Technical bulletin No.11

HYGIENIC PRODUCTION OF MILK

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INTRODUCTION

Milk from an apparently healthy animal is pure, clean, safe, sound and wholesome. These properties define almost all desired characteristics of milk. Pure means unadulterated, clean, safe, sound and wholesome are the characteristics which are ensured by a Public Health Veterinarian who practices food, sanitation, safety, protection and preservation. Milk is nature's ideal and perfect single food both for new born and mature human beings. But because of its high nutritive value and high moisture content, it also serves as a good medium for the growth of microorganisms. Good quality milk is essential for production of good quality dairy products, taste and flavour, free from pathogens and long keeping quality. Good quality dairy products cannot and can never be made from poor quality raw milk. As such, it is essential that the milch animals should adequately be protected from diseases because the causative agents of these diseases may be either excreted into milk or they may contaminate milk through environmental contamination.

An efficient hygiene program should begin at the farm. Essentially milk hygiene practice has interests in preventing the transmission of disease from animals to man, preventing the transmission of communicable diseases of man through milk, preventing diseases or physical defects that may arise from malnutrition and improving the nutritional status of man in general and of infants, children, and mother in particular.

Good quality raw milk must be:

a. Free from debris and sediment.
b. Free from off-flavours.
c. Low in bacterial counts.
d. Normal composition and acidity.
e. Free of antibiotics and chemical residues.

In order for milk to reach the processor and ultimately the consumer still in good condition, a number of points must be observed right from the farm level to the processing factory, and thereafter to the retailers and consumer.

Apart from taking hygienic precautions, the growth of microbes can be restricted by cooling or other methods such as activation of natural inhibitory systems like lactoperoxidase - thiocyanate - hydrogen peroxidase system and other food grade bio-preservatives, which can temporarily restrict the multiplication of microorganisms in milk. However, pasteurization is the universally adopted method to enhance the shelf life of milk and make it safe for human consumption.

Milk hygiene practices in India and other countries.

Generally, animals are milked at least twice a day worldwide including India, which can influence hygienic quality of milk considerably. Tropical climate,

inadequate cooling facilities, widespread adulteration, lack of quality consciousness and small-scale scattered production are the prevailing conditions in India. In India, milk production and distribution are currently being followed in unorganized way. However, in a modular system, which is carried out in highly organized way like ANAND pattern co-operative system operating in Gujarat, the individual milk producer supplies the milk within 1-3 hr. of production to a village level society. This is transported twice a day in cans within 3-5 hrs to the district level dairy plant under ambient conditions. In Indian situation where dairy plant is far off, the milk from village society goes to a chilling centre, cooled below 5°C and then transported to the district level dairy plant. Here, it is pasteurized and supplied to the consumer.

In developed countries, it is a common practice to cool the milk immediately at the farm, and the same is collected by the dairy plants every day or alternate day or twice a week. This practice requires cold storage of milk at collection centres for 2-3 days before it is processed. In western countries, the problems of milk borne disease have been solved completely by enforcing strict laws. Animals are periodically tested for contagious diseases and all measures are taken to produce milk free from pathogens. Even though, these conditions are not strictly followed in our country, the habit of boiling the milk invariably before consumption by the consumer has probably saved them from serious milk-borne infections.

Quality assurance of milk and milk products.

Quality refers to a combination of characteristics that enhance the acceptability of a product. Quality is a broad term, which relates to the chemical, physical, technological, bacteriological and aesthetic characteristics of milk and milk products. `Quality Control' or `Quality Assurance' concerns the activity or procedure (method or programme) that ensures the maintenance and continuity of the specifications and standards of the products within the prescribed tolerance limits during all stages of handling, processing, preparation, packaging, presentation, storage and distribution. It also further ensures that all the original and desirable characteristics are retained during these operations and remain unaltered until the product reaches the consumer.

Protection against pathogens can be achieved by pasteurization of milk. However, besides good quality of raw milk, the usefulness of these processes is dependent on the efficient prevention of post-pasteurization contamination of milk.

Quality control of milk and milk products is classified as (1) compositional quality and (2) bacteriological quality.

Compositional quality.

The composition of milk varies with breed of the milch animal, species, stage

of lactation, feed, season, disease conditions of udder and variation in milking. The average composition of milk is presented in Table 1.

Table 1 : Chemical composition of milk of different species of animals (%)

Species	Water	Fat	Protein	Lactose	Ash
Cow	86.6	4.6	3.4	4.9	0.7
Buffalo	84.2	6.6	3.9	5.2	0.8
Goat	86.5	4.5	3.5	4.7	0.8

Bacteriological quality.

Milk is a nutritious food for human beings. It also serves as an ideal medium for the growth of microorganisms particularly bacteria. The growth of the microbes in milk is dependent upon both intrinsic as well as extrinsic factors. Besides the prevalence of unfavourable conditions ascribed to changes in pH, redox potential and oxygen pressure may not be congenial for the growth and proliferation of some bacteria.

The basic object of microbiological quality control is to provide fluid milk from disease-free udders (physiologically healthy animals) to milk processing plants to manufacture wholesome milk and milk products. Microbiological quality assumes significance because the method of mass collection and distribution of milk provides ample opportunities for the contamination and transmission of pathogens over a wide area even if there is a single act of carelessness at any stage.

Quality control standards of fluid milk and milk products can be maintained by examination of samples at frequent intervals. Corrective measures should be taken as and when necessary. In order to achieve these objectives, a systematic programme of microbiological quality control is required to be implemented both at farm level as well as in the dairy plants.

Food borne illnesses continue to pose a threat to human health. Foods of animal origin are usually implicated as a vehicle for such illnesses. Production of milk and its products involves a long sequence of operations from harvesting to final consumption during which it is exposed to various microorganisms. Contamination occurs at different levels: at farm level, during collection and storage, and at processing centres. The employment of hygienic practices at the time of milking is therefore one of the first and most important steps in clean milk production. The assessment of microbial load at various stages of manufacture or processing may serve as a useful tool for quality assessment and improvement which will result in longer shelf life which is a desirable market requirement. In a study conducted at ICAR Research Complex for Goa milk samples were collected at different levels of milk collection and

processing, namely farmers' field, dairy co-operative collection centre, receiving dock and market. The milk samples were analysed for physico-chemical parameters like MBRT. The samples were tested for microbiological parameters like Standard plate count (SPC), coliforms, *Escherichia coli*, *Listeria monocytogenes*. The MBRT time decreased as the time elapsed from milking to processing. The SPC varied from $<10^3$ to $5.94x10^6$ at farmers' field, $<10^3$ to $5.94x10^6$ at milking utensils, $34.0x10^3$ to $5.00x10^7$ at collection centre and 5.89×10^5 to $40.0x10^7$ at receiving dock. The highest counts were recorded during March to May. The cleaning of udder before milking, milking utensils, milk cans and time taken for transportation of milk from DCS to dairy have been identified as the critical control points in hygienic production of milk.

HYGIENIC MILK PRODUCTION AT THE FARM

Good hygiene is essential whether the animals are milked by hand or machine. This requires that:

a. The milkers' hands and clothes are clean and he or she is in good health.

b. The milking machine and milk storage equipment such as milk churns are kept clean and are in good condition.

c. Immediately after milking, the milk must be cooled preferably to 4°C. This requires mechanical refrigeration or milk cooling tanks.

The following predisposing factors can influence the microbiological quality of milk at different stages of production and handling.

Milch animals.

a. Health of animal. The animals should necessarily be free from systemic diseases whose causative agents such as *Mycobacterium tuberculosis, Coxiella burnetti, Brucella abortus*, which can be transmitted to man through milk. The animals should also be free from bacterial diseases such as salmonellosis, anthrax, shigellosis, enteropathogenic *Escherichia coli, Streptococcus*, and other bacterial infections and viral infections such as vaccinia, pseudo cowpox, louping ill (Tick borne encephalitis), foot and mouth disease, etc.

Mastitis control

World experience indicates that if farmers are to control mastitis successfully they require some technical and laboratory assistance. This can be provided by government agencies, cooperatives or the milk collecting dairies. The support should:

- provide an extension service (veterinary, animal husbandry and milking machine technology) to ensure that farmers receive the correct information on the best routines to follow for their environment
- report regularly to farmers (eg. monthly) giving the results of appropriate tests made on herd bulk milk to indicate the progess made in reducing mastitis
- ensure that good milking equipment, disinfectants and antibiotics are

available

- investigate the causes of failure in herds adopting the recommendations but not making progress

Although laboratory support is essential it is important to recognize that mastitis is widespread and for successful control in a national herd or the herds in a cooperative it is necessary that most, preferably all, the herds carry out the routine. A control that concentrates on improving the worst 10 to 20% of herds will have little effect on the total problem of mastitis. Effective mastitis control depends on farmers regularly following the simple management practices. Tests will not often provide information that leads to special action for farmers to take that is additional to what they should be doing.

The tests for mastitis are either microbiological, to detect the causative pathogen, or tests for the changes in the composition of milk which occurs with the inflammation. Tests for pathogens are not required routinely but are necessary to investigate special herd problems. The tests for changes in milk composition are simpler and some may be carried out on the farm (eg. California Mastitis Test).

b. Contamination at farm level. The contaminating materials are dung, mud, bedding materials, and straws. To prevent the entry of these contaminants into milk, routine grooming, brushing and washing should be carried out and washing of teat with towel soaked in bleaching powder (10mg/litre) or potassium permanganate (1%) should be adopted. The foremilk may contain the microorganisms and it should be collected in a small pail and removed from the cowshed.

Environment.

a. Cow-shed. The stables and barns should be clean, well ventilated and well lighted.

b. Good housing and manure disposal system should be assured.

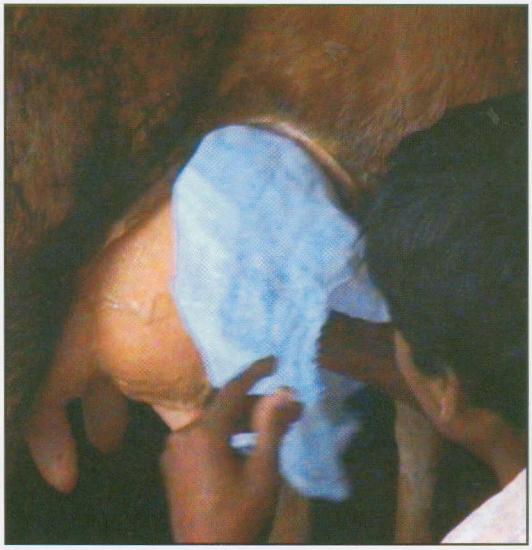
c. Feed and water. Milk is often made unsalable due to feed or weed flavour. So the feeds which are giving off flavour should be avoided.

Water supply is one of the most important sources of microbial contamination; the quality of water used at farm for different purposes should be of satisfactory quality. Hence, clean potable water supply should always be available.

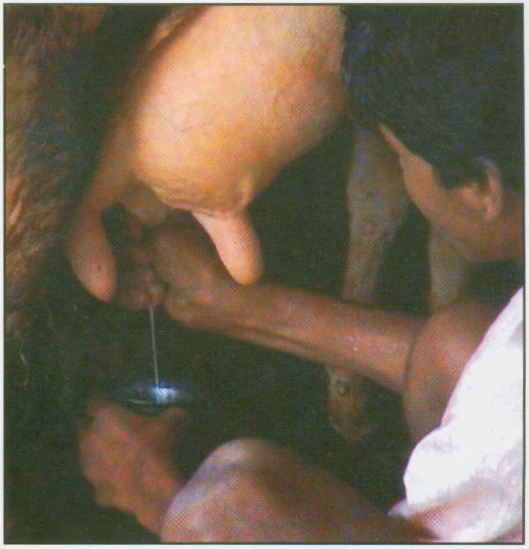
Milker's hygiene.

a. Absolute cleanliness of personnel is required specifically – Milking should be carried out under good personal hygiene of the milker. He should not be suffering from diseases, especially cough and cold, should wear clean clothes, wash hands properly and cut nails periodically before milking. Milker should be free from contagious diseases like cholera, typhoid, diphtheria and tuberculosis and should be monitored for these diseases rigorously on regular basis.

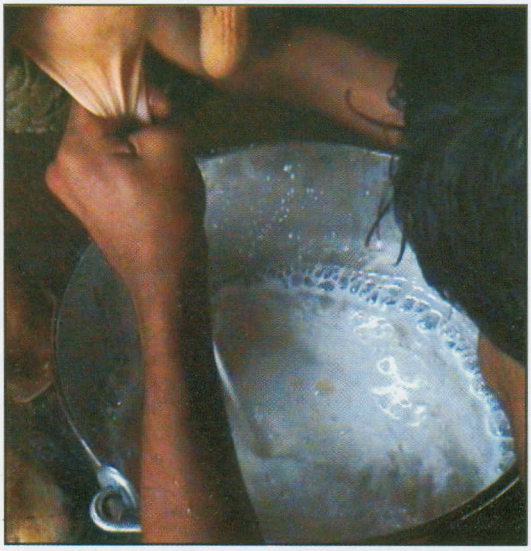
b. Milker should avoid the wrong milking practice like knuckling and incomplete



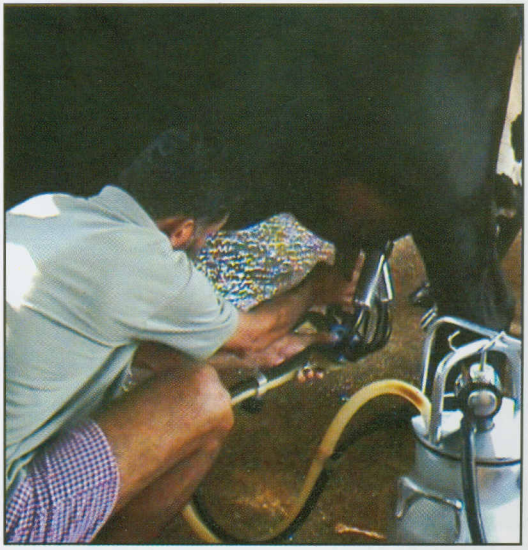
Udder should be cleaned before milking



Initial few strips of milk should be thrown out



Thumb milking should be avoided



Machine milking is better for hygienic milk production

Teat dipping after milking should be practiced

Mastitis detection should be carried out regularly

Stainless steel or aluminium cans should be used for milk transportation. Cans should be cleaned properly and dried.

milking, which leads to multiplication of organisms in the left over milk.

Dairy Sanitation at the Farm

It is in the interest of every farmer and milk processor that the following points are observed at the dairy farm.

Proper sanitation of milk cans.

Immediately after cans are emptied of milk they should be cleaned as follows:

- Cold water rinse.
- Scrubbing with brush and warm detergent (any unperfumed liquid soap will do).
- Cold water rinse.
- Sterilization (sanitisation) with boiling water or steam if available or use dairy sanitising solution such as hypochlorite or commercial brand preparations in accordance with manufacturer's instructions.
- Dry cans on a drying rack. Exposure to sunlight will enhance killing off bacteria during drip drying of cans.

Milking machines

Milking machines should be cleaned according to recommended practice:

- Cold water rinse.
- CIP detergent circulation cleaning with dairy detergent in hot water.
- Hot water rinse.

Timely replacement of worn out rubber parts should be undertaken regularly.

The cows

Follow proper milking hygiene; mastitic cows should be milked last and their milk discarded. Milk from cows treated with antibiotics should not be mixed with milk from healthy cows.

Milk transport vessels (cans and tanks)

All milk transport vessels should be cleaned in the same way as outlined for milk cans above. There should be provision for water at milk cooling centres to enable all milk suppliers' vessels or cans to be rinsed with cold water.

For small-scale dairy farmers, setting up of milk cooling centre centrally may be the ideal solution. Where farmers bring their milk to a cooling centre through a co-operative, they should do so as soon as milking is completed. A milk cooling centre with a capacity of 1000 - 3000 litres will serve up to 300 small holder farmers ensuring that the quality of their milk when produced under hygienic conditions is well preserved and accepted at the processing plant.

It is important to remember that under a hot environment milk will be spoiled within 3-4 hours. So any means of cooling that will lower the temperature of milk to 4°C at milking will help to prevent multiplication of bacteria. There are several options available.

a. Immersing milk cans in a water trough connected to water tap or water spring.

b. Using an in-can rotary cooler.

c. Using a surface milk cooler

Milk Reception at Collection-cum-Chilling Centre Premises

Rooms in the milk collection centre must be clean and risks of contamination may be reduced to the minimum by providing satisfactory safeguards. Adequate provision must be made for cleaning and sterilisation of containers and utensils.

The flours of the rooms of the collection centre may be constructed of concrete or other impervious material so that it should be easily cleaned. It shall be suitably inclined to hasten rapid drainage of wash water. The walls and ceilings of the rooms should have a smooth non-absorbent surface so that they can be efficiently cleaned. The building should be well lighted and adequately ventilated. The surroundings of the collection centre should be maintained clean and free from any water logging. Proper method should be employed for pest control.

Milk Transport to Processing Factory

Bulk milk transport.

Milk cooled on the farm or cooling centre may be transported in milk cans or in bulk tankers. Milking pails and utensils should be cleaned and sterilized regularly to avoid contamination. Bulk tankers are insulated, so the milk will remain cold until it reaches the processing factory. Milk should be cooled to less than 10°C as quickly as possible after milking.

In-can milk transportation.

Alternatively, such milk may be filled in cans and transported in milk cans. This has, the advantage that a farmer's can of poor quality milk will not be mixed with other farmers' good quality milk and spoil the lot!. Since the cans are not insulated, the transport to the factory must be efficient enough to enable milk reach the factory in acceptable condition.

In the case of farmers delivering milk via pick-up (collection) points it is advisable that the milk cans are placed in a shaded area while awaiting pick-up by a milk transport vehicle. Bad milk will be rejected at the dairy plant. Hygienic milk handling is essential at each stage; at the farm, cooling centre and during transport.

Dairy plant hygiene.

The prerequisite for production of a high quality product is the cleaning and sanitization of the milk and milk product contact surfaces, which contributes 60% of total contamination. The following factors influence the dairy plant hygiene:

1. Building. Maintenance of hygiene in the plant depends upon the design of the building. Floor should be impervious and sloped for efficient drainage of water. In walls tiles upto 2 m height help in efficient cleaning. Doors and windows should be of self-closing type. A distance of 3 m between walls and the equipment and a minimum of 42 cm to 52 cm between the bottom of equipment and floor is necessary for proper cleaning. Proper

ventilation is essential to remove odour, heat, moisture and to minimize condensation on cooled surface.

2. Equipment - Materials and Design. Stainless steel and aluminium alloys are widely used for equipment and utensils in dairy industry. The equipment surface should be free from dents, pits, rough spots, crevices and also it should be non-toxic, non-corrosive and non-taintable.

3. Personnel. Persons working in dairy plant should be educated on hygienic handling of milk and milk products. They should wear washable clean white clothes and caps.

4. Water supply. Uninterrupted, uncontaminated, nonchlorinated, potable, soft water with hardness not exceeding 112 mg/litre is essential.

5. Air Quality. Contamination of air in the plant can be controlled by spraying sanitizers at a level of 0.048 mg/litre which inactivates lactic bacteriophage. Irradiations are used to sanitize the air in culture transfer room and packaging materials. Common sanitizers used in dairy industry are hot water, steam, chlorine (200 mg/litre), iodophor (25 mg/litre) and quaternary ammonium compounds (200mg/litre).

Hygienic control of dairy equipments.

Cleaning.

Cleaning of dairy equipment refers to removal of soil which includes milk residues, water deposits, detergent and sanitizer residues, dust, sediments or any other foreign matter. Improper cleaning and sanitization of dairy equipments will lead to food poisoning due to contamination by micro-organisms like coliforms, *Bacillus* etc. Cleaning and sanitization are complementary to each other, which includes the following steps:

1. Pre-draining. Draining should be carried out thoroughly to minimize product loss, reduce the load on the sewage and helps in cleaning.

2. Pre-rinsing with water. Pre-rinsing helps for flushing of milk residues, prevents drying and sticking of milk to the surface. Lukewarm water should be used for pre-rinsing and temperature should not exceed 60°C in order to avoid coagulation of proteins.

3. Cleaning with detergent. Blended detergents at an optimum temperature and mechanical scrubbing helps in removal of soil from the surface. Common alkaline detergents used in dairy are sodium carbonate, caustic soda, sodium sesquicarbonate, sodium bicarbonate, sodium sulphate at a concentration of 0.2 - 2.0% while sodium silicate used as a protective agent for aluminium. Acid detergents widely used include nitric acid at 0.5% and phosphoric acid at 2.0%. Acid detergents helps to remove the milk stones and water scale.

4. Hot water rinsing (post - rinsing). Post - rinsing with lukewarm water removes all traces of detergent, displaced dirt and

prevent deposition of lime scale.

5. Sanitizing. It involves effective bactericidal treatment with chemical /thermal agents to reduce the bacterial count including pathogens to a safe level on the utensils and equipments. Sanitizing solution used are hypochlorites, organic solution of chlorine with 100-200 mg/L of available chlorine, mixed halogens - 25 mg/L of available Iodine.

6. Post - draining and drying. This is to prevent contamination of milk with the residual sanitizer.

Cleaning in Place (CIP).

Manual cleaning is usually practised for easily accessible utensils and equipment. CIP is practised in bigger dairies where it is difficult to dismantle and reassemble. The CIP system is time saving, labour saving, cost effective and minimizes the damage to the equipment. In this method detergent and sanitizers are circulated for specific period of time at a specific speed and in a specific sequence.

The efficiency of cleaning can be evaluated by visual inspection (by light, feel and odour) or staining procedure. Microbiological efficiency of sanitization can be assessed by swab test, rinse method, membrane filter technique and direct epifluorescent filter technique.

Hazard analysis and critical control points (HACCP).

The dairy industry throughout the world has recognized the importance of HACCP system in controlling hazards in dairy products thereby not only increasing the safety of consumers, but also winning their confidence. HACCP system which is scientific and systematic identifies a specific hazard throughout the food chain, i.e. from primary production of milk till it reaches the consumer.

The most important reason for adopting HACCP approach is that no other quality assurance system has gained acceptance at world level, especially in claiming ISO 9000 certification.

ISO has brought out a series of International standards for quality management and quality assurance systems. These standards are not product standards, but are management standards, providing a basic framework on which an organization builds up its quality management system leading towards achievement of total quality. ISO 9000 is gradually becoming a recognised method of quality certification and establishment of HACCP system in an unit is very essential.

Pasteurization and milk preservation.

At room temperature milk can be stored only for 3 hours immediately after milking. The shelf life of milk can be extended to 24 hours by cooling to 5°C. It's shelf life is further extended to 4 to 7 days by pasteurization. By UHT treatments the shelf life is extended to few months. Pasteurization needs equipments and electricity. Whereas by use of lactoperoxidase system milk can be

preserved for 6-12 hours without the need of equipments and electricity.

Pasteurization.

Pasteurization, refers to the process of heating every particle of milk to atleast 63°C (145°F) for 30 min. or 72°C (161°F) for 15 sec. or to any other appropriate time-temperature combination. After pasteurization, the milk is immediately cooled to 5°C (41°F) or below.

The main purpose of pasteurization is to destroy the undesirable and pathogenic microorganisms present in milk and to enhance the keeping quality of milk.

The various types of pasteurization methods used to heat treat the milk are:

1. Batch pasteurization / low temperature long time pasteurization (LTLT)
2. High temperature short time pasteurization (HTST)
3. Ultra high temperature treatment (UHT)

Post pasteurization contamination.

The post pasteurization contamination refers to the re-entry of microorganisms into the pasteurized product as a result of the contact of the finished product with the contaminated equipment or workers. Pathogenic microbes can be introduced in to the dairy environment through raw milk, air and moisture. The presence of any of vegetative pathogens implies post pasteurization contamination but spore formers are likely to enter through raw milk.

Packaging.

i) Packaging materials should be:

- Stored in a dry place away from manufacturing areas;
- Used in a clean and sanitary manner;
- Non-toxic.

ii) Packaging should be carried out in such a way that:

- Avoids contamination of processed products.
- Protects the product against contamination until the product reaches the consumer.

Hygienic Storage of finished products.

Products should be stored in clean conditions at appropriate temperature and humidity to prevent deterioration or permit maturation (e.g. cheese).

Hygienic Transport

Products should be transported in clean vehicles under appropriate condition and be kept away from other goods.

Personnel Hygiene and Health.

- It is recommended that persons engaged in handling foods should be subjected to health checks.
- Factory premises should be provided with clean running water and good washrooms.
- Workers should wear clean protective clothing and working gear (e.g. gum boots, coats, overalls and caps).

Laboratory Quality Control

Milk and other raw materials should be

subjected as required to regular testing in order to ensure wholesomeness and freedom from pathogens.

Residues of drugs, pesticides and other foreign substances in milk.

The economic need for rationalization in the agricultural field has led to the increased use of pesticides and active compounds for plants and animals. Contamination of milk with undesirable residues may occur through the animal itself, the environment and also during further processing. Sources of residues of different types are considered toxicological problem when present in milk. These include antibiotics, pesticides, radionuclides, mycotoxins, plant toxins and other chemical agents.

Antibiotics. Antibiotic residues in milk are of concern because they may curtail proper lactic acid fermentation in cultured products, resulting in spoilage and the ingestion of antibiotic-contaminated milk may cause a reaction in humans already sensitized to the contaminant.

Pesticides. Contamination of milk with pesticides may arise from the practice of dipping cattle in pesticides to prevent tick-borne diseases, insect control in stables, feeding stuffs and contamination from the environment.

Milk and milk products can be contaminated with residues of organophosphates and carbamates from various sources like animal feed treated with insecticides, animal feed manufactured from plant material which has been treated with pesticides during the growing season, use of insecticides in animal dwellings, direct contact of animals with treated areas. These compounds are readily metabolised in the alimentary tract and in the organs associated with digestive processes.

Mycotoxins. Mycotoxins have been isolated from a wide variety of agricultural products, including milk or milk products, and may be responsible for human and animal disease.

Mycotoxins are formed by potentially toxigenic fungi under specific conditions. Aflatoxins (produced by Aspergillus flavus)

Table 2. Sources of residues of different types in milk and milk products.

Source	Residue
1. Farm animal	Veterinary drugs e.g. antibiotics, hormones, antiparaciticides, etc. Feed additives e.g. Trace elements, antioxidants, feed drugs
2. Environment	Agrochemicals e.g. pesticides, growth promoters Emissions e.g aerosols, fumes, dusts Minerals of the soil e.g. lead, cadmium. Environmental organics e.g. mycotoxins Radionuclides
3. Milking and processing	Hygiene formulations e.g. cleaning and disinfecting agents, insecticides Surfaces e.g. metals, plasticisers

are the best known mycotoxins. Aflatoxin B1 is considered the prototype of hepatic poison responsible for tumour growth.

Bacterial enzymes. The enzymes that are secreted by the mammary gland include lipases, proteinases, phosphatases, xanthine oxidase, peroxidase and catalase. Milk may contain varying concentrations of enzymes other than those secreted by the mammary gland, principally the bacterial exoenzymes and endoenzymes.

LEGISLATIONS.

Food legislations are pre-requisite for health protection and fair trade, alongwith other purposes like promotion of sales, guarantee for purity, development of quality assurance system and for the ultimate development of an industry by the management. With the scientific advancements the markets are flooded with a variety of food products and the consumers battle for the product worth they pay and the health safety. Multiple laws/regulations prescribe varied standards regarding food additives, contaminants, food colours, preservatives and labelling. The food laws in India are enforced by the Director General of Health Services, Ministry of Health and Family Welfare, Government of India. The status of food and dairy legislations in India is briefly discussed here.

There are various food laws applicable to food and related products in India :-

- Prevention of Food Adulteration Act (PFA), 1954 and Rules (Ministry of Health & Family Welfare).
- The Standards of Weights and Measures Act, 1976, and Standards of Weights and Measures (Packaged Commodities) Rules, 1977.
- Agriculture Produce (Grading & Marking) Act (Ministry of Rural Development).
- Essential Commodities Act, 1955 (Ministry of Food & Consumer Affairs).
- Milk and Milk Products Order, 1992.
- The Infant Milk Substitutes, Feeding Bottles and Infant Foods (Regulation of Production, Supply and Distribution) Act, 1992 and Rules 1993.
- Export (Quality Control and Inspection) Act, 1963.
- Environment Protection Act, 1986.
- Pollution Control (Ministry of Environment and Forests).
- Industrial Licenses.
- BIS Act, 1986.

Prevention of Food Adulteration (PFA) Act (1954) and Rules (1955).

The Prevention of Food Adulteration Act (PFA), 1954 focuses primarily on the stablishment of regulatory standards for primary food products, which constitute the bulk of the Indian diet. The Central Committee for Food Standards, chaired by the Director General of Health Services, is the decision making entity. The appeals process, however, is cumbersome and time consuming. All imported products must adhere to the rules as specified in the regulation,

including the labeling and marking requirements.

The PFA Rules (1955) are formulated to carry out smooth operation and implementation of the Act. Main provisions of the PFA Act and Rules :-

* It is operative in whole of India.

* PFA, 1945 and Fruit Products Order (FPO), 1955 are supplementary and cumulative. The Essential Commodities Act may supersede the PFA Act.

* Definitions of adulteration in terms of purity, nutrition, wholesomeness, safety against contaminants, toxicants, bacterial toxins, preservatives, colourants, insecticides and pest infection, misbranded or mislabeled and any thing else which may be injurious to health.

* Government of India under this Act has constituted Central Committee for Food Standards (CCFS) to advise the Union Government and the State Governments on matters related to administration of this Act and to perform other functions assigned to it. The members of the committee are Director General (Health), Director (Central Food Lab.) and representatives from Central, State and Union Territories; Agriculture, Commerce and Industry interests, Consumer interests, Indian Council of Medical Research and Bureau of Indian Standards.

* One or more central food laboratories are established to carry out the functions entrusted under this act. Additional functions such as analysis of samples of food, investigation for the purpose of fixation of standard for any food article, collaboration studies with various laboratories for standardizing methods of analysis are also carried out. Four central food laboratories are located at Mysore, Pune, Ghaziabad and Calcutta for the specified areas.

The Standards of Weights and Measures Act, 1976, and Standards of Weights and Measures

The Standards of Weights and Measures Act, 1976 and Standards of Weights and Measures (Packaged Commodities) Rules, 1977 are legislative measures are designed to establish fair trade practices with respect to packaged commodities. The rules prescribe that the basic rights of consumers regarding vital information about the nature of the commodity, the name and address of the manufacturer, the net quantity, date of manufacture, and sale price are provided on the label. There are additional mandatory labeling requirements for food items covered under the PFA. The Department of Consumer Affairs in the Ministry of Consumer Affairs, Food, and Public Distribution is the regulatory authority and enforcement agency.

Milk and Milk Product order (MMPO).

Milk and Milk Products Order, 1992 order regulates the production, distribution, and supply of milk products; establishes sanitary requirements for dairies, machinery, premises; and sets quality control standards for milk and milk products. Standards specified in the order

are also equally applicable to imported milk products.

Various provisions of the order are compulsory registration, definition of milk sheets, restriction on uneven procurement and marketing of milk, strict rates for production, hygienic conditions, packing, labeling and marketing, penalty etc. help in protection and growth of the organized dairy industry.

Pollution Control Boards. Pollution Control Boards are under the purview of Ministry of Environment and Forests, Government of India. It is necessary to obtain no objection certificate from the respective state Pollution Control Board for every dairy plant discharging waste into specified streams.

Consumer Protection Act (1986). It provides protection against unfair trade practices of manufacturers and traders through the rights of consumers. This Act applies to all the goods and services and provides six rights of consumers, viz., right to safety, right to be informed, right to choose, right to be heard, right to seek redressal and right to consumer education.

Bureau of Indian Standards (BIS 1986)

The BIS (formerly known as Indian Standards Institution) was established under provision of Indian Standards Act, 1987 and took over the functions, assets and liabilities erstwhile ISI functioning from 1947. It is the statuary body under ministry of Civil Supplies, Consumers Affairs and Public Distribution.

The BIS has revised and formulated new standards for some dairy-products, viz., code of pasteurization (IS: 6397-1992), Pasteurized milk (IS: 13688-1992), Pasteurized butter (IS: 13690-1992), butter oil/butter fat (IS: 13689-1992), Skimmed milk powder - standard (IS: 134-1992). More emphasis is also laid on microbial requirements in recent revision and formulation. Recently, the bureau has launched a quality management system certification scheme to develop the industry and to protect the environment ECOMARK scheme for environment friendly products.

Agricultural Produce (Grading and Marking) Act (1937). "AGMARK" is an abbreviated form of "Agricultural Marking" which provides quality standards for Grading, Packing and marking of agricultural and animal husbandry products through the Agricultural Produce Act 1937 (as amended in 1986). The Directorate of Marketing and Inspection under the Department of Rural Development in the Ministry of Agriculture is vested with power to enforce and implement the act. At present three dairy products viz. Ghee, butter and fat spread are graded under this scheme.

Educative propaganda and incentive payment plan.

There is a need to train and educate farmer for ensuring the adoption of good animal husbandry practices, which shall result in limiting bacterial contamination. To maintain the highest standards of bacteriological quality of milk, the present system of payment, which is based on fat and SNF needs to be changed to incorporate the payment based on bacteriological quality.

Bacteriological standards as prescribed by Bureau of Indian Standards (BIS)

Bacteriological standards of row milk (IS-1479 PART III-1997)

Grades	Direct Microscopic count per ml. in lakhs	Standard Plate Count per ml. in lakhs	Methylene blue reduction time in hours	One hour resuzurin disc. No.	Presumptive coliform test (in 0.01 ml) i.e. 1 in 100
Very good	NS	< 2	> 5	NS	absent
Good	< 5	2-10	3-4	4 or higher	absent
Fair	5-40	10-50	1-2	3.5 to 1.0	absent
Poor	40-200	> 50	< 1/2	0.5 to 0	present
Very poor	> 200	NS	NS	NS	NS

NS : Not specified

Bacteriological standards of pasteurised milk (IS-6397-1971)

S.No.	Test	Requirement
1.	Standard plate count	Maximum 30000 cfu/ml
2.	Coliform count	absent in 1:10 dilution
3.	MBRT	more than 4 hours
4.	Alkaline phosphatase	test negative

Bacteriological standards of cream (IS-3509-1966)

Type of Cream	Type of Count	Level in Cfu/ml or g	Grade
Raw Cream	Standard Plate count	< 4 lakhs	Very good
		4-20 lakhs	Good
		20-100 lakhs	Fair
	Coliform Count	100 lakhs	Poor
		< 100 lakhs	Satisfactory
Pasteurised	Standard plate count	< 60000	Satisfactory
	Coliform count	< 10	Satisfactory