
UNIT 6 CLEAN MILK PRODUCTION

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6.0 OBJECTIVES

After reading this unit, we shall be able to:

- ^{2/21} state the meaning of the clean milk production
- ^{2/21} describe the importance of clean milk production
- ^{2/21} specify the measures to produce clean milk at farm level
- ^{2/21} enlist the constraints in clean milk production

6.1 INTRODUCTION

The dairy industry is an important segment of food industry in India as it plays a significant role in the national economy and socio-economic development of the country. It is an important source of self-employment and subsidiary occupation to the rural and semi-urban population of India. Milk provides relatively quick returns for small-scale livestock owners. It is a balanced, nutritious food and a key element in household food security. Over 80 per cent of milk consumed in developing countries is handled by informal market traders, with inadequate regulations. Dairy industry is an integral part of livelihood of million of people thriving on scarce resources. Dairying, as a subsidiary source of income, is a real relief to most of the weaker section in the society who depend on agriculture. Undoubtedly, the major challenge of the dairy sector in India is to increase the milk production in order to meet the increasing demands resulting from population explosion. Under such prevailing circumstances, the maintenance of high quality of milk production at farm under most hygienic conditions and bringing it to milk plant is a most challenging job. Ultimately, the quality of milk and milk products have to be evaluated based on the final products that are going to be utilized by the end users. Hence,

the dairy industry is passing through a very critical phase of quality upgradation to place the best quality of milk and milk products in the market.

6.2 CONCEPT OF CLEAN MILK PRODUCTION

Quality initiatives need to be made strong by introducing concept of clean milk production at the village level. “Clean milk” may be defined as “milk drawn from the udder of healthy animals, which is collected in clean, dry milking pail and free from extraneous matter like dirt, dust, flies, hay, manure etc. Clean milk has a normal milk flavour with low bacterial count and is safe for human consumption.”

Milk secreted from the udder under normal conditions is almost sterile. It contains many essential nutrients such as protein, lipid, lactose, minerals and vitamins and therefore, acts as an ideal medium for rapid proliferation of micro-organisms. Milk needs to be protected from all possible sources of microbial contamination and various types of pathogenic organisms. The employment of hygienic practices at the time of milking is therefore one of the first and foremost important step in clean milk production.

Clean milk production is always beneficial/profitable for both the producers and the consumers because of the following reasons:

- ^{2/21} Safe for human consumption
- ^{2/21} Better keeping quality and chances of spoilage minimized
- ^{2/21} High commercial value
- ^{2/21} Renders protection against diseases like typhoid, dysentery, etc. which are transmitted to the milk through human contact
- ^{2/21} Helps to produce good quality dairy products or value added products
- ^{2/21} Transportation over long distance

Quality of product encompasses safety, hygiene, reliability, wholesomeness and acceptance by consumers. Quality conveys different meaning to different people”.

“Milk quality is not an option but it’s an obligation”. Milk quality is the most important factor in dairying today; quality is a result of totally integrated approach, from the dairy farm environment to cooling and storage of bulk milk on the farm.

6.3 SIGNIFICANCE OF CLEAN MILK PRODUCTION

Milk production which was almost stagnant between 1947 and 1970 with an annual growth rate of merely one per cent has registered a significant growth during the last two decades. The annual milk production has increased from 17 million tonnes in 1950-51 to 91.1 million tonnes during 2004-05 in a period of over 50 years which amounts to one and a half million tonnes increase per year. With the present growth rate of 5.5 percent per annum, India is expected to produce 220 to 250 million tonnes of milk by the year 2020 which would be more than one third of the projected global production.

Dairy industry has its own peculiarities unlike other industries. Manufacturing a good dairy product is not enough but it must be free from harmful additives and microbes till it is consumed. The implementation of hazard analysis critical controls points (HACCP) in dairy industry would provide a competition edge to milk and milk products supplies in the international market. The objective of clean milk production can be achieved by judicious application of the principles and practices of HACCP, which is a scientific based system and systemically identifies specific hazards and provides measures for their control to ensure safety of milk and milk products. It is a tool to assess hazards and establish control system that focuses

on prevention rather than relying mainly on end product listing. Therefore, successful and effective implementation of HACCP system requires the use of risk-based decision-making in identifying significant hazards at different points in the food chain from producer to dairy docks and to ultimate end users as well as establishing critical limit at specify critical points.

The dairy sector is poised to play a significant role in the process of diversification and commercialization of agricultural production in our country. In spite of enormous breakthrough in milk production, India's global participation in milk trade is negligible. Milk and milk products produced in our country reaches domestic consumers to fulfill an enormous need of people. Export of milk and milk products is very low which possesses large potential for export especially to third world countries, if we are able to achieve and sustain the quality of milk and milk products.

6.4 FACTORS AFFECTING CLEAN MILK PRODUCTION

Milk is one of the main sources of proteins and calcium for a largely vegetarian population. Around 63 per cent of the available animal protein comes from milk. Milk is the most easily contaminated and perishable commodity as it is an ideal medium for bacterial growth. Hence, the employment of hygienic practices right from milking at the farm level to the factory is essential. The causes of high bacterial load in milk and the factors affecting the clean milk production are presented in Figure.6.1 and 6.2, respectively.

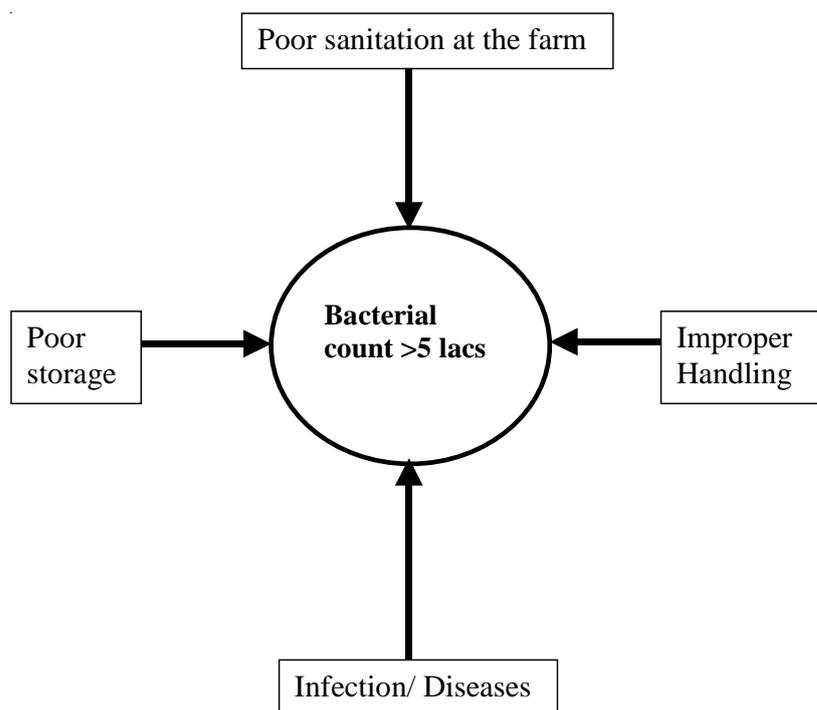


Figure 1: Causes of high bacterial load in milk

The factors affecting the production of clean and safe milk can be classified into two categories: internal and external factors.

i) Internal factors includes:

^{2/21} Udder infection – Mastitis

^{2/21} Foremilk – First few streams of milk contains a large number of bacteria

ii) External factors includes:

^{2/21} Cow/animal's body – especially dirt and dung from hind quarters and tail

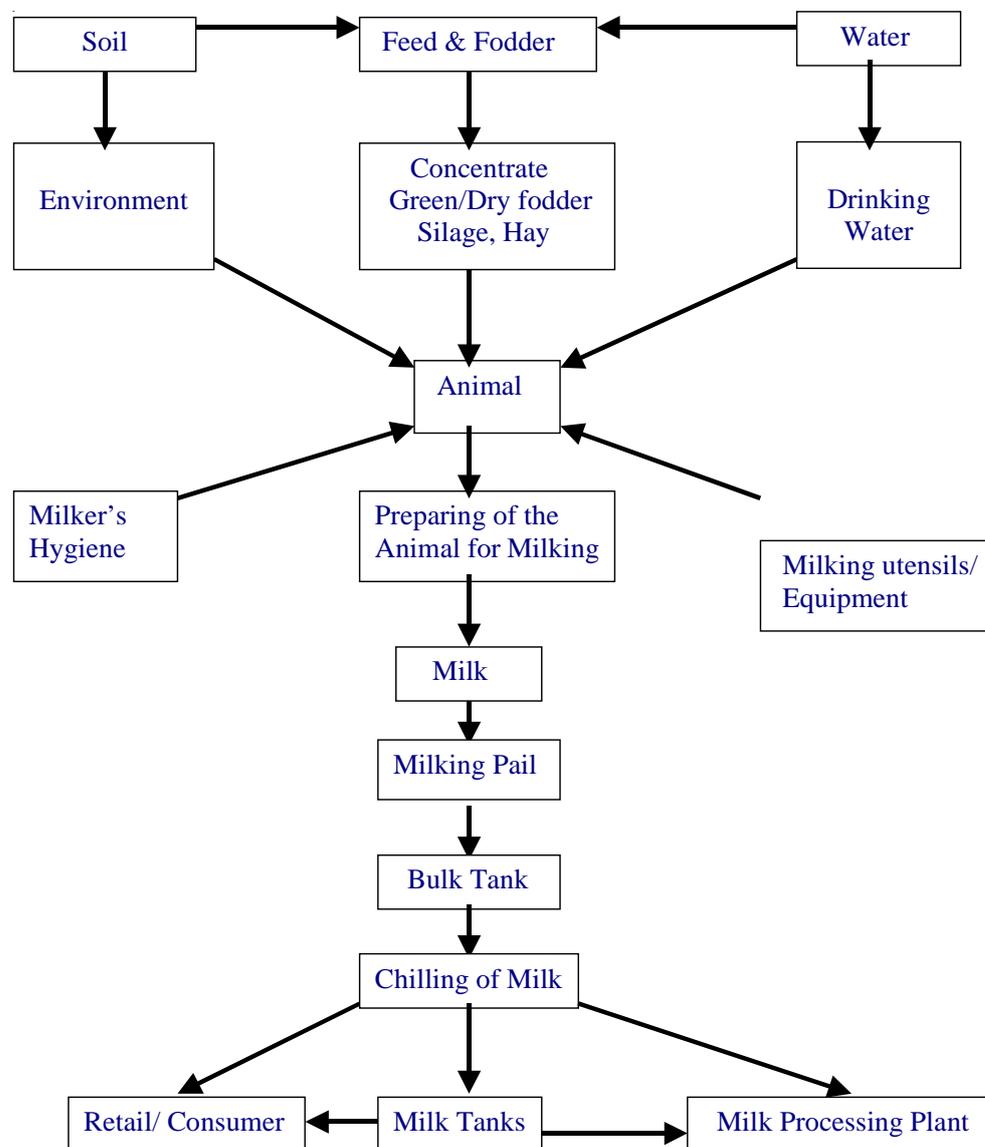


Figure 2: Factors affecting Clean Milk Production

- 2/21 Udder and teats
- 2/21 Milker – hygiene and habits
- 2/21 Milking and storage utensils
- 2/21 Method of milking
- 2/21 Feed and Water
- 2/21 Milking Environment

However, contamination of milk can be corrected at various levels as follows:

- 2/21 The animal management- includes feeding, housing and health
- 2/21 Hygiene of milking equipment and utensils
- 2/21 Milker and milking practices
- 2/21 During storage and transport
- 2/21 Personal hygiene of those who are involved in production, processing and delivery activities related to milk and milk products

Check Your Progress 1

- 1) Describe Clean Milk. How does it facilitate value addition to milk and milk products?

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- 2) Write the causes of high bacterial load in milk.

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- 3) Enumerate the factors affecting Clean Milk Production at farm level.

6.5 MEASURES FOR CLEAN MILK PRODUCTION

In order to bring out considerable change in the prevailing situation throughout the country, a systematic approach is required for milk production and manufacturing of different products. Therefore, a multidimensional team work should be initiated in which the team workers will look into the areas of animal management, nutrition, health, microbiological aspects of the milk and milk products as well as the residues of other unwanted contaminations in the milk. This should first generate information on the base line for each aspect and identify the critical points during the process of milk production and processing.

The following measures should be taken care for the production of clean milk:

i. Animal Management at Farm Level

When milk leaves the healthy udder, it is relatively free from bacteria. While some contamination with bacteria from the milking environment and the equipment is inevitable, the total bacterial count should be lower than 3 million/ml or otherwise, it will lead to significant degradation of the fat, protein and lactose causing off-flavour and would significantly reduce the flexibility in processing the milk. Although pasteurization reduces the bacterial count, it can not destroy the bacterial spores, which germinates again. Moreover, there are some bacteria producing toxins that survive even at pasteurization temperature and remain in the milk products too.

The animal management involving the feeding aspects of the animal as well as health and practices related to housing and environment at farm level are very important.

- a) **Feeding:** Feeding of milch animals should be done an hour before milking. At the time of milking, for the purpose of keeping cows busy, provide only concentrates which are less dusty. Feed and feed ingredients should meet minimum safety standards. These should only be produced, stored, marketed and used if they are safe and suitable. The presence of unsuitable substances such as industrial and environmental contaminants, pesticides, radionuclides, persistent organic pollutants, pathogenic agents and toxins/mycotoxins in the feed should be identified. Feed additives and veterinary drugs used in medicated feed should be critically assessed for safety aspects before using. Therefore, improper procurement, manufacture and handling of animal feed can result in the introduction of pathogens and chemical hazards, which can affect the safety and sustainability of milk.

Balanced feeding with appropriate quantities of green fodder, straw and concentrates having all essential nutrients and minerals is another important aspect required for quality milk production.

The points to be considered while feeding the milch animal are:

- ^{2/21} Feeds and fodders should be free from pesticides, insecticides, fungicides, herbicides, fumigants, aflatoxins as well as heavy metals.
- ^{2/21} Feed ingredients should be stored in moisture-free conditions. Rodenticides should be carefully handled.
- ^{2/21} Silage and wet crop residues should not be fed at milking place as it may impart foul odour to the milk.
- ^{2/21} Good quality straw and supply of adequate minerals and vitamins in feeds should be given high priority.

- b) **Housing:** The housing and its environment are most often forgotten. Therefore, we need to look at where the cow is milked, where she is housed, and how she gets back and forth between these areas. The animal shed is one of the main sources of contamination. At the same time, a good shed protects animals against micro-organism as it keeps out other animals, people, wind, rain and excessive heat, all increasing the danger of contamination. Mud, urine, faeces and feed residues should regularly be removed from the shed. The shed should have proper drainage, sufficient lighting and ventilation. In very wet areas, sprinkling slaked lime over the surface will help to dry it out quickly. The milking area of the shed needs special hygienic attention. The floor of the milk shed should be swept with clean water and disinfected with one per cent bleaching powder solution. Facilities should be provided for a sufficient supply of safe and potable water for drinking, washing udders and flanks of the animals, utensils and milker's hand etc.

The farmer needs to be educated to know how a well-constructed animal shed and well maintained surrounding help in keeping his animal disease-free.

- ^{2/21} The cattle shed should be well-roofed, sufficiently lighted, well ventilated, dry and comfortable with adequate elevation to avoid stagnation of water. It should not be a breeding place for pathogens, flies and mosquitoes.
- ^{2/21} There should be appropriate arrangement for disposal of animal waste in a manure pit or a biogas plant. Care should be taken to remove left over fooder and fodder lying on floor.
- ^{2/21} Proper arrangement of doors and windows with wire mesh.
- ^{2/21} Barns and holding pens have to be properly located.
- ^{2/21} Piggery and poultry farming should be avoided in the premises of animal shed.
- ^{2/21} Control of flies and insects is important as they are potential source of transmitters of disease causing organisms.

Tips to evaluate a good housing system

- ^{2/21} Housing must be kept clean and dry 24 hours a day.
- ^{2/21} Proper ventilation and lighting
- ^{2/21} Controlling the environment during summer and excessive winter.
- ^{2/21} Allotment of proper space for each animal.

- c) **Animal Health:** The pre-requisite of clean milk production is a healthy herd. The farmer should be educated and trained to adopt improved health care practices because only a healthy and clean animal can produce contamination free milk.

- ^{2/21} Routine examination of cattle is necessary to assure that they are disease-free (TB, Brucellosis etc.)

- ^{2/21} The animals suffering from contagious disease must be kept separate from healthy herd. Sanitary precaution to prevent and control the disease should be adopted.
- ^{2/21} Using inducer drugs should be avoided.
- ^{2/21} Check for udder wounds and mastitis. Avoid pooling of milk of the animals on drugs with the bulk milk until the animal fully recovers from illness.
- ^{2/21} Vaccination of animals against FMD, Anthrax, Hemorrhagic septicemia etc. should be done at least once a year.

ii. Somatic Cell Counts (SSC)

Mastitis is one such infection, which not only alter the composition of milk but also reduces the milk yield. Mastitis milk has low lactose, casein, fat and calcium and high amount of immunoglobulins and sodium. Such milk contains high number of somatic cell and pathogenic bacteria. Mastitis renders the milk unsuitable for human consumption and for production of cultured and fermented milk products. Infected udder can be source of a wide variety of micro-organisms.

Somatic cell count (SCC) is being used as an index of the udder health and quality of milk. Any inflammation or injury to the mammary gland will increase SCC of milk. Due to this reason the monitoring of somatic cell secretion in milk helps to detect the sub-clinical mastitis. In addition, SCC in bulk milk samples also indicates the level of hygiene maintained at the farm. The milk having high SCC indicates some disturbance in the udder and should be discarded. To effectively monitor the udder health and the quality of milk, the milk samples should be checked at least at fortnightly intervals and if SCC values are found more than the prescribed standards, the necessary treatment of the quarter should be immediately given. Somatic Cell Count is influenced by number of factors such as management of animal, health of animal and surrounding environmental of the animal. Milk is considered normal, if SCC are 1×10^6 cells/ ml or lower. The detailed criteria of normal and abnormal milk is given in Table 6.1.

Table 6.1: Criteria to determine the normal or abnormal milk

S.No.	Somatic cell	Status of the counts	Status of the milk udder
1.	Up to 2.5 lakhs	Normal	Normal
2.	2.5 to 4.0 lakhs	Sub-clinical mastitis	Slight change in milk
3.	>4.0 lakhs	Clinical mastitis	Visible change in milk

In order to reduce effectively the SCC in milk, cleaning and regular removal of waste should be done so that the chances of bacterial growth and pests are minimized. Milk from the animals showing clinical symptoms of diseases should neither be mixed in bulk milk nor used for human consumption. The milking byres should have provision of fans and proper ventilation so that light does not become a limiting factor in milking operations.

iii. Cleanliness of Milking Equipment and Utensils

Milking equipments and utensils used at farm include a variety of equipment and containers including milk pail, milking machine, teat cup clusters, cans, milk pipeline, recorder, bulk tank, strainer, cooler, milk flow indicators, etc. These equipment pose a serious threat. The residual milk solids on such equipment sustain the growth of micro-organism and colonization of such micro flora results into formation of biofilm. These biofilms can result into heavy contamination of milk during subsequent operation or use. Milk cans generally contribute thermophilic organisms while bulk tank and storage tank may facilitate the proliferation of psychrotrophs due to prevalence of cold temperature during holding of milk in these tanks.

Therefore, proper cleaning removes most of germs and parasites along with the dirt. The equipment and vessels coming in contact with milk should be thoroughly cleaned.

- ^{2/21} The milk vessels must be cleaned before and after each milking thereby rendering these bacteria free.
- ^{2/21} Detergents/chemicals used for cleaning of vessels, must be non-injurious to health like teepol. Use of ash or mud is not recommended.
- ^{2/21} The cleaned and sanitized vessels must be kept in an inverted position in a space.
- ^{2/21} Milking pail with dome shaped top should be used instead of open buckets or vessels by which milk contamination can be nullified to a great extent.

iv. Hygienic Milking Practices

Hygienic conditions of storage and transport equipments and storage temperature are the two key factors, which play a great role in deciding quality of raw milk. Air poses a lesser threat as a source of contamination in comparison to other sources like teat surfaces. Some organisms may enter during hand milking (falling in the milk pail) and machine milking (sucked along with air). In addition, the personal hygiene of the worker either at cattle yard or dairy dock must be taken into consideration to produce clean milk.

Hygienic practices during milking contribute to production of safe and suitable milk.

- ^{2/21} There should not be any floor sweeping (disturbances, noise etc.) at the time of milking for preventing pollution of air by dust/bacteria.
- ^{2/21} Milker's should be free from communicable diseases and should wear clean clothes, nails trimmed and should neither eat or spit anything nor clean his nose.
- ^{2/21} Before starting the milking operation, the milker should clean his hands with soap, potable water and then wipe them with clean towel.
- ^{2/21} Clean the udder and teats with lukewarm water using a cloth before each milking.
- ^{2/21} The fore stripping should be collected in separate utensil/cup and should not be thrown on the floor, so as to avoid infections by the flies.
- ^{2/21} After milking the teats have to be dipped into a bactericide to minimize the risk of infection. The practice of dipping of fingers into milk and then wetting the teats to soften them is not recommended.
- ^{2/21} Milking should be completed within 6-8 minutes.
- ^{2/21} Wet milking (moistening the hand with milk or oil or water) is not encouraged.
- ^{2/21} Milk should be strained using a clean cloth or a strainer to remove sediment and other foreign materials. If cloth is used, it should be washed and dried daily.

v. Cooling of Milk

The provision of bulk cooling facilities at each centre under clean milk production programme encouraged by NDDB has been assured in order to have the bulk milk cooling tank for maintaining the bacteriological quality of raw milk by adopting clean milk production practices and immediate cooling of milk for onward journey to dairy dock. The reduction of time between milking and reception at the center, maintenance of low temperature of milk till it is received at dairy/chilling center through chilling interventions by providing bulk milk cooling tanks enhances the safety of quality milk.

The strategic advantage of producing clean milk is lost entirely if post milking handling is not carefully managed. The microbiological contamination is the major source of continuous deterioration of milk.

- ^{2/21} To preserve the keeping quality of milk, it has to be cooled as soon as possible to a temperature below 5°C by storing in refrigerator or can be kept at cooler place.
- ^{2/21} The sooner the milk is cooled after removal from the udder, the better is the quality.
- ^{2/21} Bacterial growth is retarded by cooling and storing milk at 10°C or below within 2 hours of milking.
- ^{2/21} Delivery of milk to the factory should be as frequent and as early in the day as possible.

6.6 STRENGTHENING INFRASTRUCTURE FOR QUALITY & CLEAN MILK PRODUCTION

Government of India has introduced a centrally sponsored scheme “Strengthening Infrastructure for Quality & Clean Milk Production” during 10th Plan period with following objectives:

- ^{2/21} Creation of infrastructure for production of quality milk and milk products at the farmers level up to the points of consumption.
- ^{2/21} Improvement of milking procedure at the farmers level.
- ^{2/21} Training and strengthening of infrastructure to create mass awareness about importance of clean milk production.

Funding: The pattern of funding under the scheme will be on 100% basis, for the following components:

- ^{2/21} Training for clean milk production to all members of the society.
- ^{2/21} Detergent, antiseptic solutions, muslin clothes.
- ^{2/21} Utensils and accessories for clean milk production.
- ^{2/21} Strengthening of existing laboratory facilities.
- ^{2/21} Planning and monitoring.

The pattern of funding under the scheme will be in the ratio of 75:25 for purchase of bulk cooler between Government of India and the respective Dairy Cooperative/ Union.

Implementation: Dairy Cooperative/Union/Federation will implement the scheme through State Government. The Project shall be prepared as per the guidelines of the scheme and shall be submitted through concerned state Government/Union Territory Administration to the Department of Animal Husbandry & Dairying.

6.7 STRATEGIES TO IMPROVE THE QUALITY OF MILK

If the dairy industry in India has to gear up to be considered as one of the best in the world, the stress should be emphasized on “Quality of raw milk”. To achieve this goal, it is imperative to have comprehensive extension efforts to impart knowledge on clean milk production practices to the dairy farmers. The strategies to be employed for this are:

1. Identification of coalition or interest groups in the rural communities involved in community development activities.
2. Work with the group to get information on the needs, priorities and constraints in the various aspects of clean milk production.
3. Designing and developing new Information and Communication technologies like Interactive Multimedia on clean milk production practices as it fulfills the

need for the interaction in the communication process as compared to other media.

4. Education and training of the milk producers on hygiene, house keeping, clean methods of milking and collection of milk and good animal husbandry practices. Educational programmes should be organized for farmers for making them aware of clean milk production practices.
5. Posters/charts/video films on clean milk production can be displayed at village level, society level as well as at milk collection centers.
6. Mass media programmes should be initiated with regular visits of experts, in relation to comprehend the clean and hygienic practices by the farmers.
7. Villager should be made aware about fast multiplication of bacteria at various stages of milk handling by testing of bacteriological quality of milk from udder to milking point, society and ultimately reception dock.
8. There is a need to identify the information needs of the target group on various aspects of clean milk production practices and data base computer information system to improve the efficiency of standard practices.

6.7 PRESENT STATUS OF CLEAN MILK PRODUCTION IN INDIA

The present status of India's dairy sector has distinct advantage being the largest producer of milk in the world from a large base of livestock. The pressure of competition is such that Indian dairy industry has no option but to launch a vigorous campaign to produce clean milk. Efforts are continuing by the National Dairy Development Board in collaboration with different cooperatives and dairy federations to introduce the practices at the village level to produce clean and hygienic milk to meet the present day challenges faced by it. It is important not only in order to sustain the present level of milk production and continue paying the remunerative price presently being paid to farmer producers, but also it helps in reducing wastages and producing more value added milk products.

It is well known that the quality of milk is affected due to the contamination from feed, veterinary drugs, fertilizers and environment in the milk at the farmer level. The microbiological quality of milk is affected by general health of animals and milk handling practices subsequent to milking. In fact, the bacteriological quality of raw milk in India is similar to that of any developed countries at the cattle udder level.

The status of raw milk produced in India is reflected in its bacterial quality (Table 6.2). A comparison of status of raw milk quality in India vs. International quality standards (1000-1,00,000 SPC cfu/ml) indicates that the bacteriological quality of raw milk is almost similar at the udder level (Table 6.3). Thus, the way of milk handling subsequent to milking affects the quality of raw milk.

Studies conducted by the author at nearby villages from National Dairy Research Institute (NDRI) related to the knowledge level of farmers on clean milk production practices revealed the following aspects scoring very low:

- ^{2/21} Drying of udder with clean dry cloth after washing
- ^{2/21} Udder cleaning with lukewarm water
- ^{2/21} Shape of milking pail
- ^{2/21} Clean and sanitized animal shed
- ^{2/21} Teat dipping
- ^{2/21} Sub-clinical mastitis and its diagnosis

Table 6.2: Bacteriological status of raw milk produced under different Indian conditions

Source of sample	Age of milk from time of production (h)	Colony forming units (10 ⁶ /ml)*					
		CENTRE A			CENTRE B		
		Winter	Summer	Monsoon	Winter	Summer	Monsoon
		15-25°C	22-25°C	20-32°C	9-25°C	28-45°C	23-40°C
Fresh milk	0	0.10	0.17	0.18	0.40	0.91	0.99
Village Produced	2	0.34	0.58	0.47	0.74	2.62	1.10
Private Dairies	4-5	3.41	3.68	1.47	0.19	9.80	1.30
Milk Vendors in towns	4-5	1.59	1.99	3.75	1.21	6.66	2.45

*Average data for 200-300 samples in each category.

Centre A – South India (Characterized by a fairly temperate climate)

Centre B – Typical north Indian Town (Characterized by extremes of temperate)

Table 6.3: Comparative statement of Standard for Bacterial Load in raw milk

India (BIS)			USA (cfu/ml)		UK (cfu/ml)		IDF (cfu/ml)	
Grade	SPC (cfu/ml)	MBRT (hr)						
Very good	<2X10 ⁵	5.5	Liquid milk grade	<1X10 ⁵	Grade A	<2X10 ⁴	Min (cuf/ml)	<1000
Good	2X10 ⁵ - 1X10 ⁶	3-4	Manu-factured production grade	d'3X10 ⁶	Grade B	2X10 ⁴ - 1X10 ⁵	Max (cuf/ml)	1X10 ⁶
Fair	1X10 ⁶ to 5X10 ⁶	1-2			GradeC	>1X 10 ⁵		
Poor	>5X10 ⁶	30 min.						

The results of the study reveals the grim knowledge of milk producer's and therefore calls serious attention upon the contemporary situation in clean milk production. Hence, there is virtually an urgent need to disseminate knowledge regarding the benefits of adopting clean milk production among the farmers.

6.8 CONSTRAINTS IN ADOPTION OF CLEAN MILK PRODUCTION PRACTICE

The main constraints in adoption of different measures for clean milk production are:

- ^{2/21} Level of awareness among rural population producing milk.
- ^{2/21} Low threat perception
- ^{2/21} Lack of quality norms or legislation
- ^{2/21} Milk procurement is obligatory irrespective of quality

- 2/21 Low level of mechanical processes to collect the milk from farm to dairy dock
- 2/21 Poor technical knowledge and available infrastructure facilities for collection and chilling of milk.

Check Your Progress 2

- 1) Enumerate the constraints in clean milk production system.
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- 2) What is Somatic cell count? Give classification of normal and abnormal milk based on SCC.
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- 3) Discuss in brief strategic view points for Clean Milk Production.
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6.9 LET US SUM UP

We can understand from this unit that as milk is a highly perishable agricultural commodity, it is necessary to produce clean milk for safe human consumption. Clean milk is the milk drawn from healthy animal, collected in a clean, dry milking pail, possessing good flavour, free from extraneous materials like dirt, dung, dust, flies, hay etc. containing a relatively small number of bacteria, essentially free from pathogens and safe for human consumption. The main sources of contamination of milk are animals' body, udder, milker, milking equipment and utensils and milking environment. Proper animal management, cleanliness of milking equipment and utensils, hygienic milker and milking practices and proper storage and transportation of milk is necessary for clean milk production. There is also an urgent need to disseminate knowledge regarding the benefits of Clean Milk Production among the farmers.

6.10 KEYWORDS

- Clean Milk** : The milk drawn from the udder of healthy animals, which is collected in clean milking pail and free from extraneous matter like dirt, dust, flies, hay, manure etc. having low bacterial count, free from off- flavour and safe for human consumption.
- Quality** : Quality encompasses safety, hygiene, reliability, Wholesomeness and acceptance by consumers
- Pesticides Residues in milk** : The chemical residues which originates in milk and milk products from insecticides, fungicides, herbicides etc.

Insecticides	:	This is a chemical compound, which kills the insects and pests on agricultural commodity/ veterinary drugs etc.
Fungicides	:	The chemical compounds, which kill the fungus, mainly used to protect the fungal diseases of plants.
Herbicides	:	The chemical compounds, which kill the weed/ unwanted plants/ vegetation.
Rodenticides	:	The chemical compounds, which are used to kill rodents in agriculture field/ food grain storage.
Fumigants	:	It is a chemical compound, which are available to produce fumes for treating against insects and pests of food grains during storage.
Mycotoxins	:	Mycotoxins are a group of toxins originate from fungal origin.
Mastitis	:	It is a disease condition of udder due to bacterial infection resulting in swelling, pain and hardening of udder thereby affecting the quality and quantity of milk

6.11 SOME USEFUL BOOKS

- Codex. (1997). General Requirements (Food Hygiene), Supplements to Vol. 1B. FAO/WHO. Rome.
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- Heeschen, W. H. (1996). Bacteriological quality of raw milk: Legal requirements and payment systems. IDF Publication.
- Sohrab. (1997). HACCP Through ISO 9000 Quality Management System. *Indian Food Industry*. May-Jun, 1997. **16**(3).

6.12 ANSWERS TO CHECK YOUR

Your answer should include the following points:

Check Your Progress 1

- 1) i. “Clean milk” may be defined as “ milk drawn from the udder of healthy animals, which is collected in clean, dry milking pail and free from extraneous matter like dirt, dust, flies, hay, manure etc. Clean milk has a normal milk flavour with low bacterial count and is safe for human consumption.”

It facilitates:

- ²²¹ Safe for human consumption
 - ²²¹ Keeping quality
 - ²²¹ Commercial value
 - ²²¹ Quality base product for processing
 - ²²¹ Transportation to far places
- 2) i. Poor sanitation at the farm
 - ii. Improper handling of milk

- iii. Poor storage of milk
 - iv. Infection/disease of animal milked
- 3) i. Internal factors includes:
- 2121 Udder infection – Mastitis
 - 2121 Fore milk – First few streams of milk contain a large number of bacteria
- ii. External factors includes:
- 2121 Cow/animal's body – especially dirt and dung from hind quarters and tail
 - 2121 Udder and teats
 - 2121 Milker
 - 2121 Milking and storage utensils
 - 2121 Method of milking
 - 2121 Feed and Water
 - 2121 Milking Environment

Check Your Progress 2

- 1) i. Awareness of people producing milk
- ii. Low threat perception
 - iii. Lack of quality norms or legislation
 - iv. Milk procurement is obligatory irrespective of quality
 - v. Lack of mechanical processes
 - vi. Lack of technical knowledge and available infrastructure facilities for collection and chilling of milk
- 2) i. Somatic cell count is a measure of number of somatic cells or leucocytes in one ml of raw milk. Somatic cell count (SCC) is being used as an index of the udder health and quality of milk. Any inflammation or injury to the mammary gland will increase SCC of milk. Due to this reason the monitoring of somatic cell secretion in milk helps to detect the sub-clinical mastitis. Milk is considered normal, if SCC is 1×10^6 cells/ml.

Sl.No.	Somatic cell	Status of the counts	Status of the milk udder
1.	Up to 2.5 lakhs	Normal	Normal
2.	2.5 to 4.0 lakhs	Sub-clinical mastitis	Slight change in milk
3.	>4.0 lakhs	Clinical mastitis	Visible change in milk

- 3) i. Displaying of posters/charts/video films on clean milk production at village level
- ii. Development of database computer informations
 - iii. Training of milk producers on house keeping hygiene and animal husbandry practices
 - iv. Use of mass communication and multimedia techniques.
 - v. Testing of bacteriological quality of milk at various stages of milk handling.