

EVALUATION OF BACTERIOLOGICAL QUALITY OF KHOA SAMPLES SOLD IN NAGPUR CITY (MAHARASHTRA)-A CASE STUDY

Godbole, Suchitra, Pranoti Dabholkar and Shyamashri Mallik

Dept. of Microbiology and Biotechnology,
G.H. Raisoni Institute of Information Technology,
Hingna, Nagpur- 440016

Abstract

Present study was conducted to analyze microbial contamination in khoa (a milk product) samples sold in different parts of Nagpur city. The samples were collected randomly from various localities and processed for microbiological analysis. All samples were analyzed for total viable count, *E. coli*, *Salmonella* sp. and *Staphylococcus* sp. All the 20 samples showed bacteriological count ranging from 4.88×10^5 to 1.2×10^7 CFU/gm. Of all the samples tested 60% samples showed the presence of *E.coli*. 65% samples were contaminated with *Salmonella* sp., and 90% were found to be contaminated with *Staphylococcus* sp. Contamination of khoa samples with pathogenic bacterial could be an important factor for gastrointestinal infections, including food poisoning and food borne illness. Keeping in view the public health, more hygienic preventive measures are needed to address this problem of microbiological contamination, and to increase the quality of products sold at local levels.

Key words: Khoa, bacteriological quality, viable count, *Staphylococci*, *Salmonella*.

INTRODUCTION

Milk and milk products have high nutritive value but are most prone to contamination with different types of microorganisms due to unhygienic conditions and improper handling and storage. The consumption of unhygienic contaminated food leads to food borne diseases which cause considerable morbidity and mortality. In India people use many types of milk products including khoa, partially dessicated milk which is traditionally used in preparation of various sweets, vegetable curries etc. In tropical countries like India dairy products have been found to be responsible for many outbreaks of gastrointestinal infections. Dairy products prepared under unhygienic conditions pose a great threat to the health of the consumer. The high nutritive value and high water activity (0.96) of khoa is conducive to growth of bacteria [1]. Microbial contamination produce undesirable effects like change in colour, odour, taste and texture of the product, besides contamination of products with pathogenic bacterial can result in outbreaks of gastrointestinal infections.

Many studies carried out in India showed the presence of pathogenic microorganisms such as *Staphylococcus* sp, *Bacillus* etc. [2, 3, 4]. In studies conducted on khoa samples sold in Madhya Pradesh predominant organisms observed were *Staphylococcus* and *Streptococcus* spp., the viable counts ranging between 1.3×10^4 to 2.1×10^6 CFU/gm [5, 6].

The contamination of the khoa can take place either during cooling or handling after cooling and during storage in the shops without proper storage conditions until the product is sold to the consumers. Keeping in view the public health issue, the present study was undertaken to evaluate the bacteriological quality of khoa samples sold in Nagpur city.

MATERIALS AND METHODS

In the present study a total of 20 samples were collected from different parts of Nagpur city. Samples were collected in presterilized containers from vendors of various parts of Nagpur city and transported in ice buckets to the microbiology lab. Each khoa sample was processed under sterile condition in 10ml of sterile physiological saline and homogenized with mortar and pestle and serial dilutions were made from 10^{-1} to 10^{-7} . All samples were subjected to bacteriological analysis for determination of total viable count (TVC) on nutrient agar, *E.coli* on EMB and Mac Conkey agar, *Salmonella* sp. on xylose lysine deoxycholate agar and bismuth sulphite agar and *Staphylococcus* sp. On Baird Parker agar and mannitol salt agar.

After incubation at 37°C for 24hrs, the microorganisms were identified on the basis of colony characteristics. Gram staining and motility of the isolates was also done for confirmation. Results

were expressed as CFU per gm of sample. All samples were also subjected to methylene blue reduction test.

RESULTS AND DISCUSSION

In the present study a total of 20 samples were analyzed to determine the bacteriological quality. A total viable count (TVC) ranging from 4.90×10^5 to 1.2×10^7 CFU/gm of sample was observed. After 24hrs of incubation the colonies were identified from their colony characteristics and growth on different specific media [7]. Out of 20 samples, 55% samples showed the presence of *E.coli*, 65% of samples were contaminated with *Salmonella* sp., and 90% of samples were found to be contaminated with *Staphylococcus* sp. (table 1 and 2)

Methylene Blue Reduction test showed that, 12 samples were of poor quality and 08 samples were of fair quality. There are reports of contamination of sweets and sandesh contaminated with *E.coli*. to the range of 10 CFU/gm to 1.0×10^2 CFU/g. [8], SPC of 5×10^3 CFU/gm to 2.1×10^5 CFU/gm in khoa from Hissar market [9] and SPC count of 3×10^5 CFU/gm to 7.5×10^7 CFU/gm in Sandesh samples [10].

Staphylococcus species are found in almost 90% of samples studied. The reports also suggest that *Staphylococcus sp.* is most frequently occurring organism in sweet based milk products such as khoa, rabri, gulabjamun etc. [11, 12]. Millions of people are affected by food borne illness resulting from ingestion of toxin produced by food associated *Staphylococcus*.

The presence of *E.coli* in raw milk samples and other milk products like mawa/khoa, dahi cheese etc. have also been reported. [13, 14]. In the present study also 60% of the samples were found to be contaminated with *E.coli* species. However the presence of *Salmonella sp.* in 65% of samples in the present study is a great cause of concern from the point of view public health.

Results of the present study reveal the problem of contamination of khoa samples sold in Nagpur city. Heavy bacterial contamination was found in all samples. This can be attributed to the practice of preparing large bulk of products and storage of products at room temperature for long duration.

However considering the impact of consumption of such contaminated products on public health, the HACCP should be applied during the manufacturing process. The analysis from raw material to final product indicate that, though microbiological quality of khoa may be satisfactory at the time of production, it deteriorated by the time it is available for sale in the market. [15].

However observing proper hygienic conditions, like thorough washing of hands by food handlers, storage under proper temperature conditions etc. could reduce the chances of contamination to a greater extent. The application of HACCP would yield the desired result of improving the safety of food. However adequate education, awareness programs and extension programs on the subject needs to be undertaken and training programs organized for food handlers so that the health of the consumers is not at risk.

Table 1.0 : Bacteriological study of khoa samples from Nagpur city

S. No.	Code of sample	Place of collection	TVC CFU/g	<i>E.coli</i>		<i>Salmonella</i> spp		<i>Staphylococci</i> spp		MBRT result
				EMB	Mc Conkey	XLD	BSA	MSA	BPA	
1.	KH1	Hingna	1.27x10 ⁷	+	+	+	+	+	+	Poor
2.	KH2	Hingna	3.1x10 ⁵	+	+	+	+	+	+	Poor
3.	KJ1	Jaitala	1.2x10 ⁶	+	+	+	+	+	+	Poor
4.	KJ2	Jaitala	5.6x10 ⁵	+	+	+	+	+	+	Fair
5.	KS1	Subhash Nagar	5.4x10 ⁵	+	+	+	+	+	+	Fair
6.	KS2	Subhash Nagar	9.24x10 ⁵	+	+	+	+	+	+	Fair
7.	KDh1	Dharampeth	1.77x10 ⁶	+	+	+	+	+	+	Poor
8.	KDh2	Dharampeth	1.92x10 ⁶	-	-	-	-	+	+	Poor
9.	KSh1	Shankar Nagar	4.88x10 ⁵	-	-	+	+	-	-	Fair
10.	KSh2	Shankar Nagar	5.82x10 ⁵	-	-	-	-	+	+	Fair
11.	KB1	Buldi	8.64x10 ⁵	+	+	+	+	+	+	Fair
12.	KB2	Buldi	6.34x10 ⁵	-	-	-	-	-	-	Fair
13.	KDh1	Dhantoli	8.66x10 ⁵	-	-	-	-	+	+	Fair
14.	KDh2	Dhantoli	1.21x10 ⁶	-	-	-	-	+	+	Poor
15.	KDu1	Duttawadi	1.24x10 ⁶	+	+	+	+	+	+	Poor
16.	KDu2	Duttawadi	1.36x10 ⁶	+	+	+	+	+	+	Poor
17.	KW1	Wardhaman nagar	1.35x10 ⁶	-	-	+	+	+	+	Poor
18.	KW2	Wardhaman nagar	1.68x10 ⁶	-	-	-	-	+	+	Poor
19.	KI1	Itwari	1.35x10 ⁶	+	+	+	+	+	+	Poor
20.	KI2	Itwari	1.10x10 ⁶	-	-	-	-	+	+	Poor

TVC = Total viable count, EMB = Eosine Methylene Blue agar, MSA = Manitol salt agar

CFU/gm= Colony Faming Units, XLD=Xylose Lysine deoxycholate agar,

BPA = Baired Parker agar, BSA = Bismuth Sulphite Agar, + = Present, - = Absent

Table 2.0: Bacteria isolated in khoa samples from Nagpur city

S.No.	Name of bacteria	No. of positive samples
1.	Total viable count	All 20
2.	<i>E.coli</i> sp.	11
3.	<i>Salmonella</i> sp.	13
4.	<i>Staphylococcus</i> sp.	18

REFERENCES

1. Sawhney I.K., Patil G.R., Kumar B & Rao K.J.1994. Evaluation of glycerol as a water activity modifier in khoa. *J. of food sci & Technol.* 31; 252.
2. Gill J.P.S. Joshi D.V. & Kwatra M.S. 1994. Qualitative bacteriological survey of milk and milk products with special reference to *Staphylococcus aureus*. *Ind J of Dairy Sci.* 47; 680
3. Mandokhot W. and Garg S.R.1986. Market quality of khoa, burfi and pera: A critical Review. *J. Food Sci Technol.* 22:299.
4. Gilmour A. and Marvey J.1990. Staphylococci in milk and milk products. Symp. Series soc. In applied bacteriology. 1475-1665.
5. Bhatnagar P., Khan A.A., Jain M., Kaushik S., Jain S.K. 2007a Microbiological study of khoa sold in Chambal region (Madhya Pradesh): A case study. *Ind J. Microbiol.* 47-263-266.

6. Bhatnagar P., Khan A.A., Jain M., Kaushik S., Jain S.K. 2007b. Bacteriological study of khoa sold in Gwalior and Morena city (Madhya Pradesh) in relation to public health. *Asian J. Exp. Sci.* 21(1) 35-62.
7. Halt J.G., Crieg N.R. Smith P.H.A. Stanley J.F. and Williams S.T.1994; Bergey's manual of Determinative bacteriology (IXth edn.), Williams and Wilkins publishers.
8. Mishra K.A. & Kulia K.R. 1988. Microbiological quality of burfi and sandesh. *Asian J. of Dairy res.* 7(1). 51-55
9. Reddy G.R., Reddy K.S., Mandokhot U.V. and Chandiramani N.K. 1983. Survey and growth of microflora in khoa at different storage conditions in : Proceedings of the symposia on biology of virus plasmids, Biotechnology, Microorganisms in Agriculture and ecology, 24th Annual conference of Association of Microbiologists of India, Hyderabad, Nov. 13.
10. Sen C.D. and Rajorhia S.G.1989. Quality characteristics of sandesh marketed in Calcutta. *Ind J.of Dairy sci.* 42 (2) : 221-24
11. Grewal J.S. and Tiwari I.R.1990. Microbiological quality of rasmalai. *J. food sci. Technol.*27:178-179.
12. Hamama A. and Tatini S.R.1991. Enterotoxigenicity of *S. aureus* isolates from Moroccan raw milk and traditional dairy products. *Microbiol ali and Nutr.* 9:263-267
13. Haq. I, Mahmod F., Qadeer M.A. Mukhtar H. & Iqbal ,1995. A microbial examination of khoa. *Biologia*, 44: 127-132.
14. Soomoro A.H. Arain M.A., Khaskhedhi M & Bhutto B,2002. Isolation of *E.coli*. from raw milk and milk products in relation to public health sold under market conditions at Tandojam. *Pak. J. of nutr.* 1: 151-152
15. Bhat R.V., Rao V.S., Lingerkar K., 2000.Application of hazard analysis and critical control point for improvement of quality of processed foods. *ICMR bulletin.* 30(5).