Microbiological Analysis of Commercial Milk Samples in Ernakulam District, Kerala, with Special Reference to *Escherichia coli*

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Abstract*: Milk is a staple component of the human diet worldwide due to its high nutritional value. However, due to its composition and water activity, it is also highly susceptible to microbial contamination, which poses public health risks. This study investigates the microbiological quality of commercially available milk samples in Ernakulam, Kerala, with a focus on detecting the presence of Escherichia coli, an indicator of fecal contamination. The Most Probable Number (MPN) method was employed to assess coliform presence across various brands. The findings underscore the critical need for improved hygiene during milk handling and distribution.*

Keywords: contamination

I. INTRODUCTION

Milk serves as an essential nutritional component for millions of people globally (Yangilar, 2013). Its high water content and nutrient-rich composition make it an excellent medium for microbial growth (Martin et al., 2004). Contamination often occurs through unhygienic handling, delayed processing, and exposure to contaminated equipment. Microbial contaminants, particularly *Escherichia coli* (E. coli), pose serious health risks, including foodborne illnesses and hemolytic uremic syndrome (Tamime, 2009; Diliello, 1982).

Given its vulnerability to contamination, monitoring milk quality is essential. The detection of *E. coli* is particularly important as it serves as an indicator of fecal pollution. This study is designed to assess the quality of milk available in Ernakulam district using microbiological analysis methods to determine the presence of *E. coli*.

Objectives:
- To identify the microbiological quality of various commercial milk brands in Ernakulam.
- To perform the Most Probable Number (MPN) test for detection of coliform bacteria, particularly *E. coli*.

II. REVIEW OF LITERATURE

Milk has been consumed by humans for over 6000 years and has evolved as a key dietary element across many cultures (Harding, 1995). While milk from a healthy udder is sterile, contamination is nearly inevitable during milking, processing, or storage. Bacterial counts exceeding 10,000/ml are considered undesirable and potentially hazardous (Turchi et al., 2016).

Intentional and accidental adulteration, including the addition of water, detergents, neutralizers, and preservatives, can affect milk quality (Harding, 1995). Raw milk, while consumed in some regions, poses risks for spreading pathogens like *E. coli*, *Listeria monocytogenes*, and *Salmonella* (Amagliani et al., 2016; Öksüz et al., 2004).

Numerous studies have documented outbreaks linked to *E. coli* O157:H7 in milk and dairy products. Öksüz et al. (2004) detected *E. coli* O157 in 1% of raw milk samples and 4% of unpasteurized cheese samples. In another study in Italy, *E. coli* O157 was detected on multiple sheep farms, reinforcing the public health implications of consuming unpasteurized milk products.

III. METHODOLOGY

Study Area:

Milk samples were collected from various local stores in Ernakulam, Kerala.

Sample Collection:

Multiple brands of milk were identified, and samples were collected aseptically in sterile containers and transported under refrigeration for analysis.

Microbiological Analysis:

The Most Probable Number (MPN) test was used to determine the presence of coliform bacteria. The test relies on statistical estimation of bacterial population based on lactose fermentation with gas production in selective media across serial dilutions.

Target Organism:

Escherichia coli was the primary organism of interest due to its role as a fecal contamination indicator and its potential to cause severe gastrointestinal diseases.

IV. RESULTS

Ten raw milk samples collected from different locations in Ernakulam were tested for coliform bacteria using the Most Probable Number (MPN) method. The results are summarized in the table below.

Sample Source	MPN (Coliforms/100 ml)
Kinfra	8
Kochi Market	27
Vyttila	9
Vennala	23
Edappally	26
Kakkanad	16
Kaloor	9
Palarivattom	8
Aluva	43
Thykoodam	7

Statistical Summary

Mean MPN: 17.6

Minimum: 7 (Thykoodam)

Maximum: 43 (Aluva)

Standard Deviation: 11.93

These values indicate a significant variation in coliform counts across different locations. The coliform count in all samples exceeded the Bureau of Indian Standards (BIS) limit for raw milk, which is 0 coliforms per 100 ml, pointing to potential lapses in hygienic handling, storage, and transport.

V. DISCUSSION

The presence of *E. coli* in commercial milk samples raises significant public health concerns. Despite pasteurization practices, contamination may still occur during post-processing handling, packaging, or transport. The findings align with previous studies (Martin et al., 1986; Öksüz et al., 2004) that highlight the vulnerability of milk to bacterial contamination.

The coliform count results obtained from ten raw milk samples collected across Ernakulam district reveal considerable microbial contamination. All samples showed the presence of coliforms, with MPN values ranging from 7 to 43 per 100 ml, far exceeding the acceptable limit of 0 coliforms/100 ml as recommended by the Bureau of Indian Standards (BIS) for raw milk.

The highest coliform count was observed in the sample from Aluva (43 MPN/100 ml), suggesting either poor hygienic conditions during milking or significant post-milking contamination during transport or storage. Similarly, elevated values were recorded in samples from Kochi Market (27), Edappally (26), and Vennala (23). These areas may be hubs of high milk demand and distribution, indicating possible stress on cold chain maintenance or increased handling frequency.

On the other end of the spectrum, Thykoodam (7), Kinfra (8), and Palarivattom (8) displayed relatively lower coliform counts, although still above permissible limits. These results imply a marginally better, yet still inadequate, level of hygiene.

The mean coliform count across all samples was 17.6 MPN/100 ml, with a standard deviation of 11.93, reflecting a wide variation in sample quality. This variation could be attributed to differences in source conditions such as farm practices, equipment cleanliness, personnel hygiene, or storage temperatures.

The persistent presence of coliforms is a strong indicator of fecal contamination and signals the potential presence of other pathogenic microorganisms. Consumption of such contaminated milk can pose serious health risks, particularly to children, the elderly, and immunocompromised individuals.

These findings underscore the urgent need for improved sanitation practices, strict monitoring of milk quality, and awareness programs among dairy handlers and vendors. Measures such as pasteurization, clean milking environments, proper cold storage, and routine microbial testing must be made mandatory at all levels of the dairy supply chain.

The use of MPN testing offers a reliable estimate of microbial load, and its results can guide quality control procedures for dairy suppliers and health regulators. Moreover, educating handlers and enforcing hygiene protocols throughout the milk supply chain is imperative.

VI. CONCLUSION

This study confirms the presence of coliform bacteria, including *Escherichia coli*, in commercially available milk in Ernakulam district. The results underscore the need for stringent quality control measures, improved hygiene during milk handling, and public awareness regarding the risks of consuming improperly handled dairy products.

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