

Dairy Science and Technology

1. Introductory Dairy Science

- 1.1 Milk: definition, and diagrammatic presentation of milk constituents
- 1.2 Composition of milk (fat, lactose, protein, energy, vitamins and minerals)
- 1.3 Nutritive value of milk
- 1.4 Physical chemical properties of milk
- 1.5 Factors affecting composition of milk
- 1.6 Physiology of lactation: mammary glands and hormones related to development of udder
- 1.7 Milk secretion and letdown of milk
- 1.8 Milking: methods of milking: hand vs machine milking
- 1.9 Clean milk production: importance and factors affecting the clean milk production
- 1.11 Natural flavors and off flavors of milk
- 1.12 Flavor defects in milk and their prevention measures
- 1.13 Processing of milk (Raw milk processing): Receiving , Unloading , Grading , Sampling , Weighing, Plat form tests, Collection, cooling and transportation, Straining, Filtration, Clarification, and Bactofugation, Toning and standardization, Emulsification, Homogenization, Sterilization, Pasteurization, Packaging and distribution, Storage of milk and products

2. Commercial dairy farming

- 2.1 Dairying in Nepal: Domestication of Dairy Animals, Dairy husbandry practices in old days, Dairy development in Nepal, Present situation of dairy in Nepal
- 2.2 Opportunities in dairy farming, Advantages of dairying in Nepal, Major constrains in development of dairying and Scope of dairy science in Nepal.
- 2.3 Factors determining the efficiency of dairy animals: Daly practices, Routine Practices, Practices related to Hygiene and Others.
- 2.4 Economic dairy farming: Economic planning, The basis of economic planning of dairy farm , Level of milk yield, Feeding policy, Feeding policy and stock density, Housing facilities, Seasonality in milk production, Raising replacement stock and Watching milk yield
- 2.5 Pricing policy: Objective of pricing policy, Factors affecting pricing policy, Types of price plan, Flat price plan, Classification price policy, Base surplus price policy, pricing cow milk vs. buffalo milk, Factors Affecting the Sale Price of Milk, and others Factors Determining Price of Milk
- 2.6 Starting a dairy farm: Training; Vocational training, On farm training, Choosing the project, Business judgment, Mechanical ability, Health, Practicing punctuality and regularity, Developing patience and even temperament, and Keeping up new development
- 2.7 Purchase of dairy cattle, Commencing with small project, Wage agreement, Factor affecting optimum wages, and Kinds of labor needed

- 2.8 Cost of milk production: Purpose of determining cost, Methods determining cost, Factors affecting cost, Reasons of higher cost in urban area
- 2.9 Dairying under mixed farming: Factors determining type of farming, and Advantages of mixed farming
- 2.10 Dairying under specialized farming: Degree of specialization and diversification, Advantages of specialized farming, Advantages of mixed/diversified farming and Economic upliftment of Farmers
- 2.11 Economic of dairy farming: Economic planning, The basis of economic planning of dairy farm; Size of herds, Level of milk yield, Feeding policy and stock density, Farm area devoted to dairy farm and stocking density, Housing facilities, Seasonal production policy, Raising replacement stock, Watching milk yield, Check on food quantity and quality, Labor utilization
- 2.12 Farm budgeting: Factors affecting budgeting, Importance, Objective, Requirements of budgeting, Type of budget, Budgeting methods, Process of budgeting, and Advantages of budgeting
- 2.13 Milk Storage, Disposal and Distribution: Causes of milk contamination, Handling milk prior to storage, Necessity of cooling milk before storage, Method of cooling, Media used for cooling, Storage of milk in tank, Distribution, Distribution of raw milk, Containers of milk distribution, and systems of distribution of milk
- 2.14 Procurement of dairy stock: Factors considerable when procuring dairy animals, Herd book scheme, Means of transport, Precaution and necessary arrangement
- 2.15 Herd Recording: Advantages, materials required for milk recording and Milk production record.

3. Dairy Microbiology

- 3.1 Hygienic milk production system; microbial quality of milk produced under organized v/s unorganized milk sector in Nepal and comparison with developed countries; microbial and non-microbial contaminants, their sources and entry points in milk during various stages of production.
- 3.2 Good Hygiene Practices (GHP) during milk production operations Microorganisms associated with raw milk; morphological and biochemical characteristics of important groups and their classification; significance of different groups of bacteria i.e. psychrotrophs, mesophiles, thermotolerants, and thermophiles in milk.
- 3.3 Microbiological changes in bulk refrigerated raw milk; Impact of various stages like milking, chilling, storage and transportation on microbial quality of milk with special reference to psychrotrophic organisms; Direct and indirect rapid technique for assessment of microbial quality of milk.
- 3.4 Role of microorganisms in spoilage of milk; souring, curdling, bitter cream, proteolysis, lipolysis; abnormal flavors and discoloration.
- 3.5 Mastitis milk: Processing and public health significance, organisms causing mastitis, somatic cells secreted in milk; detection of somatic cell count (SCC) and organisms causing mastitis in milk. Milk as a vehicle of pathogens; Food infection, intoxication and toxic infection caused by milk borne pathogens like E. coli, Salmonella typhi, Staph aureus, Bacillus cereus etc.

- 3.6 Antimicrobial substances in milk: immunoglobulin, lactoferin, lysozymes, LP systems etc.

4. Market Milk

- 4.1 Market milk industry in Nepal and abroad: Distinctive features of tropical dairying as compared to those of the temperate climate of developed countries.
- 4.1.1 Collection and transportation of milk;
 - 4.1.2 Organization of milk collection routes
 - 4.1.3 Practices for collection of milk, preservation at farm, refrigeration, natural microbial inhibitors, lactoperoxidase system.
 - 4.1.4 Microbial quality of milk produced on farm. Effect of pooling and storing on microbial quality of refrigerated milk. Role of psychrotrophs, Role of tropical climate on spoilage of milk.
 - 4.1.5 Chemical tests for grading raw milk.
 - 4.1.6 Microbiological tests for grading raw milk.
- 4.2 Reception and treatment (pre-processing steps) of milk in the dairy plant:
- 4.2.1 Reception, chilling, clarification and storage: General practices.
 - 4.2.2 Homogenization: Definition, pretreatments, theories, synchronization of homogenizer with operation of pasteurizer (HTST)
 - 4.2.3 Effect of homogenization on physical properties of milk.
 - 4.2.4 Bactofugation:
- 4.3 Thermal processing of milk:
- 4.3.1 Principles of thermal processing:
 - 4.3.2 Factors affecting thermal destruction of micro-organisms.
 - 4.3.3 Definition and description of processes: Pasteurization, sterilization, UHT Processing.
 - 4.3.4 Microbiology of pasteurized milk,.
 - 4.3.5 Product control in market milk plant.
 - 4.3.6 Defects in market milk.
 - 4.3.7 Manufacture of special milks: toned, doubled toned, reconstituted, recombined, flavored, homogenized vitaminised and sweet acidophilus milk.
 - 4.3.8 Manufacture of sterilized milk. i) Distribution systems for market milk. Quality and safety aspects in dairy food chain, good manufacturing practices (GMP) in dairy processing.

5. Dairy Products Processing

5.1 Khoa:

- 5.1.1 Status and significance of traditional milk products in Nepal.
- 5.1.2 Classification of types, standards methods of manufacture and preservation factors affecting yield of khoa.
- 5.1.3 Physico-chemical changes during manufacture and storage of khoa.

- 5.1.4 Mechanization in manufacture of khoa.
- 5.1.5 Confectioneries made from Khoa-Burfi, peda, Milkcake, Kalakhand, Gulabjaman and their compositional profile and manufacture practices. Rabri and Basundhi:
- 5.1.6 Product identification, process description, factors affecting yield physico-chemical changes during manufacture.

5.2 Chenna:

- 5.2.1 Product description, Standards method of manufacture, packaging an Chhena-based sweets, Rasogolla, Sandesh, Ras-malai. Mechanization of manufacturing process.

5.3 Paneer:

- 5.3.1 Product description standards method of manufacture packaging and preservation.
- 5.3.2 Physico-chemical changes during manufacture and storage.
- 5.3.3 Mechanization of paneer manufacturing/packaging process.

5.4 Dahi:

- 5.4.1 Product description method of manufacture and packaging process.
- 5.4.2 Kheer and Payasam: Product description methods of manufacture, innovations in manufacturing and packaging processes.

5.5 Cream:

- 5.5.1 Definition & Legal standards, Efficiency of cream separation and factors affecting it; control of fat concentration in cream.
- 5.5.2 Planning and operating a cream production unit) neutralization, standardization, pasteurization and cooling of cream.
- 5.5.3 Preparation and properties of different types of cream; table cream, sterilized cream, whipped cream, plastic cream, frozen cream.
- 5.5.4 Packaging storage and distribution, defects (non-microbial) in cream and their prevention.

5.6 Butter:

- 5.6.1 Introduction to the butter making process; theory of churning, Legal standards.
- 5.6.2 Technology of Butter manufacture, Batch and continuous methods. Over-run in butter; control of fat loses in butter-milk; packaging and storage. transportation.

5.7 Ghee

- 5.7.1 Methods of ghee making-batch and industrial processes, innovations in ghee production, procedure, packaging and preservation of ghee; utilization of substandard milk.
- 5.7.2 Ghee: Composition and changes during manufacture fat constants.

5.8 Cheese

- 5.8.1 Origin and history of development of cheese manufacture, status and scope in Nepal and abroad.

- 5.8.2 Definition, standards and classification of cheese.
- 5.8.3 Milk quality in relation to cheese making. Treatment of milk; Physical and chemical. Cheese additives and preservatives.
- 5.8.4 Role of starter culture in relation to cheese quality. Rennet preparation and properties, rennet substitutes.
- 5.8.5 Action of rennet on milk in relation to cheese making.
- 5.8.6 Manufacture of different varieties of cheese: Cheddar, Gouda, Swiss, Mozzarella, Cottage and chhupi.
- 5.8.7 Microbiological changes during preparation ripening in cheese.
- 5.8.8 Role of milk constituents and changes during manufacture and ripening in cheese. Factors affecting yield of cheese. Packing, storage and distribution of cheese.
- 5.8.9 Accelerated ripening of cheese.
- 5.8.10 Microbiological defects in cheese; their cause and prevention. Manufacture of processed cheese, cheese spread and processed cheese foods.
- 5.8.11 Mechanization and automation in cheese processing. Microbiological critical control of cheese cold store.

5.9 Ice-Cream

- 5.9.1 History, development and status of ice cream industry, History, development and status of ice cream industry.
- 5.9.2 Definition, classification and composition of ice cream and other frozen desserts, Stabilizers and emulsifiers their classification, properties and role in quality of ice-cream,
- 5.9.3 Technological aspects of ice cream manufacture,
- 5.9.4 Effect of process treatments on the physico-chemical properties of ice-cream mixes and ice cream.
- 5.9.5 Processing and freezing of ice-cream mix and control of over run, Packaging, hardening, storage and shipping of ice-cream,
- 5.9.6 Defects in ice cream, their causes and prevention, Physico-chemical properties of icecream and compositional standards. Technology for preparation of dried ice-cream milk mix. and Nutritive value of ice-cream.

5.10 Condensed and Dried Milk

- 5.10.1 Definition and legal standards: Condensed milk, sweetened condensed milk and evaporated milk.
- 5.10.2 Manufacture of evaporated milk, Grading and quality of raw milk for condensed and evaporated milk, Physico-chemical changes taking place during manufacture of condensed milk, Heat stability of milk and condensed milk,
- 5.10.3 Physico-chemical properties of condensed milk and role of stabilizers in the stability of condensed milk, Chemical defects in condensed milk, their causes and prevention..
- 5.10.4 Manufacture of skim milk powder (SMP), whole milk powders and heat classified powders, Physico-chemical changes taking place during manufacture of dried milks,

- 5.10.5 Physical properties of dried milks, Defects in dried milk during manufacture and storage, their causes and prevention
- 5.10.6 Manufacture of infant foods, malted milk foods and other formulated dried products,
- 5.10.7 Microbiological quality of various dried milks including infant foods and Management of condensed and dried milk industry.