

About the Book

This need based unique book was written exclusively on emu meat processing to provide much needed information to thousands of emu farmers across India. The information provided in this first of its kind book on emu meat processing can be utilized by emu farmers and meat processors for the advancement of emu industry. It also provides valuable information to faculty members, students, researchers and all other readers interested in this new source of meat. Owing to the limited research and scientific literature available on emu meat, the information available from other ratite birds like ostriches and rheas was incorporated in few places. The authors own research findings and his experiences were included wherever required to give crisp, practical and complete information.

The first couple of chapters provide information on ratites which also includes ostriches and rheas along with emus, their origin and importance around the World. A chapter on emu meat as an alternative meat source in India was written to know the existing situation. The first important aspect of this book is slaughter requirement for emus, effluent treatment plant, rendering units, composting, existing practices, carcass characteristics, meat and byproducts yield and optimum slaughter age for maximum fat recovery. The book also provides a valuable information on emu meat quality, composition and nutritional value of emu meat, value added products from emu meat, cooking instructions, packaging and cold storage requirements, storage stability and microbiological quality. The information on sensory attributes of emu meat relative to other meats will provide inputs to emu meat processors about its acceptability and marketing potential. A chapter on utilization of emu fat, skin, toe nails and other byproducts was also included. Important tips to emu meat processors and future needs of the industry and research group were also covered. Up-to-date relevant references were also included for the benefit of researchers and students to enable them to easily access further information. Various annexures containing the details of cost-benefits involved, suppliers of different slaughtering, rendering, packaging and meat processing machineries and their addresses were also included to provide complete information to the prospective entrepreneurs.

The information found in this book should be beneficial to the entire emu industry, from the farming and processing of emus, to the marketing of products. This will serve as a handy guide to meat scientists, faculty members and students willing to learn more about emu meat processing. Above all it will provide valuable information to consumers who will be interested to know this new and potential source of meat.

Price : PB Rs. 350/- , HB Rs. 395/- USD 30

HIND PUBLICATIONS

204, Plot No. 19, Huda Complex, Saroor Nagar,
Hyderabad -35. A.P., India
Phone: 91-40-24042046, Mobile: 093913 78805
E-mail : hindpoultry@hotmail.com, Website : www.hindpoultry.com

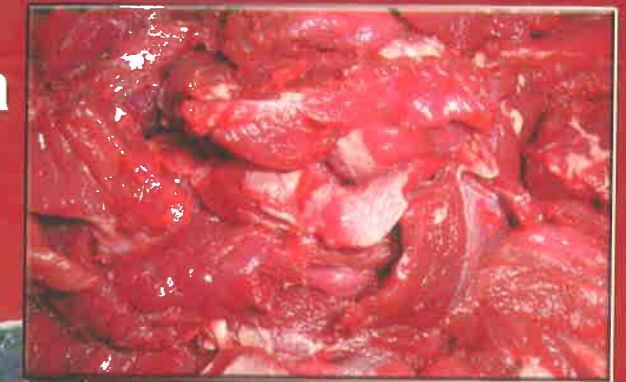
ISBN.NO :978-81-921893-9-0

EMU Meat Processing - Dr. B.M. Naveena

EMU

MEAT PROCESSING

B.M. Naveena



HIND PUBLICATIONS

2250

29



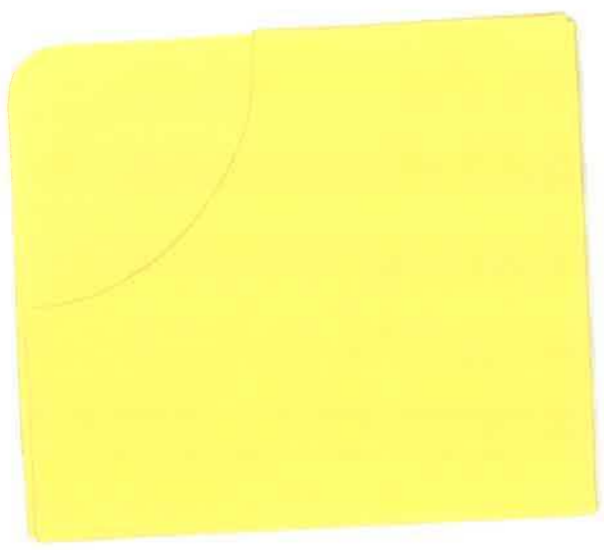
**COLLEGE OF AVIAN SCIENCES & MANAGEMENT
KVASU CAMPUS, THIRUVAZHAMKUNNU**

Acc. No. 2250.....

Call No.....

**This book should be returned on or before the
date last given below.**

--	--	--



EMU

MEAT PROCESSING

By
Dr.B.M.Naveena

HIND PUBLICATIONS
Hyderabad

Published By

HIND PUBLICATIONS

204, Plot No. 19, HUDA Complex,
Saroor Nagar, Hyderabad - 500 035, India.
Phone : 040-24042046, Mobile : 09391378805.
E-mail : hindpoultry@hotmail.com ,
Website : www.hindpoultry.com

First Edition : 2012

Price : PB Rs. 350/- , HB Rs. 395/-

ISBN : 978-81-921893-9-0

© With Publisher
All Right Reserved

No Part of this publication may be reproduce stored
in a retrieval system or transmitted, in any form or by
any mans, Electronic, Mechanical, Photo Copying,
Recording or otherwise, without the prior written
permission of the publisher.

Designed by
Smart Multimedia
Dilsukhnagar, Hyderabad.

Printed at
Akruthi Offset Printers
Chikkadpally, Hyderabad.

CONTENTS

1	Ratites _____	1 - 10
2	Emu: Alternative red meat source _____	11 - 19
3	Requirements for construction of emu slaughter house _____	20 - 27
4	Slaughtering and dressing of emu _____	28 - 38
5	Treatment and disposal of emu slaughter waste _____	39 - 42
6	Emu carcass characteristics _____	43 - 54
7	Composition and nutritive value of emu meat _____	55 - 63
8	Emu meat quality _____	64 - 70
9	Value addition and processing of emu meat products _____	71 - 80
10	Packaging and preservation of emu meat _____	81 - 91
11	Processing of emu leather _____	92 - 97
12	Processing of emu fat and other emu products _____	98 - 101
13	Emu meat: Processing tips and future needs _____	102 - 103
14	Annexures _____	104 - 111
15	References _____	112 - 116
16	Index _____	117 - 121

PREFACE

The emu industry is very young both in India and abroad. So far emu farmers are mainly involved in procuring and sale of young emu chicks for breeding purpose across India. These emu farmers have standardized their hatching, feeding, rearing and other managemental practices and are even familiar with vaccination and medication on regular basis. All their efforts have led to spreading of emus around the nation and availability of more than 14 lakh birds distributed in several states of India. Having organized this new and challenging sector, now it is time to create a potential market for these grownup birds. In their efforts to organize emu sector several emu associations have come up and everyone including few government departments are trying to find ways to better market these emu birds.

Of late, the need for organized emu slaughtering, profitable marketing of emu meat, skin, fat and other byproducts was realized. The first step in successfully marketing the emu meat will be to hygienically slaughter these birds in a modern slaughter houses and identify and quantify their quality characteristics and sensory attributes and then to market the meat accordingly. To be able to successfully market the emu meat, scientifically accurate information is needed on the nutritional value of the meat. Worldwide emu meat is considered as heart healthy and reported to have several health benefits relative to other meats. Owing to its recent entry into the food or meat market, lack of sufficient information on emu meat production, quality, storage stability, packaging requirements, value addition and sensory attributes are hindering its marketing potential.

As requested from several emu farmers, meat processors, entrepreneurs, academicians and students to provide a need based solutions to successfully market the emu meat and other products, this first of its kind book was written. The book provides scientifically valid information on the slaughtering, processing, composition and nutritional quality of meat, value addition, packaging, storage quality and sensory attributes of emu meat. It also focuses and compiles the data that is available on the yields and nutritional value of

emus that are being farmed or harvested sustainably and are found predominantly in many parts of India. The book attempts to identify and quantify some of the critical emu meat attributes and offers suggestions on how the emu industry can promote its products.

The book was written with a specific objective to diversify Indian livestock and poultry industry especially meat sector to assist in transfer of newly developed agricultural commodities to market place. The emu industry is in infancy, and future research is needed to adequately ensure that the industry can provide the quality and quantity products the consumer want. Due to the availability of limited scientific literature regarding emu meat, the author has used the findings from other similar birds like ostriches and rheas in few places for comparison and interpreted based on his own research findings and observations.

In the absence of any text book on emu meat processing both in India and abroad and due to limited emu meat research and non-availability of sufficient information, the author of this book hope that, the details covered in this book will greatly help millions of emu farmers across the World to successfully market their products.

NOTE :

B.M. NAVEENA

November, 2012

Reference is made in the annexure especially on list of companies/ manufacturers/ suppliers giving their names or brands of which the author has knowledge or experience. In no case should any such references by name to a company, ingredients or process be taken to imply the endorsement of the company over any similar companies.

INDEX

- Suman, S.P., Joseph, P., Li, S., Beach, C.M., Fontaine, M. and Steinke, L. (2010). Amino acid sequence of myoglobin from emu (*Dromaius novaehollandiae*) skeletal muscle. *Meat Science*, **86**: 623-628.
- Swart, D., Mackie, R.I. and Hayes, J.P. (1993) Fermentative digestion in the ostrich (*Struthio camelus* var. *domesticus*), a large avian species that utilizes cellulose. *South African Journal of Animal Science*, **23**: 127-135.
- Taylor, G., Andrews, L., Gillespie, J.M. and Schupp, A. (1997). Sensory Panel Comparison of Ostrich and Emu Fillets with Top Sirloin Beef, *Journal of Restaurant & Foodservice Marketing*, **2**: 55-66.
- Terevinto, A., Ramos, A., Castroman, G., Cabrera, M. C. and Saadoun, A. (2010). Oxidative status, in vitro iron-induced lipid oxidation and superoxide dismutase, catalase and glutathione peroxidase activities in rhea meat. *Meat Science*, **84**: 706-710.
- Thompson, L.D. (1995). Emu Meat. In: *Ratite Encyclopedia*, ed. Claire Drenowatz, 1st edition, San Antonio, Tex: Ratite Records.
- Thompson, L.D., Fitzgerald, D.R., Hoover, L.C., Miller, M.F., Tisdale, J.C., Butler, M. and Behrends, E. (1998). Slaughter and carcass characteristics of yearling emus. *Poultry Science*.
- Trout GR, Thomson BC, Hanrahan BG (2000) Tenderness of commercially produced Australian emu meat: effect of temperature and pH decline rate. *Food Australia* **52**, 170-172.
- Tuckwell, C. (1993). Farming of emus and processing of emu meat. *Food Australia*, **45**: 574-575.
- Van den berg, J.C. (1979) Myologia in: Baumel, J.J., King, A.S., Lucas, A.M., Breazile, J.E. & Evans, H.E. (Eds) *Nomina Anatomica Avian. An annotated anatomical dictionary of birds*, pp. 175-205 (London, Academic Press).
- Wang, Y.W., Sunwoo, H., Sim, J.S. and Cherian, G. (2000). Lipid characteristics of emu meat and tissues. *Journal of Food Lipids*, **7**: 71-82.
- Wotton, S. and Sparrey, J. (2002). Stunning and slaughter of ostriches. *Meat Science*, **60**: 389-384.

- Abattoir 20-22,28-29,95-96
- Aerobic process 41
- Age 4-6,10,15-16,18-19
- Ageing 36,38,66,70
- Air chilling, Air drying 9,82
- Amino acids 67,90
- Anaerobic process 41
- Anti-inflammatory 98-99
- Antioxidant 9
- Australia 2,8-13
- Back 17,35,37,44,47,49,70-71
- Batter 72,78
- Binders 73
- Biochemical oxygen demand (BOD) 40-41
- Birds 1-3,6-8,12-18,20-24,28-29,33,35-37,42-45,56
- Bleeding 4-5,30,33,34,37,102
- Blood 34-35,37,39-41,46,48,70,94,96
- Blooming 86
- Bones, Bone marrow 36,39,42,44,46-48,54,64
- Bowl chopper 73
- Breast 1,15,35,44,49,65
- Breeding, Breeder 2,13-19,71
- Broiler 43,44,47,56,62,66,71
- Byproducts 22,26,44,47
- Carbohydrate 55-56,90
- Carbon dioxide 4,33,41,84-85
- Carcass 3,5,6,9,21,22,28,34-36,41-51,53,66,82,122
- Casings 54,74
- Chicken 5,11,15,43,44,47,56-62,64-68,71,82,85,86
- Chick 13,15-18,104
- Chilling 9,21-22,30,36,43,66,77,81,82
- China 12,92,94
- Cholesterol 2,8,10,11,12,19,98,99,103
- Chopping 72,74
- Cold shortening 66,82
- Collagen 6,65,93,94,99
- Colour 2,3,5,6,8,9,15
- Composition 2,7,8,48,55-60,62-63,65,72,81,90,99
- Composting 22,40,42,122
- Conditioning 36,66
- Connective tissue 6,36,42,65,70,71,78,102
- Consumer 1-6,11-12,14,21,38,55,65,69-71,79,80,85-87,98,102
- Cooking 6,65,70,72,73,75,77,79,80,102-103
- Cooling 21-22,36,63,81-83
- Curing 74-75,77-78,81,93
- Cuts 4-5,12,74-75,79,83,88,96,98,102-103
- Dark colour 6,9,15,103
- Dark firm dry 64
- Declawing 96
- Deboning 22,30,66,88,102
- Deep freezer 85
- Defeathering 21-22,30,34-35,103
- Denaturation 64,69
- Deoxymyoglobin 67,85,88
- Design 19-21,29,33,35
- DFD 64

Diet 1,11,17,61-64
 Discolouration 9,67,88-89
 Distillation 75
 Domestic market 23,92,94
 Dressing 3,21,26,28,30,34,41,43,44,47-48,66,87,93
 Dressing percentage 3,43-44,47,98
 Drip loss 66,84,88-89
 Drying/ Dried meat 36,75-76,81-82
 Dry rendering 42
 Drumstick 58,60,82
 Dyeing 93,94
 Eating quality/ Eating habits 82
 Effluent, Effluent treatment plant 40-41,122
 Egg, Egg laying 8,13,15-19,54,101
 Emu 10
 Emulsion, Emulsification 72-74,76,94
 Energy, Energy value 1,57,63,73,90
 Environment 5,7,11-12,13,29,41-42,64,76,81,83,92,95
 Enzymes 58,81,90
 Equipments 27,38,86,104-107
 Evisceration 21-22,28,30,35
 Europe 4,12-13,71,76
 External fat 30,34-35,44-45,98
 Farm, Farming, Farmer 4,8,12-15,17,20,23,28-29,32,39,49,69,122
 Fat 1,2,9,10,12-14,19,22,28-30,34-36,39-48,54-59,62-64,69-70,72,74,76,79,81,89,98-103,112
 Fatty acids 2,5,8,10,11,79,90,98-100
 FDA 63
 Feathers 2,4,10,15-16,18-19,29,34-36,43,46-48,54,96,101,103
 Feed, Feeding 12-18,29,42,45,62-63,70,96,103,104
 Fertilizer 42
 Fillets 51-52,77,83
 Flavour, flavouring agent 8-9,11,66,69,70,81,85,102-103
 Food 11,20,22-25,37-38,55,58,61-63,75-76,81,89-92,102-104
 Fore quarter 51
 Formulation 38,72,74-75,78
 Freezing 22,30,36,66,73,77,81-85,88-89,103
 Fresh meat 55,58,67,71,76,81-82,84-86,89
 FSSAI 23-24
 Game meat 103
 Gases 76
 Gelation 72
 Gizzard 36,39,42-43,46,47-48,54
 Goat 1-2,11-12,21,23-24,44,47,65,70,94,103
 Grinding, Ground meat 7,36,52,70,74,78
 Haem, Haemoglobin 56,64
 Halal 37-38
 Ham 75
 Handling 5,17,22,36,39-40,45,64-65,96
 Head 5,15-16,29,33-34,39,42-43,46-48
 Heat, Heating 6,16,35,42,65,76,79-80,82-84
 Health 1,4,11,55,64,69-70,81,90,98,103
 Heart 3,36,39,43,46,48,55,58,63-64
 Hind quarter 51
 Holding pen 29,65
 Ice crystal, Ice flakes 83,88
 India 12-14,19,23,87,92,95,103-104
 Industry 2-4,13-15,45,70,80-81,84,92,94-97,100,103,122
 Inedible byproducts 22,43,47
 Ingredients 55,71-74,76,77,78,90,98
 Injuries 98
 Intestines, Intestinal content 40,42,54
 Internal fat 30,36,44-45,98

Jerky 62,76,78
 Juiciness 11,36,66,69,72,75,83,102
 Keeping quality 9,81
 Killing, killing out percentage 11,34,43-44,96
 Kidney 39,46,48
 Lactic acid, Lactic acid bacteria 6,77,85
 Lairage 22,29,30,64,77,102
 Land 1,12,13,15-16,21,104
 Legs 33,35-36,44,47,66,96-97,
 Lean meat 43-45,54-55,71,74,87
 Leather 4,12-15,19
 LDPE 84,86
 Light 6,21,29,81,101
 Linoleic acid 5,55,58-59,62,100
 Lipids 3,8-10,57,58,68
 Liver 36,39,43,46-48,69,77,102
 Live bird 13,35,42,43
 Livestock 1,13,28,49,65,67
 Lipid oxidation 5,7-8,58,67-68,72,76-77,84
 Lipolysis 57,81
 Lungs 36,46,98
 Marketing 2,5,13-15,23,92,106,112
 Marinades 80
 Massaging, Massager 73-74
 Maturity 18,70
 Meat 1-25,39,42-45,47-104,122
 Meat quality 4,8,34,38,64,71,84,122
 Methane 41
 Metmyoglobin 9,67,82,86-89,102
 Microorganisms 7,42,58,76,81,85
 Mincing 73
 Minerals 55,61,79,90
 Moisture 36,42,56-57,75-76,79,81,84
 Monounsaturated fatty acids (MUFA) 59-60,90,100
 Muscles, Muscle fibres 2-3,5,9,35-36,38,49-50,52,57,64-70,72,78,102
 Mutton 12,57-58,64
 Myoglobin 5-6,8-9,65-75,82,84,86-89,102
 Neck, Neck cutting 15,18,28-29,34-37,44-49,71
 Neck fat 44-45
 Nitrate, Nitrite 41,72-75
 Nitrogen 5,7,66,77,84,87,101
 Nutrients, Nutrition 1,42,55,62,64,66,79,90
 Nutritional quality 55,84
 Odour, Off odour 20,41,75,85
 Oesophagus 34,36-37,39
 Offals 22,42
 Oil 2,12-15,19,45,62-63,72-73,75,77-79,94,97-99,101
 Oleic acid 8,58-59,62-63,99-100
 Omega-3, Omega-6 fatty acids 55
 Organs 47
 Organic matter 40-41
 Ostrich 1-8,10,15,18,28,33,35,44-45,47-50,56-57,66-67,69-71,76-77,87,94,97
 Overhead rails 22
 Oxidation 2-3,5,7-9,36,40,57-58,67-68,72,76,81,84,86-88,102
 Oxygen 5,7,40-41,67-68,77,81,84-88,102
 Oxymyoglobin 8,67,86-87,89
 Packaging 5-7,9,22,67,77,81-82,84-89,91,95,103
 Packaging machine 109
 Pale soft exudative (PSE) 64

Pellet 17

Pens 15-16,28-29,65

pH 5-7,9,64-65,70,81,84,87-89,93,102

Phosphate 72-75,77,108

Pickling 81,93,94

Polyamide, Polyester 86,88

Polyunsaturated fatty acids (PUFA) 5,11,56,
58,60,90,100

Poultry, Poultry industry 1-2,5,9,11,17,23-24,36,42,
49,62,66-67,69-70,96,102

Preparation 7,42,54,70,72-74,77,93,103

Processing 2,6,13-16,20,23,24,28,35,39,42-43,45,
57,65-66,70-76,81,92-96,98

Proteins 9,17,40,55,64,66,68,72,74,90

Preservation 38,45,81-82,84,94

Products 1-4,8,11-15,19,23,28,32,38-39,41-42

Production 1-4,8,11-15,17-18,20,85,89,92-95,101,104

Quality 1-2,4,6-9,11,12,14,19,20,34,36,38,45,47,55,58,
64-66,69-71,76-77,81-85,87,89,94-95,103

Quantity 35,40,53,57,71,78,90,95

Rancidity 58,83

Ratites 1-3,5-6,8-10,15,47,49,56,67,68,87

Raw material 42,92

Refrigeration, Refrigerator 6,30,36,38,66,76,80-85,
87,105

Rendering, Rendering plant 14,22,33,39-40,42,
101,104,105

Research 14-15,38,61-62,64,67,69,92,96,99,103,122

Resources 1,80

Restructured products 73

Retailing, Retailers 2

Rhea 1-2,4,8-10,15,44-45,47-50,56-57,67,87,94,122

Ribs 49,53

Rigor mortis 36,66,88

Salt 70,72-75,77,78,93,94

Sausages 71,74,76,77

Scalding 21-22,30,34-35,40,103

Sedimentation 40

Sensory quality 69,103

Sex 65

Shackle, Shackling 5,33-34

Shear force 6,65,69

Sheep 1,2,11-12,21,23-24,35,43-44,47,56,65-66,70,82,
94,103

Shelf life 6-8,66,71,81-82,84-85,88,89,102

Skin 4,10,14,19,22,28-30,32-35,39,43-48,
70,78,84,92-96,98-99,103

Slaughter house 4,14,20-26,34,39-42,71,96,104

Slaughter age 10,15,104, 122

Smoking 75,81

Snack 62

South Africa 2,4,10,28,66,71,77

Spices 70

Sticking 5, 33,35,38

Storage, Storage temperature 2-3,5,7-9,38,
58,65-67,77,81-86,88-89,103

Stress 5,9,29,34,64-65,82,87,102,

Structure 67,72,93-94,96

Stunning 4,5,22,29-30,33-35,64-65,82,103

Superchilling 82-83,97

Tanning 14,92-93,95,97

Temperature 6,9,16-19,22,28,65-66,69-71,74,
76,79-89,101

Tenderness, Tenderization 11,65-66,69,72,79

Texture 64-65,69-70,73,81,83,102

Thawing, Thaw rigor 66,83,89

Thigh 36,44,50-51,58,70

Thiobarbituric acid (TBA) number 5,7,9

Tibio-tarsal joint 34

Toes 15

Toughness 6,64,66,102

Transportation 17,28,38,64-65,95-96,102

Treatment 22,39-41,76,98-99

Tumbling, Tumbler 73-74,77-78

Vacuum packaging 7,9,77,85-89,109

Value addition, Value added products 12,71,76,122

Viscera 46-48

Vitamins 55,62-63,79,90

Voltage 33

Washing 22,30

Waste 21,39-42

Water 1,6,9,12,29,34-35,40-42,62,64,66-67,72,74-76,
78,81,83,84,86,90,94,101

Water activity 75,76,78,81

Weight 3,4,10,16-18,33,39,42-48,50,56,61-63,70,76, 82,84

Wet rendering 42

Wings 1,17,15,46-49

Yield 9,19,39,42-48,54,64,71-72,82,101,122

