Original Research

Distribution of *E. coli* in Milk and Dairy Products Marketed in Different Zones of Chennai Metropolis

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Abstract

Milk and dairy products act as an important source of food-borne pathogens. Among pathogens that can get access to milk, E. coli is of great concern since 1980s and thus remains a serious health risk. In the present study, raw milk (75), pasteurized milk (45) and dairy products (447) were purchased from several retail outlets and supermarkets in different zones of Chennai city and were screened for E. coli contamination by both conventional and molecular methods. Out of 567 samples examined, 34 (5.99%) were found to be positive for E. coli which comprises of 9 (12%) raw milk and 25 (5.59%) dairy products. Further, highest contamination was seen in indigenous heat and acid coagulated products. While none of the pasteurized milk samples were positive for E. coli. All the samples were found to be negative for E coli O157:H7 in CT-SMAC agar, in the present study.

Key words: Conventional, *E. coli*, Dairy Products, Milk, Molecular Method

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Introduction

Distribution of *E. coli* and its pathogenic strains in food is of major concern because of its transmission through contaminated milk and dairy products to human. The low infectious dose and life-threatening complication has made this organism an important pathogen and serious threat to public health (Akkaya *et al*., 2006). Milk and dairy products such as dahi, khoa, butter milk, sweets, kheer etc, have been implicated

in food-borne outbreaks in India (CD Alert, 2017). In India, consumption of value added dairy products is experiencing significant annual growth rate of around 15 to 20 per cent owing to the increased demand for dairy products such as dairy whitener, butter, ghee (clarified butter), paneer (cottage cheese), flavoured milk, ice cream, cheese, yoghurt, butter milk and ethnic sweets (GAIN Report, 2017). Consumers demand for the milk and dairy products is met by increased production of these components by organized as well as unorganized sectors. Needless to say, the quality of raw milk is the basis for preparation of any quality dairy products. Considering the above facts, the present cross sectional study was envisaged to isolate the *E. coli* from milk and milk products sold under market conditions in different zones of Chennai Metropolis to ensure safe food supply to the consumer.

Materials and Methods

Sampling

The study area for conducting this study was purposively selected based on the bifurcations of Chennai into three regions viz., Chennai north, Chennai central and Chennai south and each region constitutes five zones and thus the city is composed of fifteen zones. From each zone, the samples were collected by a simple random sampling procedure yielding a total of 567 samples (75 raw milk, 45 pasteurized milk, 447 dairy products viz., channa based sweets, khoa based sweets, fermented milk products, concentrated or partially desiccated milk products, heat and acid coagulated milk products, frozen milk products and other milk products like butter, cheese and cream). These samples were collected from local milk vendors, cooperative milk dairies, dairy/ confectionery shops, supermarkets and sweet shops in sterilized milk collecting tubes and clean polyethylene bags aseptically at various locations of Chennai city and transported in insulated containers under refrigerated condition to the laboratory and stored at 4ºC and analyzed within 24 hr.

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Sample Collection

Location	Sample collection area	Raw milk from local vendors and bulk milk tanks (n)	Pasteurized milk from retail outlets (n)	Dairy products from retail outlets (n)	Total (N)
Chennai north zone	Manali, Mathur, Mathavaram, Vyasarpadi, Royapuram, Periyamet, Vepery, Purasaiwalkam, Triplicane, Egmore, Pudupet, Perambur, Old Washermanpet	25	15	146	186
Chennai central zone	Puliyanthope, Vadapalani, Kilpauk, Villivakkam, Choolai, Chetpet, TVK Nagar, Mylapore, Saidapet, Santhome, MGR Nagar, Anna Nagar, Ambattur, Royapettah	25	15	152	192
Chennai south zone	Guindy, Adayar, Alanthur, Thiruvanmiyur, Maduravoal, Velachery, Palavakkam, Kotivakkam, Neelankarai, Valasaravakkam, Madipakkam, Ingambakkam, Sholinganallur	25	15	149	189
Total		**75**	**45**	**447**	**567**

Conventional Method

Nutrient broth, Eosin methylene blue agar and MacConkey agar from M/s. Himedia Laboratories, Mumbai, were used for isolation of *E. coli* from milk and dairy products by conventional method. Isolation of *E. coli* was done as per the standard procedure mentioned in FDA- BAM described by Feng *et al* (2002). KB010 Hi *E. coli*™ identification kit procured from M/s. Himedia Laboratories, Mumbai, was used for biochemical characterization. Further confirmation of *E coli* O157:H7 was done by selective plating using CT- SMAC agar as per OIE Terrestrial Manual (2008). Identification of isolates obtained from both raw milk and dairy products was based on the growth on selective agar, colony morphology, gram's staining and biochemical characterization. Results were analysed as per FDA- BAM described by Feng *et al.* (2002).

Molecular Method

Polymerase Chain Reaction analysis was carried out to detect the food-borne pathogen of our interest targeting *usp* A gene, which is specific to *E. coli* as described by Chen and Griffiths (1999).

Result and Discussion

In the present study, out of 567 samples analysed by the cultural, biochemical and molecular methods for the presence of *E. coli*, 34 (5.99%) samples were found to be positive for *E. coli* which comprises of 9

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(12%) raw milk and 25 (5.59%) dairy products. The zone wise distribution of *E. coli* in raw milk and dairy products was shown in Table 1 and Fig. 1.

Table 1: Zone wise prevalence of *E. coli* in milk and dairy products by conventional and molecular methods

Samples	Chennai North	Chennai Central	Chennai South	Chi-square Test
Raw Milk (n=75)	12.00 (3/25)	24.00 (6/25)	Nil	NS
Dairy products (n=447)	7.53 (11/146)	3.94 (6/152)	5.36 (8/149)	

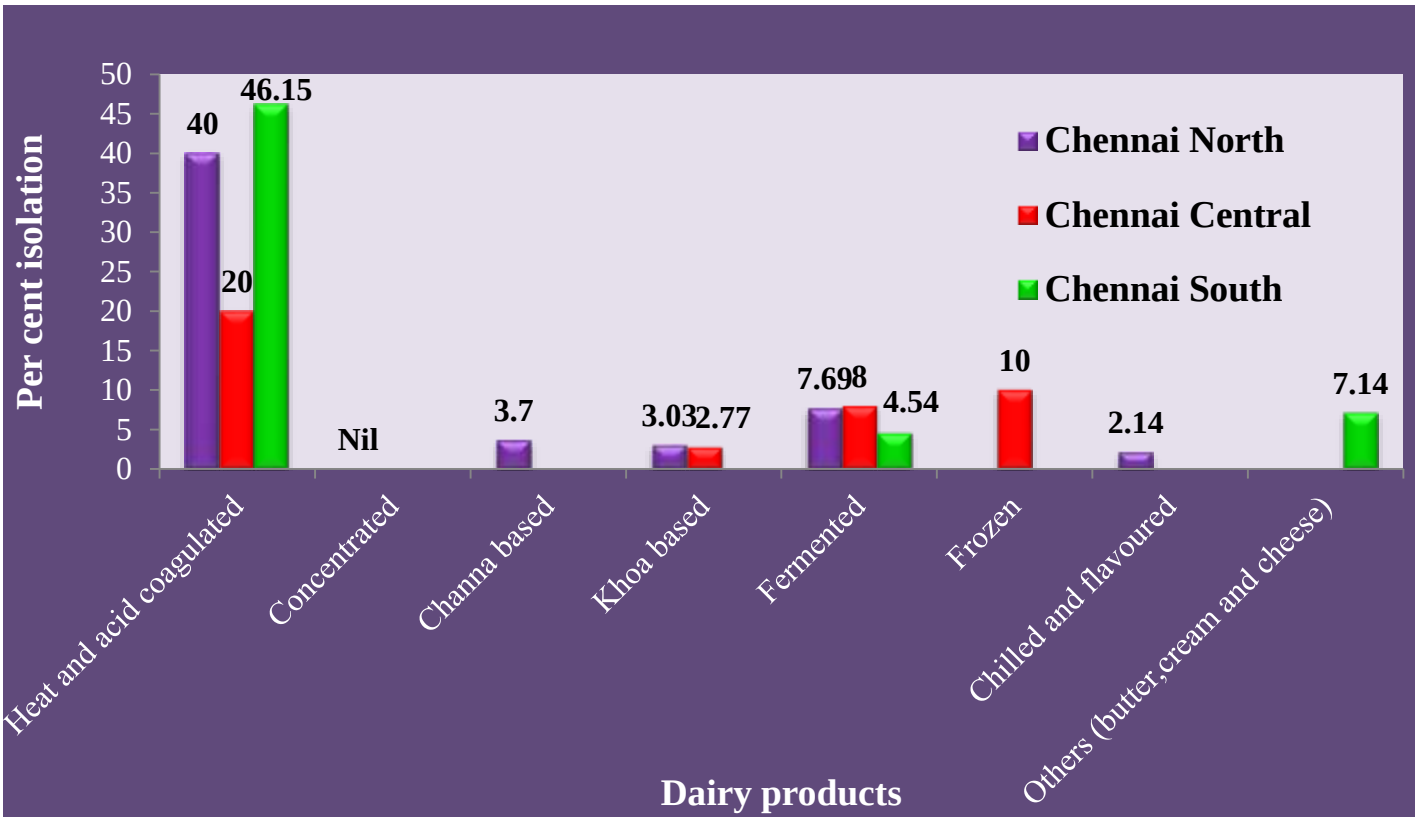

Fig 1: Zone wise distribution of *E. coli* in dairy products (n=447)

Kaur *et al.* (2015) reported that 3.79 per cent of the dairy products sold in Chandigarh were contaminated by *E. coli,* which is slightly lesser than our results. In another study, Kumar *et al.* (2011) reported a prevalence of *E. coli* in 29.09 per cent dairy products sold at Jalander city, which is higher when compared with the present study. These variations might be due to different geographical location, hygienic practices adopted for production and processing of milk and dairy products. The possibilities of *E. coli* contaminating dairy products may be attributed to the poor hygienic practices adopted and hence constitute a health risk if pathogenic species are present.

High incidence of *E.coli* in raw milk samples from Chennai north and Chennai central zones may be due to various reasons like unhygienic or neglected sanitary practices during milking. Elnahas *et al* (2015) also

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stated that detection of *E.coli* in milk reflects faecal or environment contamination. Therefore, awareness should be created among public regarding clean milk production. Virpari *et al.* (2013) reported the overall prevalence of *E. coli* in Anand city as 32 per cent in the samples comprising of milk (52%), cheese (28%), ice cream (20%), mawa (44%) and dahi (16%) which varies with the results of our study. In another study, Soomro *et al* (2002) found that 57 and 51.66 per cent samples of milk and milk products from different localities of Tandojam were positive for *E. coli* respectively. The prevalence recorded in the present study is less when compared to other studies.

In the present study, all the three zones of Chennai city showed highest contamination in indigenous heat and acid coagulated products that comprises of paneer, channa etc., which indirectly indicates that the microbiological quality of the dairy products highly depends upon the manufacture, handling, storage condition and sale of products. It may also depend on the extent of exposure of product to the atmosphere and the storage temperature. Though the contamination of *E. coli* in milk and dairy products was not high in the present study, it may pose severe food-borne illness if enteropathogenic and enterotoxigenic strains are present.

Conclusion

In this context, it is mandate to adapt, Hazard Analysis Critical Control Points (HACCP) for all the dairy products produced and processed in India in view of complying the Codex Alimentarius Commission guidelines to ensure food safety. The research findings revealed that milk and dairy products act as potential vehicles for transmitting food-borne illnesses. Hence, practical strategies and a strict pathogen testing regimen has to be enforced along with the good hygienic practices for avoiding recontamination during production, distribution and retail sale with an ultimate aim of providing safe and wholesome food to the public. Furthermore, routine total quality assessment and management of milk and dairy products in retail shops, inspection at production sites and periodic medical check-up of the persons involved in food handling should be instituted.

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