organized sector samples in the present study were almost similar to the counts of 3.5 to8.5CFU/g (18)from Marathwada and 9.6CFU/g(5)from Kanpur city.Higher counts of 1×10^2(25)and 2×10^2CFU/g (16)than the present study from organized sector were reported from different places in India.No counts from organized sector was reported (19).The coliformcount(6.21×10^3CFU/g)observed in the unorganized sector in the present study was almost similar to the counts of 2.9×10^3CFU/g(16)and 0.7×10^3CFU/g(1).Very low counts of 1×10^2CFU/g(25)and (19)were also reported. Very high counts in the khoa samples from unorganized sector of 10^4CFU/g (28) from Maharashtra.The counts in the samples from semi-organized sector in the present study(5.25×10^2CFU/g) was higher than the counts of 1.1×10^3CFU/g(16)and low counts of 1.93CFU/g (19)and 3.5CFU/g(18)were reported for the samples from semiorganized sector. The difference in the coliform count of khoa among the different sources could be due to uncleaned hands workers, poor quality of milk,unhygienic conditions of manufacturing unit, inferior quality of materials used water supplied for washing the utensils and post processing contamination(21).

The Yeast and mouldcounts in khoa samples was 3.53×10^2CFU/g from organized sectors 6.85×10^3CFU/g in the samples from semiorganized sector and 5.35×10^4CFU/g in the samples from unorganized sector. Almost similar counts from organized sector in the present study were reported from Maharashtra(28),Allahabad city (22) and Kanpur city (5).Low counts of 60CFU/g from Bhokar region was reported (26). Counts of 5.3×10^3CFU/g from Nanded(1)and 2.8×10^3CFU/g from kamareddy(19) were reported from semiorganized sector were almost similar to the counts observed in the present study. Low counts of 10.5 CFU/g(18) Marathwada region and 1.1×10^2CFU/g(16)were reported from unorganized sector.The high count (5.35×10^4CFU/g)observed in the samples from unorganized sector in the present study were less than the counts of 4×10^5CFU/g(33)from Kanpur city.Almost similar counts from the unorganized sector in the present study were reported (19)from kamareddy. Less counts of 1.9×10^3CFU/g(16)and 3.46CFU/g (5)from Kanpur city were observed from unorganized sector.Occurrence of yeast and mould in dairy products in India is due to the prevailing tropical climate and high humidity and they are transmitted through air (16).

The unhygienic conditions of preparations of khoa, water used for washing of utensils and the handling persons cleanliness enhances the bacterial contamination of khoa (14), however eventhough the microbiological quality of khoa maybe satisfactory at the time of production, it deteriorated by the time it is available for sale in the market (2).

Pathogenic microorganisms:

The incidence of pathogenic microorganisms in khoa samples presented in table:3

Table :3 Incidence of pathogenic microorganisms in khoa samples.

Parameter	Organized sector	Semi Organized sector	Unorganized sector
Escherichia coli	2(10%)	5(25%)	20(100%)
Staphylococcus	2(10%)	7(35%)	18(90%)
Salmonella	1(5%)	8(40%)	11(55%)
Listeria	1(5%)	5(25%)	10(50%)

The incidence of*Escherichia coli* was 10%,25% and 100% in the samples from organized,semi-organized and unorganized sectors respectively in the present study.Higher incidence of *Escherichia coli* (60%) was observed in the samples from Nagpur city from organized sector (8)than the incidence in the present study (10%). The incidence of 55% *Escherichia coli*reported in the semi-organized sector samples (8)was higher than the incidence (25%) observed in the present study.All the samples in the present study from unorganized sector were positive for *Escherichia coli*,which was higher than the incidence observed in Maharashtra (28),Kanpur city (5)and Kamareddy(19).*Escherichia coli* is frequently occurring organism

in milk products like khoa and mawa(haq*etal.,* 1995). Higher incidence of *Escherichia coli* was reported from Tandojam,pakistan(30).

The incidence of *staphylococcus* was 10%,35% and 90% in the samples from organized,semi-organized,unorganized sectors respectively in the present study. An incidence of 90% (8)from unorganized sector was similar to the counts in the present study. Higher incidence of 94% was reported in the khoa sold in Gwalior and Morena in India. *Staphylococcus* is frequently occurring organism in milk products(10).

The incidence of *salmonella* was higher (55%) in the samples from unorganized sector, followed by (40%) in the samples from semi-organized sector and least (5%) from organized sector in the present study.The incidence of 65% of *salmonella* was reported (8)in the unorganized sector was slightly higherthan the incidence in the present study (55%).*Salmonella* absence was also reported(24).

The incidence of *listeria* was higher 50% in the samples from unorganized sector, followed by 25% in the samples from semi-organized sector and least 5% from organized sector.

The counts of pathogenic microorganisms in the khoa samples were presented in table:4

Table :4 Counts of pathogenic microorganisms in khoa samples.

Parameter	Organized sector		semi- organized sector		Unorganized sector	
	Count	Range	Count	Range	Count	Range
Escherichia coli	3.52×10^1	$1.8 \times 10^1 - 2.5 \times 10^2$	8.51×10^2	4.6×10^2 to 3.8×10^3	8.68×10^4	4.5×10^3 to 3.8×10^5
Staphylococcus	5.23×10^2	8.6×10^1 to 3.8×10^3	3.68×10^3	5.2×10^2 to 9.3×10^4	8.68×10^4	3.5×10^3 to 4.6×10^5
Salmonella	1.52×10^1	0 to 2.8×10^1	5.65×10^2	3.6×10^1 to 6.8×10^3	8.36×10^3	1.8×10^2 to 3.8×10^4
Listeria	0.31×10^1	0 to 2.5×10^1	2.86×10^1	0.3×10^1 to 5.6×10^1	3.86×10^2	5.6×10^1 to 3.8×10^3

The counts of *Escherichia coli*were least (3.52×10^1CFU/g) in the samples from organized sector, moderate(8.51×10^2CFU/g) from semi-organized sector and high (8.68×10^4CFU/g) in the samples of unorganized sector in the present study.The *Escherichia coli*count of 10CFU/g reported (25)from organized sector samples was less than the counts of 3.52×10^1CFU/g observed in the present study.

The *staphylococcus* count was highest (8.68×10^4CFU/g) in the samples from unorganized sector,least 5.23×10^2CFU/g from organized sector and in between 3.68×10^3CFU/g in the samples from semi-organized sectors in the present study.The count of 8.74 to 26.82CFU/g in the khoa samples fromdifferent regions of Maharashtra from organized sectors was less than the counts observed in the present study.Almost similar to the counts in the samples from semi-organized sector in the present study was reported from Maharashtra(28). Regulatory authorities proposed the maximum acceptable limit 1×10^2CFU/g of khoa.

The *salmonella* counts in the present study was 1.52×10^1CFU/g,5.65×10^2CFU/g and 8.36×10^3CFU/g in the samples of organized,semi-organized and unorganized sectors respectively. No *salmonella* was reported in the samples of khoa sold in Maharashtra(28).

The *listeria* count was least (0.31×10^1CFU/g) in the samples from organized sector, highest (3.86×10^2CFU/g) in the unorganized sector and in between (2.86×10^1CFU/g) from semi-organized sector. No listeria was reported in the samples of khoa sold in Maharashtra (28).

The sample contamination can be attributed to the practice of preparing large bulk of product in advance prior to the requirement and storage of the product at room temperature for long duration(31).Observing proper hygienic conditions by food handlers,using clean utensils,application of HACCP,adequate education,awareness programmes,and extension programmes on the subject to the food handlers will decrease microbial risk (8).

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