INTRODUCTION
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"Swadu, shitam, mridu, snigdham
shalakshanpichhlam; Guru, mand, prasanna
cha gavyam dashaguna paya"

- Charak Sutradhan 27-214.

'Charak Shastra' is one of the most ancient books in the history of medical science. Rishi Charak, an eminent Indian physician wrote the above lines in his book Charak Shastra. This means cow's milk is tasty, sweet and dense has a fine flavour, contains fat, but light, easily digestible and not easily spoiled. It gives us tranquility and cheerfulness.

Man has been in search of an Elixir or Nectar or 'Amrita', a sip or two of which could make him free from all sufferings and make him immortal. It is not known yet, whether such an elixir ever existed but India's ancient scriptures have described cow 'Milk' as 'Amrita'. There are a number of mantras in all the four Vedas, which describe the importance of cow and cow milk not only as a complete food but also as a curative drink. Of course, the feed and fodder given to cows was also required to be of a very high quality and having various herbs as its essential ingredients.

The Aryans were the first people to domesticate cattle as long ago as 1500 to 2000 B.C. not only for agricultural purposes but also utilizing their milk and milk products. Milk has been a part of diet of Indian Society since times immemorial. Apart from mother's milk, only cow milk has been equated with Amrita (Narang, 2002). Milk has long been recognized as the most wholesome and complete single food available in nature for health and as a medicine, preventive as well as curative.
Milk is one of the few food-stuffs consumed in its natural state. It is the only article in the diet, with the exception of honey, whose sole function in nature is to serve as a food. It is the one food-stuff upon which all nutritionists agree concerning its value for the growth and development of children and young animals. No other single substance can serve as a complete substitute for milk in the diet. Its value was established when the first mammal nursed its young, but only in recent years have the reasons for this superiority been recognized.

India represents one of the world's largest or fastest growing markets for milk and milk products. Indian dairying is emerging as a sunrise industry surpassing 85 million tons per year. The future of Indian dairying will no doubt be a hi-tech one, although its base will continue to be in the hands of millions of small and marginal farmers as well as landless labourers. India has attained the top position in the world in milk production surpassing the USA in 1998-99 to become the world leader in milk production with 740 lakh tonnes (Gandhi and Sharma 2001). The milk production in India is likely to continue to increase as a result of the massive, effective integrated system created for dairy development through the operation flood projects (OFP).

Dairy products constitute a very important and vital dietary component of majority of Indian population in view of their high nutritive value and health attributes. However, these products are extremely vulnerable to contamination with spoilage and pathogenic microorganisms as well as a variety of toxic metabolites of microbial or non-microbial origin if subjected to advertent and inadvertent abuse during their production and processing. Dairy products are frequently involved in a number of food-borne illnesses all over the world including India and the causative agents could be both chemical and biological (Prasad, 1998).
A variety of highly undesirable microorganisms can gain access into dairy products from various sources primarily as a result of unhygienic practices, unclean environment, lack of adequate infrastructure along with lack of proper education and faulty management (Marth, 1969). The prevalence of tropical humid conditions makes the situation worse because the growth of undesirable microorganisms in these products after their contamination makes them highly unsafe for human consumption. The shelf-life of such products is expected to be limited due to the growth and activity of spoilage organisms. Their safety for human consumption could always be at risk as a result of contamination with potential traditional pathogens and their toxins.

As far as food-borne illnesses through milk and milk products are concerned the situation is quite serious in countries like India where incidence of these pathogens in dairy products is alarmingly high. The incidence of such pathogens could be the possible cause for frequent food poisoning outbreaks occurring in our country. It is mainly due to consumption of dairy products of inferior microbiological quality. Moreover, the gravity of the situation remains unintimated in the country due to lack of proper presentation and reporting.

Grossly abused dairy products may also produce highly undesirable toxic metabolites, which could cause serious health concerns. Hence, production of high quality dairy products is extremely important to safeguard the health of the consumers who are becoming more and more quality-conscious day to day. Nevertheless, food-borne illnesses associated with dairy products do occur invariably in countries like India largely due to mishandling of these products during their production and processing. In order to curtail the incidence of outbreaks, it is extremely important that the microbiological quality of these foods must be proved to conform to
high standards by adopting meticulous hygienic practices, effective foolproof management and imparting proper education to the personnel involved in different aspects of handling of dairy products. Now-a-days in many parts of the world, the food scientist is challenged by the advent of the new generation of consumers who demand choice products with fresh characteristics. In general these products are minimally processed, contain little or no preservative and may be packaged under modified atmosphere to extend their shelf-life, thereby making these products extremely vulnerable to microbial contamination from different sources if not handled properly. The factors responsible for the contamination of milk at the farm level include the cows, the fecal, bedding materials, moisture, air and personnel handling the cows. Microbial contamination can find their way in the processing unit from the raw milk itself. Other potential source of microbial contamination at the level of processing include dairy premises, dairy environment, dairy equipment, water and handlers which require special sanitation and hygienic treatments to counter their ill-effects.

In recent years, the consumer awareness has played a predominant role in emphasizing the need for microbiologically safe foods for human consumption. Serious health hazards due to the presence of pathogenic microbes in foods can lead to food poisoning outbreaks (Varadaraj, 1993).

Outbreaks of food-borne illness associated with milk and milk products have been reported from both developed and developing countries. Hence, it becomes imperative to carry out the microbiological quality of milk and milk products. More than 200 food-borne illnesses are now recognized and most of them require specific laboratory diagnosis (Prasad, 1998).

Attention has been focussed in the last two decades on the contamination of food with those fungi causing considerable
hazards to health, associated with liver damage and carcinogenicity and also considerable economic losses through spoilage and discoloration (Mossel and Zwart, 1960).

In recent years, food poisoning has become a major topic of both public and scientific debate. Public, these days, has become increasingly concerned about "Green" issues and safety and quality of food. On the other hand, professionals, concerned with public health are facing the reality of an increasing incidence of food transmitted diseases. Some long recognized pathogens have appeared in foods once believed to be incapable of supporting their growth. Recent findings that some of these pathogens are far more resistant to long standing food processing and storage techniques than expected have caused alarm within the food and Dairy industry.

HISTORY OF COURTALLAM

Courtallam, the spa of South India is situated in Tirunelveli district, Tamil Nadu state at an elevation of about 167 meters. It lies within 8° 50' and 9° 0' North latitude and 77° 20' East longitude. It is about 56 kilometers west of Tirunelveli town and about 7 kilometers from Tenkasi town and Railway Station. The temple of Kurtallanathar at Courtallarn is one of the oldest temples of the district and in legends it is connected with the rishi 'Agastya'. This temple is believed to have been constructed in the 7th century A.D. It contains inscriptions of Chola and Pandya Dynasties. Another small temple called Chitra Sabha (hall of pictures) is dedicated to Lord Nataraja, being one of the Sabhas where Lord Nataraja performed the cosmic dance. The temple contains paintings of rural deities, puranic stories of religious events. The falls branches into several streams that are tributaries of Chittar. The river Chittar is considered as the Ganges by Hindus and Tenkasi as the Kasi (Banaras) of the South as the name indicates. Millions of
Hindus accept its water as sacred. People carry treasured Courtallam water all over India because it is ‘holy’ and known for its curative properties.

**COURTALLAM IS AN IMPORTANT TOURIST CENTER**

In recent times, Courtallam has acquired the status of an important tourist center and health resort in the whole of South India. This is mainly due to the presence of a number of panoramic water falls, cascades and bathing sports in a sylvan environment coupled with religious sanctity. The picturesque beauty of the place and the refreshing climate attract tourists. The region also attracts large number of people interested in nature study and plant collections.

The influx of tourists to Courtallam to enjoy the bracing climate particularly during the season (June to September) is heavy (30,000 to 40,000 per day). Similarly a large number of Iyyappa devotees (nearly 2 lakhs) also visits this place during the months of December and January to have holy bath after their ‘Dharshan’ at Sabarimala. Considering the above points one can easily imagine the huge number of tourists and pilgrims pouring into Courtallam every day. There are no adequate facilities available to receive large number of people visiting Courtallam. Indiscriminate urination, defecation and waste disposal by the tourists can cause deterioration of the environment, consequently contamination of most food items sold in this area. In addition, unscrupulous vendors adulterate the milk and milk products whenever there is a high demand due to heavy tourist influx to Courtallam. Since the milk is a good medium for the growth of microorganisms, it is easily contaminated with food-borne disease producing microorganisms. Hence, the transmission of food-borne disease is possible in a very rapid manner.
Considering the above points, the present work has been designed to study the microbial pathogens in milk and commonly available milk products in and around Courtallam namely Tenkasi, Shencottah, Melagaram, Courtallam and Viswanathapuram. The samples collected were milk, butter, dahi, khoa and ice cream. They were subjected to various biochemical and microbiological analysis to evaluate the quality.
**PLAN OF STUDY**

**Sites:**
Tenkasi, Melagaram, Courtallam, Shencottah and Viswanathapuram

**Sources of Milk and Milk Products and Sample Size**

**Milk:**
- Home, Vender, Local dairy farm of five villages.
- Co-operative milk producer's society,
  *(Tenkasi and Shencottah alone)*
- Seven commercial brands of pocketed milk
  *(Total samples: 144)*

**Butter:**
- Home, vendor and Retail shop for dairy products,
  *(Total samples: 90)*

**Dahi:**
- Home, vendor, Retail shop for dairy products and
  Restaurant *(Total samples: 120)*

**Khoa:**
- Vendor, Retail shop for dairy products
  *(Total samples: 60)*

**Ice cream:**
- Seven brands of ice cream commonly available in local stores
  *(Total samples: 42)*

**BIOCHEMICAL AND MICROBIOLOGICAL EVALUATION OF MILK AND MILK PRODUCTS**

<table>
<thead>
<tr>
<th>Milk</th>
<th>Butter*</th>
<th>Dahi</th>
<th>Khoa</th>
<th>Ice cream</th>
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<td>Specific gravity</td>
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<td>Moisture</td>
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<td>Acidity</td>
<td>Protein</td>
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<td>S. aureus</td>
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<td>Yeast and mold</td>
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</tbody>
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* Analysis of samples were carried out on initial and 30 days after storage at 4 ± 1°C.