

# The Complete Technology Book on Meat, Poultry and Fish Processing (2nd Revised Edition)

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India is endowed with the largest livestock population in the world. Livestock and poultry in Indian tropical and sub tropics play a critical role in agriculture economy by providing milk, meat, eggs etc and provide flexible reserves during period of economic stress and buffer against crop failure. Mutton and Chicken is an important livestock product which in its widest sense includes all those parts of the animals that are used as the food by the man. So, with increase in population there is also an increasing consumer demand for food products that are low in fat, salt and cholesterol at local, national and international levels. Food manufacturers need to be able to produce meat, poultry and fish products which are considered to be healthy and that can meet the consumer demands. Meat industry, although is a very developing stage in India, is the top food industry in the world. Processed meat products are poised for continuous growth in the country. Poultry is one of the fastest growing segments of the agricultural sector.

The main aim of this book is to provide complete guide on meat, fish and poultry processing. Owing to the wide variety of products and type of processes and treatments (curing, dry curing, fermentation, cooking smoking etc), this products need particular analytical methodologies for proper consumption. It examines the nutritional principles behind the drive for reductions in fat, salt and cholesterol in our diet, and illustrates formulations and procedures utilized to produce such products. The reader would get to explore brief discussion regarding the Indian meat industry followed by the next chapter which includes structure, composition and nutritive value of meat tissues, postmortem changes and some meat quality parameters are also added in the preceding chapters. It also discuss about meat cutting and packaging, processing of meat and meat products, microbial and other deteriorative changes in meat and their identification, chemical composition and nutritive value of poultry meat, pre slaughter handling, transport and dressing of poultry, fish products, freezing fish fillets, miscellaneous fish dishes, spreads, salads, loaves fish spreads for appetizers, sandwiches, shellfish and miscellaneous marine products, meat removal and pre freezing treatment, packing and freezing, classes and sizes of fresh and frozen oysters, freezing whole raw lobsters etc. The book contains manufacturing processes of various meat, chicken and fish products in much illustrative manner. Special content on machinery equipment photographs along with supplier details has also been included.

It is anticipated that, it turns out to be a resourceful book for entrepreneurs, technocrats, food technologists and others linked with this industry; as this would be an invaluable reference

source for meat, poultry and fish processors, and food industry personnel involved in the development and marketing of new products.

## 1. INDIAN MEAT INDUSTRY

Livestock Resource

Meat Production

World Scene

Processed Meat Industry

## 2. STRUCTURE, COMPOSITION AND NUTRITIVE VALUE OF MEAT TISSUES

Structure of Muscle Tissue

Skeletal Muscle and Associated Connective Tissue

Smooth Muscles

Cardiac Muscles

Composition of Muscle Tissue

Water

Protein

Lipids

Carbohydrates

Minerals

Vitamins

Nutritive Value of Meat Tissues

## 3. POSTMORTEM CHANGES

Loss of Homeostasis

Postmortem Glycolysis and pH Decline

Rigor Mortis

Loss of Protection from Invading Microorganisms

Degradation due to Proteolytic Enzymes

Loss of Structural Integrity

## 4. SOME MEAT QUALITY PARAMETERS

Meat Colour

Water Holding Capacity

Marbling

Quantum of Connective Tissue

Firmness

Meat Storage Conditions

Cold Shortening

Thaw Rigor

Antemortem Factors Affecting Meat Quality

## 5. MEAT CUTTING AND PACKAGING

Wholesale Cuts of Lamb Carcass

Wholesale Cuts of Buffalo or Beef Carcass

Grading

Packaging

Overwraps

Tray with Overwrap

Shrink Film Overwrap

Vacuum Packaging

Modified Atmosphere Packaging

## 6. PROCESSING OF MEAT AND MEAT PRODUCTS

Basic Processing Procedures

Cured and Smoked Meats

Hams  
Commercial Processing of Ham  
Cooked Ham  
Country Ham  
Prosciutto  
Bacon  
Commercial Processing of Bacon  
Sausages  
Classification  
Processing Steps  
Formulations of Some Sausages with Special Features  
Intermediate Moisture and Shelf Stable Meat Products  
Humectants  
Basic Processing Techniques  
Stability of Intermediate Moisture Meats  
Hurdle Concept  
Restructured Meat Products  
Other Popular Meat Products  
**7. MICROBIAL AND OTHER DETERIORATIVE CHANGES  
IN MEAT AND THEIR IDENTIFICATION**  
Sources of Microbial Contamination of Meat  
Growth of Microorganisms in Meat  
Deteriorative Changes in Meat  
Identification of Meat Spoilage  
**8. FRAUDULENT SUBSTITUTION OF MEAT AND  
ITS RECOGNITION**  
Recognition of Fraudulent Substitution or Adulteration  
Physical Methods  
Anatomical Methods  
Dentition  
Bone Percentage of Carcass  
Ribs on the Thorax  
Characteristics of Long Bones  
Histological Methods  
Chemical Methods  
Composition of Body Fats  
Immunological/Serological Methods  
Electrophoretic Methods  
Isoelectric Focusing  
Enzyme-Linked Immuno Sorbent Assay (ELISA)  
**9. CHEMICAL COMPOSITION AND NUTRITIVE  
VALUE OF POULTRY MEAT**  
Chemical Composition  
Moisture  
Protein  
Fat  
Carbohydrate  
Vitamins  
Minerals  
Nutritive Value  
**10. PRE-SLAUGHTER HANDLING, TRANSPORT  
AND DRESSING OF POULTRY**  
Pre-slaughter Care and Handling

Transport  
Dressing of Poultry  
Slaughtering  
Scalding  
Defeathering  
Singeing  
Washing  
Removal of Feet and Oil Gland  
Evisceration  
Chilling and Draining  
Washing  
Grading  
Packaging  
Storage

#### 11. ANTEMORTEM AND POSTMORTEM EXAMINATION OF POULTRY

Antemortem Inspection of Poultry  
Postmortem Inspection

#### 12. PROCESSING OF SOME CONVENIENCE POULTRY PRODUCTS

Tandoori Chicken  
Chicken Barbecue  
Chicken Seekh and Shami Kababs  
Chicken Kofta  
Poultry Pickle  
Chicken Samosa  
Chicken Sausage  
Chicken Patties  
Chicken Tikka

#### 13. ROLE OF MEAT AND POULTRY PRODUCTS IN HUMAN NUTRITION

#### 14. CURED MEATS

General Recommendations  
Thawing Frozen Cuts  
Sanitation is Important  
Curing Cellar Temperature  
Curing Methods for Large Meat Cuts  
Artery Pumping  
Injecto Curing  
Sweet Pickle Cure  
Dry Cure  
Curing Pickle Ingredients and Government Regulations  
Permitted Moisture Content  
Phosphates  
Ascorbates  
Flavourings  
Preparing Pickles for Curing  
Pumping Pickles  
Using Sodium Erythorbate (or Sodium Ascorbate)  
Without Phosphate and Sodium Erythorbate  
When Phosphates are Used  
Government Regulations Concerning Destruction of Trichinae  
Boneless Pork Loins and Loin Ends

Coppa  
Freezing to Destroy Trichinae  
Management Assistance in Safeguarding Processed Meats  
Hams and Picnics  
Curing Whole Smoked Hams  
Arterial Pumping of Pickle  
Pumping Scales  
Pumping  
Fast Cure  
Full Cure  
Procedure for Smoking  
Marketed as Uncooked Hams  
Ready to Eat Fully Cooked Hams  
Artery-Pumped Smoked Picnics (Shoulders)  
Ready-to-Eat Fully Cooked Picnics  
Boneless Oval Shaped and Elongated Ready-to-Eat  
Smoked Hams in Fibrous Casings  
Processing Procedure  
Boneless of Bone-in-Pear-Shaped Ready-to-Eat Smoked  
Hams Processed in Stockinette  
Processing Procedure  
Export Hams and Picnics  
Processing Procedure  
Boiled Hams  
Processing Procedure  
Canned Hams (Pear-Shaped and Pullman)  
Processing Procedure  
Washing and Boning  
Smoke is Optional  
Filling and Pressing  
Cooking  
Cooling  
Keep Under Refrigeration  
Prosciutti (Italian-Style Hams)  
Processing Procedure  
Pork Butts and Loins  
Capocollo (Italian-Style Cured Butts) (Also Capicola, Capacola)  
Dry Cure Procedure  
Fully Cooked Ready-to-Eat Capocollo  
Curing  
After-Cure Treatment  
Smoking  
Final Treatment  
Twins Wrapping  
Smoked Boneless Butts  
Processing Procedure  
Dewey Hams (Loins)  
Processing Procedure  
Canadian-Style Bacon  
Curing  
Stuffing (Encasing)  
Smoking  
After-Smoke Treatment

Bacon (Bellies)  
Continuous Process with Overnight Cure  
Box Dry-Cured Bacon  
Processing Procedure  
Dry Penetronic-Cured Bacon  
The Penetronic Machine  
Processing Procedure  
Injecto-Cured Bacon  
Injecto Process  
Cured Beef Products  
Beef Bacon  
Dried Beef for Slicing  
Dried Beef for Slicing (Fast Method)  
Processing Procedure  
Kosher-Style Corned Beef Brisket  
Curing Pickle  
Curing  
Packaging  
Cooked Corned Beef Rounds  
Curing Pickle  
Curing  
Boning  
Aging and Flavour Development  
Molding and Cooking  
Chilling and Stuffing  
Peppered Beef Rounds  
Boning  
Aging  
Smoking and Cooking  
Packaging  
Pastrami  
Curing Pickle  
Curing  
Rubbing  
Smoking and Cooking  
Chill and Package  
Cured and Smoked Beef Tongues  
Artery Pumping and Curing  
Cover Pickle Curing  
Smoking  
Cured and Cooked Beef Tongues Canned in Tin or  
Glass Containers  
After-Cure Treatment  
Packaging  
Processing  
For Tin Containers  
For Glass Containers

## 15. SAUSAGES

Fresh Sausages  
Low Temperatures are Important  
Practice Strict Sanitation  
Destruction of Trichinae  
Avoid Smeary Texture

Use of Spices  
Shelf-Life  
Casings and Stuffing  
Processing Procedure  
Hot Whole Hog Sausage  
Processing Procedure  
Procedure  
Seasoning Formulas  
Meat Selection  
Grinding and Mixing  
Italian-Style Sausage  
Processing Procedure  
Fresh Chorizos  
Bockwurst (White Sausage)  
Bockwurst using Nonfat Dry Milk  
Dry and Semidry Sausages  
Government Regulations  
Selection of Meats  
Cleanliness of Kitchen and Equipment  
The Sausage Making Procedure  
Dry Salami  
Processing Procedure  
Genoa Salami  
Processing Procedure  
Salami De Milano  
Salami Dâ€™Arles  
Processing Procedure  
Dried Farm Sausage  
Processing Procedure  
Pepperoni Sticks  
Processing Procedure  
Dried Chorizos  
Processing Procedure  
Tiroler Landjager Sausage  
Processing Procedure  
Mortadella (Dry Process)  
Mortadella-Style Sausage using Nonfat Dry Milk  
Krakauer Dry Sausage  
Cervelat Summer Sausage  
Cervelat Sausage using Nonfat Dry Milk  
Thuringer-Style Sausage using Nonfat Dry Milk  
Semidry Sausages using Lactic Acid Starter Culture  
Suggestions for Producing a Semidry Sausage with Lactacel  
Lactic Acid Starter Culture  
Meat Formulation  
Spice Formulation  
Grinding and Mixing  
Addition of Starter Culture  
Stuffing  
Smoking Schedule  
Cervelat Summer Sausage with Lactic Acid Starter Fermentation  
Smoking Procedure for Both Methods  
Thuringer Summer Sausage with Lactic Acid Starter Fermentation

Thuringer Sausage using Lactic Acid Starter Culture  
Meat Formulation  
Spice Formulation  
Hot Bar Sausage using Lactic Acid Starter Culture  
Critical Factors Related to the Use of Starter Culture (Lactacel)  
Cooked Smoked and Unsmoked Sausages (Frankfurters, Wieners, Bologna Types)  
MID Regulations Concerning Added Materials in  
Sausage Products  
New FDA Ban on Premixed Commercial Seasoning Containing Sodium Nitrite  
Outline of Rapid Processing Procedure for Skinless Frankfurters Through Conveyor System  
Bologna-Type Sausages: Jumbo, Long, and Ring  
Chopping Operation using Grinder  
and Conventional Chopper  
Chopping Operation when High-Speed Chopper is used  
Chopping Operation when Grinder, Conventional Chopper,  
and an Emulsifier are used  
Chopping Operation when High-Speed Chopper and  
an Emulsifier are used  
Chopping Operation using Grinder, Mixer, and an Emulsifier  
Other Added Materials  
Stuffing  
Smoking and Cooking  
Fast Process using Combination of Glucono Delta Lactone or Sodium Acid Pyrophosphate and  
Sodium Erythorbate  
Frankfurter Sausages (Wieners)  
Chopping Operation using Grinder and Conventional Chopper  
Chopping Operation when High Speed Chopper is used  
Chopping Operation when Grinder, Conventional Chopper and Emulsifier are used  
Chopping Operation when High Speed Chopper and  
Emulsifier are used  
Chopping Operation using Grinder, Mixer, and Emulsifier  
Added Materials  
Stuff  
Smoke and Cook  
Fast Process using Combination of Glucono Delta Lactone with or without Sodium Acid Pyro-  
phosphate and Sodium Erythorbate  
Oil Spice for Smoked Meat Flavor  
Ring Bologna using Nonfat Dry Milk  
Large Bologna using Nonfat Dry Milk  
Bologna Formulas using Soy Protein  
High Grade Frankfurter using Nonfat Dry Milk  
Processing Data  
Frankfurter using Soy Protein Concentrate  
Hot Dogs Extended with Textured Vegetable Protein  
Skinless Frankfurters using Nonfat Dry Milk  
Skinless Cheesefurters using Nonfat Dry Milk  
Cooked Salami (Salami Cotto)  
Cooked Salami Cotto (Perishable) Finest Quality Cooked  
Salami in 3- or 6-LB Cans  
Salami Cotto using Nonfat Dry Milk  
Kosher and Kosher-Style Salami  
Minced Ham  
All Meat Smoked Sausage



Smoked Link Sausage with 3½ % Cereal and Nonfat Dry Milk Added  
• Smokies • Pork Sausage  
New England Style Smoked Sausages  
Smoked Italian-Style Hot or Mild Sausage  
All Meat Polish Sausage  
Polish Sausage in Vinegar Pickle  
Polish Sausage Containing 3½ % Cereal and Nonfat Dry Milk  
Polish Style Sausage with Textured Soy Protein  
Polish-Style Sausage using Nonfat Dry Milk  
Blood Sausage  
Cure Pork Tongues  
Cure Beef Blood  
Cure Beef Shank Meat  
Cure Pork Snouts  
Cure Pork Jowls or Backfat  
Precook Meats  
Grind, Chop, and Mix  
Stuff and Tie  
Cook  
Chill  
Smoke Bung-Encased Sausages  
Keep Product Refrigerated  
Liver Sausage Smoked or Unsmoked  
Keep Product Refrigerated  
Braunschweiger Liver Sausage  
Braunschweiger-Style Liver Sausage with Soy Protein  
Braunschweiger with Isolated Soy Protein  
Braunschweiger-Style Liver Sausage using Nonfat Dry Milk  
Kosher-Style Liver Sausage  
Farmer-Style Liver Sausage  
Bohemian Liver Sausage  
Homemade German-Style Liver Sausage (Housmacher Leberwurst)  
Hungarian-Style Rice Liver Sausage  
Ring Liver Pudding  
Cooked Krakauer Sausage  
Berliner Sausage using Nonfat Dry Milk  
Knockwurst  
Thuringer Knockwurst  
Knoblauch Sausage using Nonfat Dry Milk  
Acme Sausage using Nonfat Dry Milk  
Miscellaneous Sausages  
Heat-and-Serve Pork Sausage  
Best Quality Canned Pork Sausage  
Canned Bulk Breakfast Sausage with 3½ % Cereal Added  
Sausage Canned in Vegetable Oil (Good Quality)  
Suggested Process  
Final Chill  
Canned Chorizos in Lard  
Canned Vienna Sausages  
Canned Imitation Vienna Sausage  
Canned Vienna Sausages with Beans and Tomato Sauce  
Prepare Vienna Sausages  
Prepare Beans

Prepare Sauce  
Fill Cans  
Suggested Process  
Vienna Sausages Packed in Barbecue Sauce  
Canning Procedure  
Suggested Process  
Cocktail Frankfurters in Glass Jars  
Retort  
Suggested Process

## 16. FISH PRODUCTS

Separating Fish Flesh from Bones and Skin Mechanically  
Yield of Flesh and Waste from some Pacific Ocean Fish Passed through a Laboratory-Model  
Flesh Separator  
Reducing Drip Loss in Fish Fillets  
Treatment for Freezing  
Results of Tests on Fresh Fish  
Manufacturing Fish Flour (Fish Protein Concentrate)  
Salted and Pickled Fish  
Salting Fish  
Salting of Cod, Lusk, Haddock, Hake, and Pollock  
Cleaning  
Salting  
Drying  
Skinning and Boning  
Salting Mackerel  
Salting Salmon  
Salting Mullet  
Dry-Salting  
Brine-Salting  
Bismark Herring and Variations  
Cut Spiced Herring  
Pickled Herring for Rollmops, Cut Spiced, or Bismark Herring  
Herring in Wine Sauce  
"Scotch-Cured" Herring  
Rollmops  
Herring in Sour Cream Sauce  
Matjeshering  
Gaffelbiter  
Gabelebissen  
German Delicatessen Anchovies  
Scandinavian Anchovies  
Russian Sardines  
Potted Herring  
Fish Pickled in Wine  
Pickled Haddock Fillets  
Pickled Salmon  
Pickled and Spiced Mackerel Fillets  
Pickled Eels  
Canning Frozen-at-Sea Tuna  
Canning Fresh Tuna  
Canning Salmon  
Canning Mackerel  
Canning Sardines in Oil

Canning California Sardines  
Canning Herring  
Canning Shad  
Canned Salmon Caviar Canape Spread Base  
Canned Fish Chowder  
Make a Fish Broth First  
Fill Cans  
Suggested Process  
Canned Norwegian-Style Fish Balls (Fiskeboller)  
Suggested Process  
Canned Salmon or Tuna Loaf in 12-oz or 3-or 6-Lb Oblong Cans  
Canned Fish Cakes  
Frozen Fish  
Freezing Minced-Fish Blocks  
Preparation of Minced Fish Flesh  
Preparation of the Frozen Blocks  
Freezing Ready-to-Heat-and-Eat Fish Sticks  
Forming Fillet Blocks  
Freezing Fillet Blocks  
Cutting the Fish Sticks  
Coating the Sticks  
Frozen Foods Dipping Batter Mix  
Frozen Foods Breading Mix  
Cooking the Sticks  
Cooling and Packaging the Cooked Sticks  
Freezing  
Freezing Fish Fillets  
Fillets or Pieces of Breaded Fish  
Freezing Halibut and Salmon Steaks  
Steaking the Frozen Whole Fish  
Freezing  
Frozen Heat-and-Eat Fried Fish  
Frozen Fish Chowder  
Frozen Fish Stew  
Frozen Tu-Noodle  
Frozen Swordfish au Gratin  
Smoked Fish  
Smoking Salmon  
Hard-Smoked Salmon  
Barbecued Sablefish (Kippered Black Cod)  
Canned Smoked Salmon Spread  
Suggested Process  
Processing Kippered Salmon  
Processing Kippered Herring  
Canning Kippered Herring  
Smoking Herring  
â€œBloatersâ€•  
Smoking Halibut  
Smoking Haddock (Finnan Haddie)  
Finnan Haddie (Scotch Method)  
Smoking Alewives or River Herring  
Smoking Mackerel  
Smoking Sturgeon

Smoking Eels  
Smoking Carp  
Miscellaneous Fish Dishes, Spreads, Salads, Loaves  
Fish Spreads for Appetizers, Sandwiches  
Fish Loaf  
Fried Fish Cakes  
Marinating Fried Small Fish  
Fish Sausage  
Salmon Salad  
Alternatives  
Tuna Salad  
Tuna Salad with Textured Vegetable Protein  
Smoked Herring Salad  
German-Style Herring Salad  
Italian-Style Herring Salad  
Alaska-Style Herring Salad  
Tuna Souffle  
Salmon Loaf  
Tuna Noodle Casserole  
Lutefisk

Standard Cooking Procedure

## 17. SHELLFISH AND MISCELLANEOUS MARINE PRODUCTS

Shrimp

Freezing Shrimp

Preparation of Raw Shrimp

Blast Freezing Shrimp

Freezing Glazed Shrimp

Freezing Cooked Shrimp

Canning Shrimp

Suggested Process

Frozen Shrimp in Creole Sauce

Frozen Shrimp Bisque

Frozen Shrimp Creole

Frozen Curried Shrimp

Frozen Shrimp Patties with Textured Vegetable Protein

Flavour Base for Rice Pilaf with Freeze-Dried Shrimp

Smoked Shrimp

Pickled Spiced Shrimp

Clams

Preparing Clams for Freezing

Soft Clams

Hard Clams (Quahog)

Surf Clams

Freezing

Canning Razor Clams

Canning Clam Extract

Canning Clam Nectar

Maryland Fried Clams

Canned Clam Chowders

For Manhattan Chowder

For New England Chowder

Batch Process

Canned Clam Stew (Hot Pack)

Frozen New England Clam Chowder  
Made from Fresh Clams  
Made from Canned Clams  
Packaging  
Canned Manhattan Clam Chowder  
For Condensed Canned Chowder  
Frozen Manhattan Clam Chowder (Batch Process)  
Frozen Clam Patties  
Crabs  
Canning Pacific Crab Meat  
Freezing Blue Crab Meat  
Cooking  
Meat Removal  
Freezing Soft-Shell Crabs  
Freezing King Crab Meat  
Freezing King Crab Legs in the Shell  
Freezing Dungeness Crab in the Shell  
Freezing Dungeness Crab Meat  
Cooking  
Meat Removal and Prefreezing Treatment  
Packing and Freezing  
Frozen Crab Cakes  
Frozen Deviled Crabs  
Packaging  
Frozen Crab Cakes  
Frozen Deviled Crab Pastries  
Frozen Crab Imperial  
Prepare White Sauce  
Prepare Crab  
Package and Freeze  
Chesapeake Bay Crab Imperial  
Frozen Crab Cocktail Balls  
Frozen Crab Patties  
Frozen Crabburgers  
Oysters  
Freezing Oysters  
Classes and Sizes of Fresh and Frozen Oysters  
Canning Oysters  
Frozen Oyster Stew  
Prepare Base  
Prepare Oysters  
Package  
Chesapeake Bay Oyster Stew  
Frozen Oyster Patties  
Virginia Pickled Oysters  
Lobsters  
Freezing Whole Raw Lobsters  
Freezing Spiny Lobsters  
Canning Lobster  
Frozen Lobster Chowder  
Frozen Lobster Newburg  
Frozen Lobster Bisque (Batch Process)  
Miscellaneous Marine Products

Freezing Sea Scallops  
Shucking and Washing  
Bagging and Icing  
Freezing and Storing  
Frozen Seafood Croquettes  
Crayfish Bisque  
Prepare the Crayfish  
Prepare a Dressing  
Prepare the Bisque  
Fill and Process  
Canning Mussels  
Pickling Mussels  
Pickled Mussels  
Canned Pickled Mussels  
Preparing Abalone Steaks  
Frozen Batter-Dipped Abalone Patties  
Fresh-Grain Russian Caviar  
Pickled Grainy Caviar  
Pasteurized Caviar  
Preparation of the Roe  
Pasteurization  
Dried Mullet Roes  
Freezing Sea Urchin Roe  
Freezing Turtle Meat  
Canned Terrapin Stew  
Suggested Process  
Canned Snapping Turtle Stew  
Preparation of Agar-Agar  
Dried Shark Fins  
Shark-Flesh Paste

## About NIIR

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