

Meat Hygiene and Food Safety

Mohammad Rashid
Rajesh Agarwal

About the Book

This book is a hand book, useful for the undergraduate and post graduate students of veterinary colleges. It is written as per the new VCI syllabus for VPE-321 and VPE-605 courses. It is easy to handle and read. It also meets the requirements of aspirants for competitive examinations and veterinarians posted in meat inspection in different slaughter houses/ municipalities etc.

Contents of the Book

- ❖ Introduction to veterinary public health
- ❖ Meat hygiene and elements of meat inspection
- ❖ Ante-mortem inspection of meat animals
- ❖ Humane and ritual methods of slaughtering
- ❖ Post-mortem inspection of meat animals
- ❖ General pathological conditions of food animals and judgement
- ❖ Bacterial diseases and judgement
- ❖ Parasitic diseases and judgments
- ❖ Meat borne diseases, their classification prevention and control
- ❖ Occupational injuries and infections
- ❖ Food of animal origin
- ❖ Rigor mortis and lymphnode examination
- ❖ Preservation of meat
- ❖ Hygienic management of a modern abattoir
- ❖ Transportation of meat animals
- ❖ Sanitary and phyto-sanitary measure agreement and control of zoonoses
- ❖ Food safety-hazard analysis and critical control system



Narendra Publishing House
Publishers & Distributors

1417 Kishan Dutt Street
Maliwara, Delhi-110006 (INDIA)
Ph.: 91-11-23268470; 91-11-23259412

Email: info@nphindia.com, nphindia@gmail.com www.nphindia.com



Meat Hygiene and
Food Safety

Meat Hygiene and
Food Safety
664.9 RAS/M
595



Mohammad Rashid
Rajesh Agarwal

Meat Hygiene and Food Safety

664.9 RAS/M

CASMTVK



MEAT HYGIENE AND FOOD SAFETY

by :

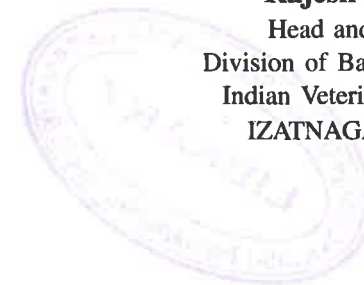
Mohammad Rashid

Division of Veterinary Public Health and Epidemiology
Sher-e-Kashmir University of Agricultural Sciences and Technology,
JAMMU - 180012

and

Rajesh Kumar Agarwal

Head and Principal Scientist
Division of Bacteriology and Mycology
Indian Veterinary Research Institute,
IZATNAGAR - 243122, Bareilly



NARENDRA PUBLISHING HOUSE
DELHI-110006 (INDIA)

Copyright © 2013, Narendra Publishing House, Delhi (India)

All rights reserved. Neither this book nor any part may be reproduced or used in any form or by any means, electronic or mechanical, including photocopying, microfilming, recording, or information storage and retrieval system, without the written permission of the publisher and author.

The information contained in this book has been obtained from authentic and reliable resources, but the authors/publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors/ publisher have attempted to trace and acknowledge the materials reproduced in this publication and apologize if permission and acknowledgements to publish in this form have not been given. If any material has not been acknowledged please write and let us know so we may rectify it.

First Edition 2013

ISBN: 978-93-82471-12-7 (HB)

ISBN: 978-93-82471-22-6 (PB)

Published by :

NARENDRA PUBLISHING HOUSE

Publisher and Distributor

1417, Kishan Dutt Street, Maliwara,

DELHI-110006 (India)

Phones: 91-011-23268470, 91-011-23259412

E-mail: info@nphindia.com Website: www.nphindia.com

Laser Typeset by Amrit Graphics, Shahdara, Delhi 110 032

Printed in India Rashtriya printers, Delhi



Contents

Preface

xiii

1. INTRODUCTION TO VETERINARY PUBLIC HEALTH.....	1
1.1 Introduction	1
1.2 Famous Veterinarians who have Contributed in the Field of Public Health	4
1.3 Areas of Veterinary Public Health, Public Health and Veterinary Medicine	5
1.4 Justification of Veterinarians Participation in Public Health Activities	5
1.5 Activities of Veterinary Public Health	6
1.6 Objectives of the Course	7
1.7 Public Health Organization and Veterinarians Place on the Team	7
1.8 Blue Print for Veterinary Public Health Activities in India	9
2. MEAT HYGIENE AND ELEMENTS OF MEAT INSPECTION	13
2.1 Introduction	13
2.2 Objectives of Meat Hygiene	13
2.3 Elements of Meat Hygiene	14
2.3.1. Sanitation	14
2.3.2 Ante-mortem Examination	15
2.3.3 Post-mortem Examination	16
2.3.4 Hygienic Methods of Slaughter	16
2.3.5 Re-inspection	16
2.3.6 Labeling	16
2.4 The Reasons for Veterinary Examination of Livestock for Slaughter, ...	16
2.5 Emphasisation of Good Hygiene Practices in India for Clean and Wholesome Meat	17

3. ANTE-MORTEM INSPECTION OF MEAT ANIMALS.....	19
3.1 Purpose of Ante-mortem Examination/Aims and Objectives:	19
3.2 Guidelines and Procedure for Ante-Mortem Inspection:	20
3.3 Abnormalities to be Checked on Ante-Mortem Examination	21
3.4 Decisions to be taken by the Veterinarian at.....	22
Ante-Mortem Inspection.	
3.5 Condemned Animals	23
3.6 Suspect Animals	23
3.7 Emergency Slaughter	23
3.8 Casualty Slaughter	23
4. HUMANE AND RITUAL METHODS OF SLAUGHTERING.....	25
4.1 Humane Slaughter	25
4.1.1 Mechanical Stunning Methods	25
4.1.2 Chemical (Carbon Dioxide-CO ₂)	28
4.1.3 Electrical (Stunning or Slaughtering with Electric Current)	28
4.1.4 Poultry Stunning and Slaughter	30
4.2 Ritual Slaughter	31
4.2.1 Jewish Shechita	32
4.2.2 Islamic Dhabihah or Zabiha	36
4.2.3 Baliss	39
5. POST-MORTEM INSPECTION OF MEAT ANIMALS.....	42
5.1 Purpose of Post-Mortem Examination (PME)	42
5.2 Facilities for Post-Mortem Inspection	43
5.3 Carcass Identification	43
5.4 Post-Mortem Inspection Procedure	43
5.4.1 Cattle	43
5.4.2 Calves	45
5.4.3 Sheep and Goats	45
5.4.4 Pigs	46
5.5 Decisions at the Post-Mortem Examination	46
5.6 Treatment of Conditionally Fit Carcasses	50
5.7 Routine Post-Mortem Chemical Tests for Judging Carcass Quality	53

6. GENERAL PATHOLOGICAL CONDITIONS OF FOOD	55
ANIMALS AND JUDGEMENT	
6.1 Localized Condition	55
6.2 Generalized Condition	55
6.3 Acute Versus Chronic Conditions	55
6.3.1 Acute Conditions	55
6.3.2 Chronic Conditions	56
6.4 Conditions and Judgement	56
7. BACTERIAL DISEASES AND JUDGEMENT	64
7.1 Anthrax (Malignant Pustule, Malignant Edema,	64
Rag Picker's Disease, Wool Sorter Disease Hide and Porter Disease, Splenic Fever)	
7.2 Salmonellosis	65
7.3 Haemorrhagic Septicemia	66
7.4 Pneumonic Pasteurellosis of Cattle (Shipping Fever, Transit Fever)	67
7.5 Pasteurellosis in Rabbits (Snuffles, Pneumonia)	67
7.6 Pneumonic Pasteurellosis: (Enzootic Pneumonia	70
of Sheep and Goat)	
7.7 Brucellosis (Bang's Disease, Contagious Abortion,	71
Undulant Fever, Malta Fever).	
7.8 Black Quarter (Black Leg)	71
7.9 Botulism	72
7.10 Tuberculosis	73
7.11 Tularemia	74
7.12 Yersiniosis	75
7.13 Q-Fever (Queensland Fever, Nine-mile Fever)	76
7.14 Avian Influenza (Fowl Plague, Highly Pathogenic	77
Avian Influenza (HPAI)	
8. PARASITIC DISEASES AND JUDGMENTS.....	80
8.1 Protozoan	80
8.1.1 Amoebiasis (Amoebosis)	80
8.1.2 Balantidiosis (Balantidiasis)	80

8.1.3	Besnoitiosis	81
8.1.4	Cryptosporidiosis	82
8.15	Babesiosis (Texas Fever, Piroplasmosis, Red – Water Disease, Tick Fever)	82
8.1.6	Sarcocystosis (Sarcosporidiosis)	83
8.1.7	Trypanosomiasis	84
8.1.8	Theileriosis	85
8.1.9	Toxoplasmosis	85
8.2	Helminthes	87
8.2.1	Trichinellosis (Trichinosis)	87
8.2.2	Cysticercosis (Cysticercus Cellulosae Infestation)	87
8.2.3	Ascariasis	88
9.	MEAT BORNE DISEASES, THEIR CLASSIFICATION	90
	PREVENTION AND CONTROL	
9.1	Meat Borne Diseases of Chemical or Toxicological Origin	90
9.1.1	Intrinsic Toxicity	90
9.1.2	Environmentally Originated Toxic Chemicals	90
9.1.3	Chemical Preservatives	91
9.1.4	Accidental or Criminal Contamination with Chemicals	91
9.2	Endogenous Animal Infections Transmissible to Man	91
	by Meat (Zoonoses)	
9.2.1	Zoonoses Acquired Occasionally Through Intestinal Tract	91
9.2.2	Zoonoses Acquired Occupationally By Meat Handlers	93
9.2.3	Zoonoses Acquired Chiefly Through Intestinal Tract	94
9.2.4	Meat-Borne Helminthic Zoonoses	95
9.2.5	Rare Meat Borne Zoonoses	99
9.3.	Infections and Intoxications Caused by Exogenous	101
	Contamination of Meat and Meat Products (Bacterial Food Poisoning)	
10.	OCCUPATIONAL INJURIES AND INFECTIONS	104
10.1	Injuries	104
10.2	Allergies	105

10.3	Zoonoses	105
10.3.1	Anthrax (Splenic Fever / Wool Sorter's Disease, Hide and Porter's Disease)	105
10.3.2	Brucellosis	106
10.3.3	Contagious Pustular Dermatitis	106
	(CPD, Contagious Ecthyma, Orf)	
10.3.4	Erysipeloid	106
10.3.5	Erysipelas	107
10.3.6	Leptospirosis (Haemorrhagic Jaundice, Weil's Disease, Mud Fever, Swineherd Disease)	107
10.3.7	Listeriosis (Circling Disease, Mononucleosis)	107
10.3.8	Louping ill	108
10.3.9	Psittacosis and Ornithosis (Parrot Fever, Chlamydiosis)	108
10.3.10	Lyme Disease (Borreliosis, Tick-borne Meningopolyneuritis) ...	108
10.3.11	Q fever (Query Fever, Abattoir Fever, Balkan Influenza)	109
10.3.12	Ringworm (Dermatophytosis, Dermatomycosis, Tinea)	109
10.3.13	Skin Sepsis	110
10.3.14	Cutaneous Salmonellosis	110
10.3.15	Clostridial Cellulitis	110
10.3.16	Streptococcus	110
10.3.17	Tetanus (Lockjaw)	110
10.3.18	Tularaemia (Rabbit Fever, Deerfly Fever, Ohara Disease)	111
11.	FOOD OF ANIMAL ORIGIN	112
11.1	Indian Meat Industry	112
11.2	Food Animals	116
11.3	Domestication of Food Animals	117
11.3.1	Cattle	118
11.3.2	Sheep	120
11.3.3	Pigs	122
11.3.4	Goats	124
11.3.5	Poultry	125

11.3.6 Horse	126
11.3.7 Rabbits	126
11.3.8 Deer	127
11.4 Common Definitions used for Different Food Animals	127
12. RIGOR MORTIS AND LYMPH.....	129
NODE EXAMINATION	
12.1 Mechanism of Rigor Mortis Occurrence	129
12.2 Effect of Lactic Acid and Proteolytic Enzymes on Meat	130
12.3 Factors Affecting Rigor Mortis	130
12.3.1 Extrinsic Factors	130
12.3.2 Intrinsic Factors	130
12.4 Lymph Node Examination of Food Animals	131
13. PRESERVATION OF MEAT	134
13.1 Refrigeration/Chilling	134
13.2 Freezing	135
13.3 Thermal Processing	136
13.4 Canning	136
13.5 Curing	137
13.6 Smoking	138
13.7 Drying	141
13.8 Irradiation	142
14. HYGIENIC MANAGEMENT OF A MODERN ABATTOIR	144
14.1 Introduction	144
14.2 Objectives	145
14.3 Planning of Abattoir	146
14.4 Sanitation of Abattoir	155
14.5 Terminology	157
14.6 Sanitizing Agents e.g. Halogen, Quaternary Ammonium	158
Compounds, Amphoteric Compounds, Acids and Alkalis	
14.7 Abattoir Effluent Treatment	159

15. TRANSPORTATION OF MEAT ANIMALS	161
15.1 Modes of Transportation	161
15.2 Effect of Transportation on Meat Animals	162
15.3 Regulations, Recommendations and Standards for	163
Transportation of Meat Animals	
15.3.1 Loading and Unloading	163
15.3.2 Journey to Slaughter	163
15.3.3 Transport Guidelines	163
15.3.4 Welfare of Animals during Transport Order, 1994	164
(With Amendments)	
15.3.5 Transit of Animals (Road and Rail) Order, 1975	165
(Amendments 1985, 1992)	
15.3.6 Transport of Animals (General) Order 1973	165
(Amendments 1988, 1992)	
15.3.7 Transit of Animal, Order 1927	166
15.3.8 Animal (Sea Transport) Order 1930	166
15.3.9 Horses (Sea Transport) Order, 1952	166
16. SANITARY AND PHYTO-SANITARY MEASURE	167
AGREEMENT AND CONTROL OF ZONOSSES	
16.1 Introduction	167
16.2 What SPS Agreement Deals?	167
16.3 What is a Sanitary and Phytosanitary Measure?	168
16.4 Basic Goals and Objectives of Sanitary and	168
Phytosanitary Measures Agreement	
16.5 Codex Alimentarius Commission (CAC)	169
16.6 Office International des Epizooties (OIE)	169
16.7 International Plant Protection Convention (IPPC)	170
17. FOOD SAFETY-HAZARD ANALYSIS AND	172
CRITICAL CONTROL SYSTEM	
17.1 Food Safety	172
17.2 Importance of Food Safety	172
17.3 Hazard Analysis and Critical Control System	174

17.3.1 HACCP System	175
17.3.2 Hazard	175
17.3.3 Hazard Analysis	175
17.3.4 Critical Control Point (CCP)	175
17.3.5 Critical Limit	176
17.3.6 HACCP Plan	176
17.3.7 Risk Assessment	176
17.4 Principles of HACCP System	176
17.5 Model HACCP Programs	177

Preface

The main objective of meat hygiene is to produce safe and wholesome meat, maintenance of hygienic standards during livestock production at the farm of origin, transportation and subsequently at the slaughter premises. This responsibility does not end at this point only but continues through storage, marketing of meat and until it reaches at consumers doorsteps. The veterinarians because of their unique training are the most suitable persons to ensure wholesomeness of a country's meat supply. Though there are several books written with this objective, which are mostly of foreign authors in big volumes, more over costly also. This book is a text book written as per the new VCI syllabus for undergraduate level teaching, easy to handle and read. It also meets the requirements of aspirants for competitive examinations. As such, an attempt was made to compile the class lectures, internet material and other literature based on experience into a text book. The compiler of this handbook feels that it will be useful document for all those concerned viz., students, teachers, and field veterinarians engaged in ante-mortem and post-mortem inspection of meat. The readers are humbly requested to give their valuable suggestions so that it can be improved for the benefit of all.

**Mohd. Rashid
and
R.K. Agarwal**