
UNIT 1 QUALITY – DEFINITION AND IMPORTANCE

Structure

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1.0 OBJECTIVES

After reading this unit we should be able to:

- 1 define the term “food quality”;
- 1 enumerate important components of the quality;
- 1 specify the importance of food safety;
- 1 outline various quality assurance activities;
- 1 state the importance of quality aspects in reference to milk and milk products; and
- 1 outline the quality control tasks in the dairy industry.

1.1 INTRODUCTION

We all are familiar with the word “quality”. If we bring some fruits or vegetables from the market, the other family members will reflect on their quality by making observations such as: fresh or stale, good or bad quality or inferior product, etc. These observations are perceptions of consumers based on the sensory attributes of the fruit or vegetables such as colour, appearance touch, smell or taste.

The quality characteristics of food that are acceptable to consumers are comprehended under the term “Food Quality”. It includes external factors such

as appearance (size, shape, colour, gloss, and consistency); internal factors (chemical, physical, microbial) and characteristics/ specifications prescribed under the Government laws/ standards. If consumers perceptions regarding quality of food are not positive he or she either will not purchase the material or will be paying less compared to when the consumer has positive perception about the quality. Our country is the largest producer of the milk in the world and has good potential to export the dairy products, particularly indigenous dairy products such as *ghee* and *khoa /chhana based* sweets. Food items or dairy products to be traded in international markets should be manufactured in accordance with global accepted norms and standards. In order to improve the quality of milk and milk products the Government of India is focusing on “Clean Milk Production”. As a dairy technologist and entrepreneur, we must ensure production of quality products. Let us learn more about quality.

1.2 DEFINITION AND COMPONENTS OF FOOD QUALITY

Definition: Quality is a measure of the degree of excellence or degree of acceptability by the consumer. It can be defined as “summary of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs”. In simple words the product should have attributes to “satisfy the wants/ needs of the consumer or conformance with the user’s requirements”. It also covers the safety and value for money. Food quality can be considered as a complex characteristic of food that determines its value or acceptability to consumers. Thus it may be defined as “the composite of those characteristics which have significance in determining the degree of acceptability by the buyer. These characteristics should also have the ability to differentiate individual unit of the product.”

Components: The important components of food quality are: food safety, sensory characteristics and nutritional value. Safety of food is a basic requirement of food quality. “Food safety” implies absence or acceptable and safe levels of contaminants, adulterants, naturally occurring toxins or any other substance that may make food injurious to health on an acute or chronic basis. Besides safety, quality attributes include: nutritional value; organoleptic properties such as appearance, colour, texture, taste; and functional properties. The quality attributes are outlined in Table 1.1 and includes primarily sensory attributes and hidden attributes. The sensory attributes include characteristics such as colour and appearance, viscosity and consistency, smell, taste, touch etc. The hidden characteristics are those which can not be evaluated with human senses and yet are of real importance to human health and welfare. Nutritive value is one of the hidden characteristics, which is now considered by the consumers as a quality attribute. Adulterants and toxicants are the other hidden characteristics. Toxic substances may be of microbial origin, veterinary drugs residues, pesticide residues or heavy metals.

Table 1.1 Classification of quality attributes

Sight	Appearance Colour Gloss Viscosity/ consistency Size and shape
Touch	Texture Hand/ Finger/ Skin feel Mouth Feel
Smell and Taste	Flavour
Hidden	Nutritive value Digestibility Adulterants contaminants Toxicity

i) **Food safety:** In order to understand “food safety” we must first know the terms safe and hazard. “Safe” means that nothing harmful happens when we consume a food. A “hazard” is the capacity of a thing to cause harm. The objective of the food safety is to protect the food supply from microbial, chemical and physical hazards or contamination that may occur during all stages of milk production and handling-management of animals at farm, milk production, transportation, storage of raw milk, processing, production of value added products, distribution and storage of end products. It aims for keeping food wholesome and free from food borne illness. The important associated definitions and factors are described for better understanding of the food safety.

(a) **Food borne illness:** Food borne illness or food poisoning is caused by consuming food contaminated with pathogenic bacteria, toxins, viruses or parasites. The contamination may or may not alter a food’s organoleptic properties but cause illness and disease to human beings after consumption and usually arises from improper handling, preparation or storage of food. Food-borne diseases are classified as food infections or food intoxications. Food infections involve microorganisms present in the food at the time of consumption which then grow in the host and cause illness and disease. Food intoxications involve toxic substances produced in foods by microorganisms prior to consumption and cause disease upon ingestion. The toxin producing microorganisms need not to grow in the host to produce a disease or even be present in the food. So we must acknowledge that intoxication can occur even if no viable microorganisms are ingested.

(b) **Food hazards:** Food becomes hazardous by contamination. Contamination is the unintended presence of harmful substances or microorganisms in food. Food hazards can be defined as a biological, chemical or physical agent in a food, with the potential to cause an adverse health effect (Table 1.2). Physical hazards are foreign particles, like glass/wood or metal pieces, stone, bone fragments, feathers, fibre, hair, etc. Chemical hazards include substances such as cleaning solutions and sanitizers, non permitted adulterants, pesticide and heavy metal residues. Biological hazards come mainly from microorganisms. The Directorate General of Health Services

(DGHS), Ministry of Health is pursuing a broad and long-term science-based strategy to improve the food safety and to better protect the public health. Part of this strategy is a farm-to-table approach to improve the safety of food at each step in the food production, distribution, and marketing chain. The website (<http://foodsafetyindia.nic.in>) gives a good diagrammatic account of potential hazards and guidelines for food safety at home. One of the interesting terms used is “FAT TOM”. It is a term that in short explains what encourages food borne pathogens to grow i.e. F is for Food or nutrients present; A is for Acidity; T is for time; T is for Temperature; O is for oxygen and M is for Moisture.

Table 1.2: Hazards associated with food

Physical	Biological	Chemical
		Natural occurring poisons of biological origin and Chemicals or deleterious substances
Glass Hair Metal Stones, Plastic, Parts of pests Insulation material Bone	Microbiological Pathogenic Bacteria Spore- Forming Non- Spore forming Parasites and Protozoa Viruses	Mycotoxins Algal Toxins Veterinary drug residues, Antibiotic residues, Chemical residues Non-permissible food additives, Excess amount of permissible food additives, Pesticide residues, Growth stimulants, Adulterants

Source: Food Safety- Basic Concepts

- (c) **Food Safety Management Systems Certification(FSMS):** The Bureau of Indian Standards (BIS) has launched Food Safety Management Systems (FSMS) Certification IS/ISO 22000:2005 scheme which envisages grant of FSMS Certification licence to organizations according to IS/ISO 22000. This standard integrates the principles of Hazard Analysis and Critical Control Point (HACCP) system developed by Codex Alimentarius Commission and combines the HACCP plan with Pre-requisite Programmes (PRPs) and is fully compatible with Quality Management Systems (QMS) as per ISO 9001: 2000. The standard provides framework for systematically managing safety in food supply chains.
- (d) **The Food Safety and Standards Act, 2006:** The chapter six of the Act titled as “Special Responsibilities as to Food Safety” deals with responsibilities of the food business operator, liability of manufacturers, packers, wholesalers, distributors and sellers and recall procedures.
- (e) **Safety concerns:** We know that the goal of food safety is to reduce the size of risks to the lowest reasonable level without severe disruption of the food supply. For this we should first identify hazards related to foods or food components and then estimate the size of the risk that the hazard will cause. It is important to note that all foods have some degree of risk and

that no food is absolutely “safe.” The important consideration becomes “the size of the risk and how the size of the risk can be reduced” without eliminating the food source. Specific food safety concerns differ markedly and include:

- 1 Additives, colours and flavours.
- 1 Antibiotics and other food additives.
- 1 Fertilizers and other growing aids.
- 1 Irradiation.
- 1 Microbiological contamination.
- 1 Naturally occurring food toxicants.
- 1 Nutrition.
- 1 Pesticides.
- 1 Pollutants.
- 1 Processing, packaging and labelling.
- 1 Tampering.

(f) Adhering to Safety Standards: The advantages associated with adhering to food safety standards are:

- 1 Ensures safety of food products.
- 1 Greater health protection.
- 1 Increased international acceptance of food products.
- 1 Helps to meet applicable food safety related statutory & regulatory requirements.
- 1 Demonstrate conformance to international standards and applicable regulatory requirements.
- 1 Reduces risk of product/service liability claims.

(g) Recent Concerns of Food Safety: Prions, genetically modified foods, the incidence of bovine spongiform encephalopathy (BSE), and dioxin-contaminated foods are some of the new food safety concerns. Let us know about them.

Prions are one of the new sources of food borne diseases. A prion is the short form of proteinaceous infectious particle. Dr. Stanely Prusiner coined the word “prion” as a name for the infectious agent, by combining the first two syllables of the words “proteinaceous” and “infectious.” While the infectious agent was named a prion, the specific protein that the prion was made of was named PrP, an abbreviation for “protease-resistant protein”. The normal form of the protein is called PrP^C, while the infectious form is called PrP^{Sc}, which stands for *prion protein of scrapie*. Prions are generally quite resistant to denaturation by protease, heat, radiation, and formalin treatments, although potency or infectivity can be reduced.

Prions enter cells and apparently believed to infect and propagate by refolding abnormally into a structure which is able to convert normal

molecules of the protein into the abnormally structured form. The proteins accumulate in the brain causing holes or plaques and the subsequent clinical symptom leading to death.

Prion diseases are grouped as transmissible spongiform encephalopathy (TSE). The diseases associated by prions are: Creutzfeldt-Jakob Disease (CJD), Bovine spongiform encephalopathy (BSE- commonly known as “mad cow disease”), fatal familial insomnia and kuru (translated as “to tremble with fear”).

Bovine Spongiform Encephalopathy (BSE): Bovine Spongiform Encephalopathy is commonly known as mad- cow diseases. It is a progressive neurological disorder (brain disease) of cattle that results from an infection by an unconventional transmissible agent. BSE is one of a transmissible Spongiform Encephalopathies (TSEs) that affect a number of different mammals.

Creutzfeldt-Jakob Disease (CJD): It is one of the most commonly known diseases among humans. This is a rare and fatal form of dementia and mainly occurs in individuals between the ages of 40 and 80.

Dioxin–Contaminated Foods: Dioxin is the popular name for the family of halogenated organic compounds, the most common consisting of polychlorinated dibenzofurans (PCDFs) and polychlorinated dibenzo-p-dioxins (PCDDs). PCDD/PCDFs are industrial pollutants that persist in the environment. They have been shown to bio accumulate in humans and wildlife due to their lipophilic (fat loving) properties. Dioxins are a carcinogen in higher amounts, and cause developmental and reproductive problems. They are absorbed primarily through dietary intake of fat, as this is where they accumulate in animals, including humans.

Genetically Modified (GM) Foods: The GM foods are produced from genetically modified organisms (GMO). A GMO means: an organism that has been modified (manipulation of DNA) by gene technology. Genetically modified (GM) crops and food are being grown and consumed by the public. The advantages associated are: increased yields from agriculture, more powerful control of pests and weeds, reduced use of some agrochemicals and enhancement of nutritional value or other characteristics of crops, etc. There are many things which people hold up as possible dangers of genetic modification: risk of transferring crop traits to wild species, negative impacts on wildlife from more powerful control of pests and weeds, increased use of some agrochemicals, increased corporate control of seed supply and; limited studies on food safety concerns on human health in form of toxins/ allergenic reactions/ reduction in good micro flora of duct, etc.

- ii) **Nutritional Value:** Nutritional value of the product has grown in importance as consumers have become better informed about foods. The consumers demand for nutritional labelling in addition to food safety. Nutritional changes occur in foods during handling, processing and storage due to microbiological, enzymatic

and chemical reactions. One of the principal responsibilities of the dairy technologists is to preserve nutrients through all phases of food acquisition, processing, preparation and storage. As a food processor, we should have good knowledge of the stability of nutrients under different conditions. Vitamin A is highly sensitive (i.e., unstable) to acid, air, light, and heat; on the other hand, vitamin C is stable in acid but is sensitive to alkalinity, air, light, and heat. Because of the instability of nutrients under various conditions and their water solubility, cooking losses of some essential nutrients may be greater than 75%. In modern food processing operations, however, losses seldom exceed 25%. The food should not contain any toxic/ anti- nutritional substances.

iii) **Sensory Characteristics:** The sensory characteristics of foods and materials are based on perception of human senses i.e. senses of sight, smell, taste, touch and hearing. The sensory evaluation of milk and milk products has been covered extensively in the next block i.e. Block 3 of this course. Some of the attributes are described below:

Colour and Gloss: Colour is the property, which is based on the spectral distribution of light. The white colour of milk is due to the reflection of light by the casein micelles dispersed in the continuous phase/ dissolved phase of water and yellow tinge in cow milk is because of the presence of β -carotene in it. Similarly the glossiness, transparency, haziness and turbidity are the properties of substance due to the differences in reflectance and transmittance of light. Spectrophotometer is the instrument used for measuring of colour intensity while turbidity meter is used to measure turbidity.

Viscosity/ Consistency: It has great importance in liquid products such as fluid milk products or semisolid products like condensed milk, ice-cream, *rabri*, *lassi*, etc. Consumers judge the richness of these products by viscosity/ consistency characteristics. These can also be used as an index to the concentration of ingredients.

Size and Shape: Grading into various size and shape categories is usually one of the first steps in food processing operations of fruit and vegetables. For milk products it can be applied in case of sweets like *Rasogulla*, *Gulabjamun*, etc.

Texture: Texture is the most important property of most of the milk products such as *Rasogulla*, *Paneer*, *Chhana*, *Khoa*, Ice-cream, Butter, *Ghee*, *Gulabjamun*, *Peda*, *Burfi* etc. There are several instruments available to measure texture attributes of these products in the form of cohesiveness, chewiness, gumminess mealiness, stickiness, etc.

Flavour: Flavour includes taste and odour/ aroma. Like texture the flavour is also very important attribute of the milk and milk products. Even it is much more important than texture in some of the products like ice-cream. An ice-cream will be rejected if it does not have pleasing flavour even if it is otherwise good.

Check Your Progress – 1

1. Define food quality.

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2. Define the important quality characteristics of food.

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3. What do you understand by sensory or organoleptic characteristics?

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4. What are hidden characteristics of Food quality?

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5. Explain the terms food safety and food borne diseases.

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1.3 FUNCTIONS OF QUALITY CONTROL UNIT

The quality control discipline is constantly developing with growing importance of the quality aspects in food processing operation. The vocabulary includes terms like: quality control, quality assurance, total quality management, etc. Let us understand the terms. Earlier the quality control was primarily concerned with maintaining the quality standards. The need to produce and sell high quality products and increase the efficiency of the production process, has led to the development of quality assurance systems. The difference between quality control and quality assurance can be explained as follows:

Quality control is the evaluation of a final product prior to its marketing, i.e. it is based on quality checks at the end of a production chain for maintenance of prescribed standards and assigning the final product to quality categories such as “high quality”, “regular quality”, “low quality” and “non-marketable”. Since, at the end of the production chain, there is no way to correct production failures or upgrade the quality of the final product, the low-quality products can only be sold at lower prices and the non-marketable products have to be discarded. Their production costs, however, had been as high as those of the high and regular quality products. Thus, quality control has only a limited potential to increase the quality and efficiency of a multi-step production procedure.

Quality Assurance: In contrast to quality control, the quality assurance includes the planning and surveillance of everything to do with the quality throughout the company. It is the implementation of quality checks and procedures to immediately correct any failure and mistake that is able to reduce the quality of the interim products at every production step. Quality assurance seeks to generate confidence both within the organization and externally, among its customers, that their requirements will be fulfilled. The additional features acquired in the progress from quality control to quality assurance are:

- 1 The definition of a quality policy and objectives;
- 1 The development of a quality manual;
- 1 Ensuring competency of personnel;
- 1 Conducting periodic internal audits;
- 1 The elimination of the root causes of the problems found; and
- 1 Periodic review of the system by top management

Thus, the desired high quality of the final product is planned and obtained by conducting:

(b) Standard Operating Procedures (SOP’s) guarantee the desired quality of the interim products at every production step.

(c) Good Manufacturing Practices (GMP) is a written document of the guidelines describing the procedures, equipment facilities, and controls for operational conditions to ensure that the food meets the consumers’ needs and wants, and also gives them the security of safety and reliability. Good manufacturing practice are based on the knowledge and skills throughout the food system, from primary production of the raw materials, through processing of the industrial ingredients, manufacturing of the consumer products, distribution of the final retail products to the consumers and eating of the final foods.

Total Quality Management (TQM) The management approach to long-term success through customer satisfaction, based on the participation of all members of an organization (suppliers and distributors included) in improving processes, products, services and the working culture. The table 1.3 explains the term more clearly.

Table1.3: Meaning of Total Quality Management (TQM)

Total	Every one associated with the dairy unit is involved in continuous improvement, in all functional areas, at all levels.
Quality	Consumers expressed and implied requirements are met fully
Management	Managers and associated officials are fully committed Effective utilization of resources Decision in a planned way To maintain existing level of quality To improve existing level of quality

Examples of quality control versus quality assurance in the area of food safety are:

The testing of final product for residues is quality control, the implementation of residue avoiding production procedures at farm level is quality assurance; the testing of milk products for salmonella prior to their marketing and consumption is quality control, the implementation of on- and off-farm salmonella-reducing measures as standard operating procedures is quality assurance.

i) Basic Quality Control Activities: The activities in a quality control unit include:

- 1 Establishing the specifications of the parameters to be controlled;
- 1 Preparing quality plans for control;
- 1 Performing checks or inspections;
- 1 Diagnosing and taking action on the variations observed; and
- 1 Checking that the variations have been corrected.

The fundamental purpose of a quality control programme is to acquire dependable information on all the attributes of a product which affects its quality. Quality control ensures that raw materials meet set standards, processing methods should be performed as designed, finished products meet company standards and consumer confidence in the enterprise remains high. The basic functions of a quality control programme are:

- 1 Physical and chemical evaluation of raw materials and processed products.
- 1 Control of
 - a) Raw materials, ingredients and packaging supplies.
 - b) Processing parameters.
 - c) Finished products.
- 1 Microbiological analysis and control of raw materials and finished products.
- 1 Control of storage and handling conditions.
- 1 Sanitation and waste products control.
- 1 Assurance that final products are within the legal and marketing standards established.

Specific Responsibilities: The specific responsibilities of quality control assigned to a department or to an individual include:

- 1 Standardizing procedure for sampling and examining raw materials. Development of test procedures.
- 1 Establishment and implementation of quality standards for fresh and processed products.
- 1 Setting up preventive quality control methods for in-plant liaison between manufacturing section and test laboratories.
- 1 Examination of finished products.
- 1 Storage controls.
- 1 Sanitation inspection
- 1 Conformance to food regulations
- 1 Waste disposal control
- 1 Research and development into new products and their packaging.

Advantages: Quality control leads to:

- 1 Raw material control
- 1 Process control
- 1 Inspection of finished products
- 1 Sensory evaluation or evaluation of the acceptability of the final product.
- 1 Packaging
- 1 Labelling and storage
- 1 Sanitation inspection
- 1 Conformance to food regulations
- 1 Waste disposal control

1.4 QUALITY ASPECTS OF MILK AND MILK PRODUCTS

The quality aspects are important in reference to milk and milk products because of:

- (a) **Milk is perishable in nature:** We know that milk is a biological product which is easily susceptible to spoilage from the time it is drawn from the udder of the animal. The perishable nature of milk demands due care to be taken in its handling to prolong its life. In addition to the spoilage brought by microbial fermentation, milk or its products can easily become the medium for transmission of diseases.
- (b) **An essential part of diet plan:** Milk is almost a complete food and is preferred by our vegetarian population. Milk and milk products form an essential part of dietary plan. The two well recognized terms in this context are: “Milk and Public Health and Safeguarding the Milk Supply”. These aspects have been discussed here. A good quality milk is the one which satisfies the following requirements:

Quality

- (a) Wholesome and pure
 - (b) Free from sediment and foreign matters
 - (c) Good normal flavour
 - (d) Low in bacterial count and free from pathogenic microorganisms
 - (e) Free from antibiotics residues, pesticide residues and heavy metals
 - (f) Reasonably long shelf life and
 - (g) Nutritional components retained in the normal state
- (c) **Export potential:** Our country being the number one in milk production in the world has the potential to export various milk products, particularly the indigenous dairy products and milk based sweets like *Rasogolla*, *Gulabjamun*, *Burfi*, *milk cake*, etc. to the third world countries provided that the quality of our products is up to the international standard and these are free from adulterants and toxicants like animal drug residues, pesticide residue, heavy metals, etc.

Milk and milk products are very prone to different type of adulterations. The quality aspects play an important role in ensuring the consumers that the food they are eating is wholesome and free from adulterants and toxic substances. Let us know about “Milk and Public Health”, “Safeguarding the Milk Supply” and “Adulteration of Milk and Milk Products” to appreciate the importance of quality. We have already been introduced to these aspects in the course 1 titled “Milk production and quality of milk”.

- i) **Milk and public Health:** There are many possibilities for contamination of milk during its journey from production point to the consumers end. The different sources of infection and corresponding important diseases are enlisted here.
- (a) Infection of milk directly from the animal (Cow/buffalo): These diseases are essentially of bovine origin. The causative organisms enter the milk through the mammary glands or through faecal contamination, and may cause a diseased condition in person who consumes the milk. Examples are: Bovine tuberculosis, undulant fever, etc.
 - (b) Infection from man to cow and then to milk: These diseases are essentially human, but can become established in the cow’s udder. Examples: septic sore throat; scarlet fever; diphtheria; etc.
 - (c) Direct contamination of milk by human beings: These diseases may be transmitted to the milk by direct contamination through human contact, either by carriers or by patients. Examples: septic sore throat; scarlet fever; typhoid fever; dysentery, gastroenteritis, diphtheria, etc.
 - (d) Indirect contamination of milk by human beings: These are human diseases, the pathogenic organisms of which enter the milk through contaminated bottles or other utensils, water supply, insect and dust. Examples: typhoid, dysentery or diarrhoea, etc.
- ii) **Safeguarding the Milk Supply:** It is desirable that milk being consumed by human being should be clean, wholesome and safe. We know that cleanliness implies freedom from extraneous matter (such as manure, dust etc) and safety means freedom from pathogenic microorganisms. The wholesomeness implies

that no nutrients from the product has been removed or destroyed. The sanitation of milk supply can be safeguarded in two ways: (a) production and handling of raw milk in such a manner as to prevent its contamination by pathogenic organisms. This will require: (i) ensuring the health of dairy cattle by various control measures; (ii) safeguarding the health of employees by regular medical examination; (iii) protection of the water supply from contamination by pathogenic organisms; (vi) flies and their control, etc. (b) Pasteurization of milk, so as to kill all pathogenic organisms and avoidance of any post-pasteurization contamination.

iii) Adulteration of Milk and Milk Products: The adulteration of milk and milk products can be defined as the process by which the quality or the nature of product is adversely affected through the addition of a foreign or an inferior substance and the removal of a vital element such as fat from milk. Adulteration may be intentional or unintentional (contamination). Adulteration in our country is very common in case of milk and milk products due to their higher price compared to plant foods. You must be aware about news paper reports about preparation of “synthetic milk” and “turning animal fat into ghee”. As a quality control team member it is our responsibility to ensure availability of unadulterated products to the consumers. Milk and milk products are adulterated with the following substances.

Unintentional adulteration or contamination: The unintentional contaminants may include antibiotic residues, pesticide residue, heavy metals and toxins secreted by different microorganisms.

Intentional adulteration: Intentional adulteration of milk and milk products is done to make more profit by the unscrupulous traders. Milk is adulterated either by the removal of its fat or addition of water, glucose, starch, urea etc. In the same way milk products are adulterated with the addition of vegetable or animal body fat, starch, arrowroot, etc.

iv) Role of quality control in preventing the adulteration of milk and milk products: Despite of the advantages of modern technology and sophisticated instrument, the menace due to adulteration/ contamination of milk and milk products is one of the leading causes of sickness or death. Food borne diseases, range from acute gastroenteritis to precancerous/ cancerous stage. Consumers are therefore offered tips in ascertaining quality of food by quick and simple tests for detection of common adulterants. National Dairy Research Institute, Karnal, has developed a platform test for detection of adulteration of milk with “synthetic milk”. The platform test is colour based test and provides the results within 5-10 minutes.

The control must take place at the point where the contamination occurs. For examples, dairy plants can make acquaint the farmers about the pricing advantages associated with quality of milk, rejection of milk and penalties linked with the adulteration and safe limits about the use of antibiotics and pesticides at farm, so that the residual limits are not exceeded in the milk supplied.

Quality Initiatives: Quality initiatives taken up in the dairy cooperative sector includes a massive awareness programme of the Government of India on Clean Milk Production (CMP) covering village Dairy Cooperative Societies (DCSs) across the country under the scheme “Strengthening infrastructure for Quality and Clean Milk Production”. Through a range of informational and educational inputs,

including a book titled “*Doodh Ki Kahani Gai Ki Zabani*” published in Hindi and in 10 other state languages, producers are made aware of hygienic milking and milk handling practices. Similarly various other schemes supported by different Ministries are also under operation. International dairy federation (IDF) and Food and Agriculture Organisation (FAO) has also published “Guide to Dairy farming Practices” focussing on the farm practices within the integrated safety and quality assurance system to ensure profitability with responsibility of protecting human health, animal health, animal welfare and the environment.

1.5 QUALITY CONTROL TASKS IN DAIRY INDUSTRY

The quality control activity in the dairy industry must cover all the quality aspects of milk and milk products and all the way from the dairy cow to the consumer. The scope of the tasks of the quality control in the dairy industry as outlined in one of the FAOs documents are outlined here.

- i. Dairy farm**
 - 1 Dairy animal
 - 1 Personnel
 - 1 Cow shed and milking parlour
 - 1 Milk handling and storage rooms
 - 1 Cold and hot water
 - 1 Milking include milking machines, utensils and materials
 - 1 Milk handling including utensils and materials
 - 1 Quality of cleaning and washing
 - 1 Milk cooling and storage
 - 1 Collection delivery
 - 1 Possible direct sales of milk on farm
- ii. Transport of milk from farm to milk collection centre or to milk plant**
 - 1 Cleanliness and conditions of transport vehicle
 - 1 Temperature during transport
 - 1 Duration of transport
 - 1 Unloading and reception methods
- iii. Milk Collection Point/Centre, Milk Processing Plant**
 - 1 Overall cleanliness and condition
 - 1 Personnel
 - 1 Cold and hot water
 - 1 Milk reception timetable
 - 1 Milk cooling and storage
 - 1 Storage time

- 1 Heat treatments
- 1 Milk handling and processing
- 1 Packaging and labelling (production and best before dates)
- 1 Storage
- 1 Loading and transport for distribution
- iv.** Transport of milk products
 - 1 Cleanliness and condition of transport vehicle
 - 1 Loading and transport system
 - 1 Temperature during transport
 - 1 Duration of transport
 - 1 Unloading system and place
- v.** Distribution and resale
 - 1 General cleanliness and conditions
 - 1 Personnel
 - 1 Cold and hot water
 - 1 Quality of cleaning
 - 1 Storage time of milk products
 - 1 Storage temperature
 - 1 Methods of handling, distribution and sale
- vi.** Functions of a Dairy Plant Quality Control Laboratory
 - 1 Raw milk quality during collection and at reception
 - 1 Various quality aspects related to processing
 - 1 Quality of finished products
 - 1 Quality of milk products during storage and distribution
 - 1 Cleanliness and hygiene at the milk processing plant
- vii.** Maintenance of Laboratory Equipment
 - 1 Routine sanitizing of all equipment
 - 1 Simple sterilization methods of equipment
- viii.** Safety in Laboratory

Check Your Progress – 2

- 1. Explain intentional and unintentional adulteration.

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- 2. Define the following terms:
 - (a) Quality Control
 - (b) Quality assurance
 - (c) Total quality management
 - (d) GMP
 - (e) Genetically Modified Food

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- 3. What are the basic functions of quality control programme?

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- 4. Name two diseases caused by prions.

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- 5. Why quality aspects are important in reference to milk and milk products?

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- 6. What are the different sources of milk infection?

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1.6 LET US SUM UP

The quality aspects are gaining importance in the era of globalization. The perishable nature of milk demands more sincere efforts and care in its handling to prolong its life and make it safe for human consumption. The quality characteristics of food

that are acceptable to consumers are comprehended under the term “Food Quality”. The important components of food quality are: food safety, sensory characteristics and nutritional value. Safety of food is a basic requirement of food quality. “Food safety” implies absence or acceptable and safe levels of contaminants, adulterants, naturally occurring toxins or any other substance that may make food injurious to health on an acute or chronic basis. The term quality assurance includes the planning and surveillance of everything to do with the quality throughout the company; and seeks to generate confidence both within the organization and externally, among its customers, that their requirements will be fulfilled. A good quality milk is the one which satisfies the following requirements: (a) Wholesome and pure, (b) Free from sediment and foreign matters, (c) Good normal flavour, (d) Low in bacterial count and free from pathogenic microorganisms, (e) Free from antibiotics residues, pesticide residues and heavy metals, (f) Reasonably long shelf life and (g) Nutritional components retained in the normal state. Quality initiatives taken up in the dairy cooperative sector includes a massive awareness programme of the Government of India on Clean Milk Production (CMP) covering village Dairy Cooperative Societies (DCSs) across the country under the scheme “Strengthening infrastructure for Quality and Clean Milk Production”. The country has a good potential to export the dairy products to the third world countries provided that the quality of our products is upto the international standards and these are free from adulterants and toxicants like heavy metals, antibiotic residues, pesticide residues and pathogenic microorganisms and their toxins. Therefore, quality or safety of milk and milk products is very important. The quality assurance exercise should begin with good quality animals.

1.7 KEY WORDS

Sensory attributes	: Attributes which can be judged with human senses.
Hidden attributes	: Those attributes of food which can not be judged with human senses such as nutritive value and presence or absence of adulterants/ toxicants.
Toxicant	: substance which cause harm or injury to human beings.
Heavy metal,	: Metals like lead, mercury, cadmium and arsenic which are harmful to human health.
Contaminant	: Any biological or chemical agent, foreign matter. or other substances not intentionally added to food which may compromise food safety or suitability .
Control measure	: (Food safety) action or activity that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level.
Pesticide residues	: Remains of pesticides or their compounds
Antibiotic residues	: Remains which are of the drugs given to cure the milch animals.
Food handler	: any person who directly handles packaged or

unpackaged food, food equipment and utensils, or food contact surfaces and is therefore, expected to comply with food hygiene requirements.

- Food hygiene** : all conditions and measure necessary to ensure the safety and suitability of food at all stages of the food chain.
- Food safety** : concept that food will not cause harm to the consumer when it is prepared and /or eaten according to intended use. It is related to the occurrence of food hazards and does not include other human health aspects related to for example, malnutrition.
- Food safety hazard** : biological, chemical or physical agent in food or condition of food, with the potential to cause an adverse health effect.
- Quality** : degree to which a set of inherent characteristics fulfils requirements.
- Quality assurance** : part of quality management focused on providing confidence that quality requirements will be fulfilled.
- Quality System** : The management system that direct and control an organization with regards to quality.
- Quality control** : To have a check on the quality of food.
- Risk** : The likelihood that an adverse health effect will occur within a population as a result of hazards in a food.
- Gastroenteritis** : Gas related problems in human beings.
- Cancerous** : Substances causing cancer in human body.

1.8 SOME USEFUL BOOKS

IS 7005: 1973-code for hygienic conditions for production, processing and transportation of milk. Bureau of Indian standards New Delhi.

IS-5239: 2000 Food Hygiene-code of practice for manufacture, storage and sale of ice-cream. Bureau of Indian standards New Delhi.

Multon, J.S. (1995) Quality control for food and Agriculture products. VCH Publishers, New York.

Food safety- Basic Concepts

1.9 ANSWER TO CHECK YOUR PROGRESS

Your answer should include the following point:

Check your progress – 1

1. Food quality is composite of good and bad attributes.
2.
 - i. Physical characteristics like viscosity/ consistency, texture, body, shape and size etc
 - ii. Chemical-concentration and forms of different nutrients, presence or absence of adulterants and contaminants, presence or absence of off flavour.
 - iii. Biological characteristics, presence or absence of beneficial or pathogenic organisms, their spores and toxins.
3. Sensory or organoleptic characteristics are those characteristics, which are judged by human senses like smell, taste, appearance, colour etc.
4. Hidden characteristics are those which can not be judged by human senses like concentration and type of different nutrients. Presence or absence of adulterants and toxicants.
5.
 - (a) Food safety implies absence or acceptable and safe levels of contaminants, adulterants, naturally occurring toxins or any other substance that may make food injurious to health on an acute or chronic basis
 - (b) Food born diseases are those, which are caused due to eating unhealthy food, which is contaminated with microorganism or toxicants which are harmful for health.

Check your progress – 2

1. Intentional adulterants are the addition of something to the food which is not the natural ingredient or removal of one or more nutrients from the food with an intention to make profit. While the unintentional adulteration is the contamination of food either due to negligence or accident with something which is not present in it or is harmful to human health..
2.
 - (a) **Quality control:** The evaluation of a final product prior to its marketing, i.e. it is based on quality checks at the end of a production chain for maintenance of prescribed standards or grading the quality of products.
 - (b) **Quality assurance:** It includes the planning and surveillance of everything to do with the quality throughout the company. It is the implementation of quality checks and procedures to immediately correct any failure and mistake that is able to reduce the quality of the interim products at every production step.
 - (c) **Total Quality Management (TQM):** The management approach to long-term success through customer satisfaction, based on the participation of all members of an organization (suppliers and distributors included) in improving processes, products, services and the working culture.
 - (d) **Good Manufacturing Practices (GMP)** is a written document of the guidelines describing the procedures, equipment facilities, and controls for operational conditions to ensure that the food meets the consumers' needs and wants, and also gives them the security of safety and reliability.

- (e) The GM foods are produced from genetically modified organisms (GMO). A GMO means: an organism that has been modified (manipulation of DNA) by gene technology.
3. The basic functions of a quality control programme are:
- 1 Physical and chemical evaluation of raw materials and processed products.
 - 1 Control of
 - d) Raw materials, ingredients and packaging supplies.
 - e) Processing parameters.
 - f) Finished products.
 - 1 Microbiological analysis and control of raw materials and finished products.
 - 1 Control of storage and handling conditions.
 - 1 Sanitation and waste products control.
 - 1 Assurance that final products are within the legal and marketing standards established.
4. **Prions** are one of the new sources of food borne diseases. A prion is the short form of proteinaceous infectious particle. Prions enter cells and are apparently believed to infect and propagate by refolding abnormally into a structure which is able to convert normal molecules of the protein into the abnormally structured form. The proteins accumulate in the brain causing holes or plaques and the subsequent clinical symptom leading to death.
- Prion diseases are grouped as transmissible spongiform encephalopathy (TSE). The diseases associated by prions are: Creutzfeldt - Jakob disease (CJD), Bovine spongiform encephalopathy (BSE- commonly known as “mad cow disease”), fatal familial insomnia and kuru (translated as “to tremble with fear”).
5. The quality aspects are important in reference to milk and milk products as: (a) Milk is perishable in nature, (b) Milk and milk products form an essential part of diet plan and (c) Good export potential particularly indigenous dairy products.
6. The different sources of infection and corresponding important diseases are enlisted here.
- (a) Infection of milk directly from the animal (Cow/ buffalo): These diseases are essentially of bovine origin. The causative organisms enter the milk through the mammary glands or through faecal contamination, and may cause a diseased condition in person who consumes the milk. Examples are: Bovine tuberculosis, undulant fever, etc.
 - (b) Infection from man to cow and then to milk: These diseases are essentially human, but can become established in the cow’s udder. Examples: septic sore throat; scarlet fever; diphtheria; etc.

- (c) Direct contamination of milk by human beings: These diseases may be transmitted to the milk by direct contamination through human contact, either by carriers or by patients. Examples: septic sore throat; scarlet fever; typhoid fever; dysentery, gastroenteritis, diphtheria, etc.

- (d) Indirect contamination of milk by human beings: These are human diseases, the pathogenic organisms of which enter the milk through contaminated bottles or other utensils, water supply, insect and dust. Examples: typhoid, dysentery or diarrhoea, etc.