वार्षिक प्रतिवेदन

Annual Report

2011-12

राष्ट्रीय माँस अनुसंधान केंद्र

NATIONAL RESEARCH CENTRE ON MEAT

(भारतीय कृषि अनुसंधान परिषद)

(Indian Council of Agricultural Research)

चेंगीचेर्ला, बोडुप्पल / Chengicherla, Boduppal post

हैदराबाद - 500 092 / Hyderabad-500 092

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Director (Acting),
National Research Centre on Meat,
Hyderabad 500 092

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Preface

The National Research Centre on Meat, Hyderabad has walked extra miles during the year 2011-12 to achieve greater recognition and making maximum impact in the meat sector. It gives me immense pleasure to present glimpses of this wide range of diverse activities for the aforesaid period.

In order to promote nutritional security, employment opportunities and to provide safe and wholesome meat to public, NRC on Meat has undertaken various research and extension activities. In the research front, development of innovative super-chilling and vacuum packaging technologies for prolonged storage of buffalo meat steaks and mutton chunks will be of great significance to Indian meat exporters. The packaging technology for improving buffalo meat shelf-life has been transferred to a private entrepreneur. Experiments are being carried out on genotyping of Calpastatin (CAST) gene from different sheep breeds to uncover meat quality characteristics. The NRC on Meat technologies for purification and use of natural phenols in developing value added meat products was commercialized and signed an agreement for undertaking contract research.

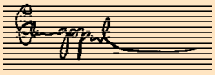
Utilization of slaughterhouse by product- rumen liquor as source of feed enzyme, detection of animal fat in edible fats through molecular techniques, process development for shelf stable, ready to eat (RTE) meat products in retort pouches, development and popularization of shelf-stable dried meat and novelty meat products using spice mix and curry leaves powder and effect of feeding sheep with zinc and selenium on meat quality, training module to create awareness among meat industry workers are some of the important research areas currently being undertaken.Two projects regarding muscle food safety are being carried out to estimate the level of various pesticide residues in chicken meat, byproducts, fish muscle and environmental samples. The project on brucellosis aimed to assess the prevalence of the disease among food animals, meat workers and veterinarians and also create awareness among meat workers about the safety precautions to be practised to avoid contacting disease. Preliminary work on evaluating emu meat quality and development of value added products from emu meat is in progress. Projects are also undertaken to preserve and develop value added meat products from spent hen, goat and sheep meat.

Under National Agricultural Innovation Project (NAIP) the centre has established and commissioned new feed processing unit at Mahabubnagar, Andhra Pradesh. Construction of model slaughter house for demonstration of clean meat production was completed at Veterinary college, SVVU, Tirupati and inaugurated by honourable DDG Dr. K.M.L Pathak. Also provided training and technical inputs on scientific ram lamb rearing and requirements for clean meat production with scientific packaging methods.

In addition to its regular research activities NRC on Meat has undertaken several human resource development and transfer of technology programs. NRC on Meat has conducted one interactive discussion seminar, industry and butchers meet, consultative group meeting for XII plan discussion, stake-holder's meeting, five awareness programs and six

entrepreneurship development programs. For the first time a national workshop on strategies for modernization / up gradation of service abattoirs in India was conducted in March 2012. Five MoU/Agreements have been signed and successfully helped the entrepreneurs in establishing their own meat processing business. Consultancy projects on 'benchmarking of abattoir, quality issues in meat sector and socio-economic aspect of meat industry workers' was undertaken for NABARD. Collaborative activities were undertaken with APEDA on meat export promotional aspects and National Meat and Poultry Processing Board on meat sector development activities.

The NRC on Meat gratefully acknowledges the valuable guidance and encouragement received from Dr. S. Ayyappan, DG, ICAR, Dr. K.M.L. Pathak, DDG (Animal Sciences), Dr. B.S.Prakash, ADG (AN & P) ICAR and other experts of meat science community. I appreciate the efforts of editorial committee, scientists and all other staff of NRC on Meat in bringing out this report which will be of great use to the meat scientists, technologists, entrepreneurs and other extension workers.



(G. Venugopal)
Director (Acting)

Executive Summary

The National Research Centre on Meat, Hyderabad has undertaken diverse activities related to meat sector specifically applied and basic research in meat science. Numerous trainings , consultancy services and extension activities were under taken to popularise the technologies developed and intensive efforts made to develop benificial technologies The summary of the Institutes activities during the period from April 2011 to March 2012 is presented below:

Research accomplishments :

- Experiments were conducted for detection of genotype in Calpastatin (CAST) gene from 67 sheep including 30 Deccani and 37 Nellore breeds. Single stranded conformation polymorphism (SSCP) technique was employed with non-radioactive staining method. Suitable primers for CAST gene were designed.
- An innovative super-chilling (storage at -1°C) and vacuum packaging process for buffalo meat steaks and mutton chunks which significantly improves the shelf-life upto 3 months without freezing compared to 30 and 4 days at refrigeration temperature under vacuum and aerobic packaging conditions respectively was developed.
- Modified atmosphere packaging (MAP) for improved colour and display life of ground buffalo meat and mutton was optimized.
- Production and processing technologies for ready to eat (RTE) chicken kheema and mutton kheema which are stable in room temperature for more than 12 months have been developed and standardized in flexible retortable transparent and non transparent pouches.
- Optimized the process for use of curd/dahi as an alternative source as lactic cultures for the production of semidry fermented sausages without having detrimental effects on the quality.
- The levels of organochlorine, organophosphorus and synthetic pyrethroids in chicken, byproducts, feed, water and certain varieties of pond reared fishes from Kolleru region including environmental samples have been estimated.
- Technologies were developed for utilization of slaughter house byproduct specifically rumen liquor as a source of feed enzyme. Experiments are being carried out for detection of animal fat in edible fats through molecular techniques.
- Blood samples from cattle, buffaloes, sheep and goats, meat industry personal, butchers and veterinarians were screened for presence of antibodies against brucellosis. Six awareness programs were organised at several places across Andhra Pradesh.
- Varities of shelf stable, sun dried chicken products with more than 1-2 year stability have been developed. Efforts are on to popularize and commercialise these products.

- Effect of feeding different level of Zinc on the quality characteristics of meat from ram lambs has been studied.
- Experiments were carried out to preserve and prepare value added meat products viz, samosa, meal maker, cutlets, spring-rolls, chips etc. from spent hen, goat and sheep meat.

NAIP :

- Package of feeding practices for quality mutton production have been developed for intensive rearing of Nellore jodipi ram lambs by feeding complete feeds containing crop residues and agricultural by products
- A model slaughterhouse was constructed at Veterinary College, SVVU, Tirupati under NAIP project was inaugurated.
- A national level workshop on "Strategies for upgradation of service abattoirs in the conuntry " with more than 50 participants was organised under NAIP.

Consultancy, trainings and extension activities:

- Signed an agreement for undertaking a sponsored research project at a cost of Rs. 1.75 lakhs with Kancor Ingredients Ltd., Ernakulam, Kerala.
- Six hands-on entrepreneurial training programs on "Value added chicken products processing" for more than 100 small and medium scale entrepreneurs was organised.
- Three memorandum of understanding (MoU)/agreements were signed with entrepreneurs for licensing and test marketing of value added products developed by NRC Meat.
- Provided 3 bankable project reports to entrepreneurs for establishing "Meat products processing unit".
- A packaging technology for buffalo meat storage and enhancement of shelf-life has been transferred to a private entrepreneur.
- Training materials on clean meat production, value added meat products have been developed for creating awareness and dissemination of developed technologies.
- Undertaken two consultancy projects related to establishment of slaughter houses for emus.
- NRC Meat technologies were showcased at four different exhibitions.
- Several awareness campaigns on clean meat production, modern slaughter houses was organised across Andhra Pradesh.
- In collaboration with National Meat and Poultry Processing Board, New Delhi, an Industry meet and two butchers meeting was were organised.
- Three scientists have visited abroad for training and paper/poster presentations. One scientist was awarded with Lal Bahadur Shastri Young Scientist award-2010.
- Developed liaisons / collaborations and interacted with stake holders and experts from Department of Animal Husbandry , Greater Hyderabad Municipal Corporation, pollution control board, export meat industries, poultry and meat processors, veterinary university officials, private entrepreneurs etc.

Introduction

As a home to largest number of buffaloes, goats and other livestock species, India has already achieved the distinction of standing number one and two for milk and leather production in the world. Its meat sector has contributed about 19% of the total value of output from livestock sector during 2008-09. Currently, buffalo meat is the largest individual agricultural commodity exported from India accounting for around Rs. 12000 crores. Provided the much needed support and willingness to uplift this neglected sector, the Indian meat production has the potential to reach a significant position in the global arena.

Keeping in mind the importance of meat sector and its contribution to nutritional security, sustainable animal production and employment generation, the National Research Centre on Meat (NRCM) was established in 1999 to conduct basic and applied research in the frontier areas of meat science and technology and to develop human resource for the fast growing meat sector. The centre was initially established at Project Directorate on Poultry, Hyderabad and later moved to Central Research Institute for Dry Land Agriculture, Hyderabad. However, the NRC on Meat was established with its own building at Chengicherla, Hyderabad in the year 2007 with an overall objective to conduct basic and applied research, to promote quality meat production, value addition, training and entrepreneurship development and to provide policy support. Since 2007, NRC on Meat is functioning with 6-7 scientists and only in the year 2010-11 a total of 14 scientists were filled with only one technical staff (T1). With this meagre strength and within a span of five years the NRC on Meat has made enormous progress in creation of facilities, research, human resource development, entrepreneurship development, extension, TOT, consultancy and several other programs and the scientists of this centre were awarded with several national and international awards.

The NRC on Meat is the only premier institution devoted fully to the meat research in the country. The centre was created with main emphasis on value addition, quality attributes of fresh and processed meat, imparting education, training and attention towards sanitary and phyto-sanitary measures in the slaughter of animals and meat production. These require scientific and technological support to develop knowledge and skills through participatory approach of farmers, entrepreneurs and scientists. Scientists of this centre have conducted various experiments on evaluation and improvement of quality of fresh and processed meat, analysis of chemical residues in meat and fish, biochemical understanding of tenderness, species and sex identification of meat, retort pouch packaging for ready to eat meat products, dried meat products development, microbiological quality evaluation of fresh meat and meat products, meat inspection and utilization of slaughterhouse waste.

Vision

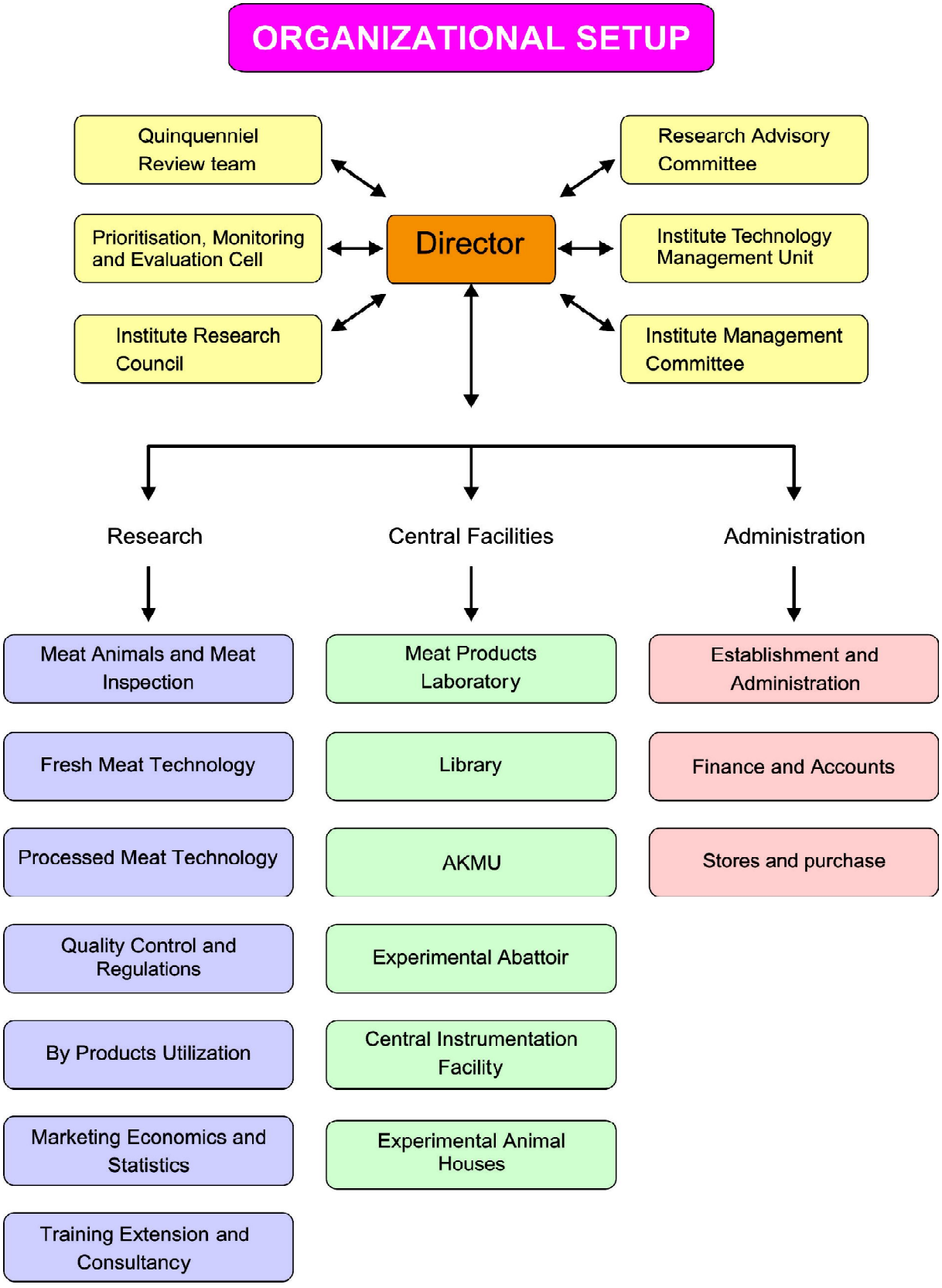
NRC on Meat is a premier institution of meat research to solve the problems and face challenges of meat and allied sectors development.

Mission

Development of modern organized meat sector through meat production, processing and utilization technologies to serve the cause of meat animal producers, processors and consumers.

Mandate

- To conduct basic and applied research in meat science and technology for development of a modern organized meat sector in the country.
- To develop appropriate and relevant technologies/ processes/ practices for meat production, processing, value addition and utilization to contribute for sustained meat production and consumption.
- To provide need based training for different levels of personnel in meat and allied sectors.
- To establish a liaison with industry, trade, regulatory and developmental organizations operating in meat sector.
- To support bilateral and international programmes.
- To serve as a national repository of information in meat and allied sectors.


ORGANIZATIONAL SETUP
Quinquenniel Review team
Research Advisory Committee
Prioritisation, Monitoring and Evaluation Cell
Director
Institute Technology Management Unit
Institute Research Council
Institute Management Committee
Research
Central Facilities
Administration
Meat Animals and Meat Inspection
Fresh Meat Technology
Processed Meat Technology
Quality Control and Regulations
By Products Utilization
Marketing Economics and Statistics
Training Extension and Consultancy
Meat Products Laboratory
Library
AKMU
Experimental Abattoir
Central Instrumentation Facility
Experimental Animal Houses
Establishment and Administration
Finance and Accounts
Stores and purchase

Staff Strength
2011-12

STAFF	Sanctioned	Filled
Scientific (Including Director)	15	14
Technical	5	5
Administrative	14	8
Skilled Supporting	2	1*
Total	**36**	**29**

*Retired on 31/03/2012

Budget : (FY 2011-12) In Lakhs

HEAD		PLAN		NON PLAN	
		SANCTIONED	UTILIZED	SANCTIONED	UTILIZED
1	Establishment	-	-	254.00	251.78
2	Contingencies	97.00	78.75	39.00	38.99
3	Equipment	103.00	86.95	-	-
4	Furniture and Fixtures	5.00	4.99	-	-
5	Library	5.00	2.04	-	-
6	Works	4.00	4.00	-	-
7	TA	3.00	3.00	5.00	4.79
8	HRD	1.00	1.00	-	-
9	Misc & Others	4.00	3.99	-	-
10	P.Loans & Advances	-	-	5.00	2.96
11	Pension & ORB			10.00	9.97
12	IT			1.00	0.96
Total		**222.00**	**184.72**	**314.00**	**309.45**

Research Highlights

Institutional Projects:

Project title: Estimation of pesticide residues in pond reared fishes in Kolleru region of A.P.

Principal Investigator : Dr. G. Venugopal, Principal Scientist

Co-Investigators : Dr. M. Muthukumar and Dr. P. Baswa Reddy

The coastal districts of Andhra Pradesh witnessed tremendous development of aquaculture activities especially in three coastal districts viz., Krishna , West Godavari and East Godavari. Due to intensification there have been frequent incidences of disease outbreaks and in order to combat diseases farmers resorted to indiscriminate and rampant use of pesticides in fish ponds. This has would increase the possibility of direct accumulation of residues in fish tissues. The presence of chemical residues is of high concern because of possible transmittance of these residues load into the human food chain. For obvious reasons there should be consistent monitoring of chemical residues to safe guard health of consumers. Hence, the present study was designed to estimate the various pesticide residues in Indian major carps and pangas fishes at different age intervals during culture phase.

Samples of fishes viz., Rohu , Catla , Pangus, Grass carp and samples of soil, water and feed were collected bimonthly from different fish farms located in Kolleru region of Krishna & West Godavari districts. The samples drawn comprised of seed, fingerlings, stunted yearlings, adults (harvestable size) were processed and utilized for assessing the level of pesticide residues using gas chromatograph. All the four species of fishes contained pesticide residues. Similarly, all the soil and feed samples collected from fish ponds showed presence of certain pesticide residues. In case of water 75% samples showed presence of pesticide residues. In total 85.3% of samples were positive for pesticide residues. However, the levels of these pesticide residues were lower than the maximum residue limit prescribed by Food Safety and Standard Act (2006).

Among the pesticides, the incidence of cypermethrin was very high and it was recovered in 13 fish samples and 2 feed samples. The HCH residues (á, â, ã and ä) were found in 10 fishes and 10 soil samples. Residues of DDT were noticed in 7 fishes, 2 soil and 2 feed samples. Residues of cycleodine group of OC pesticides like aldrin, eldrin, endosulfan and heptachlor were found in few fish, soil, water and feed samples. However, the residues of OP compounds like chloropyrifos, Malathion and methyl parathion were also noticed in few samples collected from Kolleru region.

Figure 1. Incidence of pesticide residues (%) in different fish species

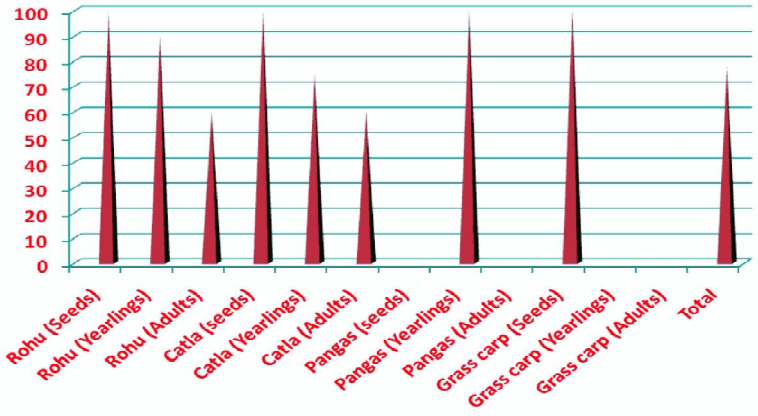


Table 1.Concentration of various pesticide residues (ppm) in fish muscles, feed, water and soil samples

Name of the pesticide	Fish*	Feed	Water	Soil
Organochlorine				
DDT	0.0365			
DDE	0.0099	0.0479	0.0006	0.0025
DDD	0.0291	0.0047	0.0008	0.0013
Alpha HCH	0.0021	0.0097	-	0.1753
Beta HCH	0.0015	0.0285	-	0.0140
Gamma HCH	0.0131	0.0088	0.000	0.0157
Delta HCH	0.0239	0.0061	-	0.0055
Aldrin	0.0117	0.0276	0.0002	0.0010
Dieldrin	0.003	0.0764	0.0011	
Endrin	0.0024	0.0965	0.0039	
Endrin aldehyde	0.009	-	0.0001	0.0007
Heptachlor	0.0434	-	-	0.0002
Heptachlor epoxide	0.0111	0.0015	-	
Endosulfan		0.0830	-	
Endosulfansulfate	0.0022	0.0378	0.0007	
Organophosphorus				
Malathion	0.0034	-	-	
Chloropyrifos	0.0008	-	-	
Dichlorovas	0.0007	-	-	
Methyl parathion	0.0007	0.0005	-	
Synthetic pyrithroids				
Cypermethrin	0.1083	0.0246	-	-
Deltamethrin	0.0389	0.0524	-	-

*Fish includes Rohu, Catla, Pangus and Grass carp samples together

Project title: **Utilization of rumen liquor from slaughtered animals as feed enzyme source**

Principal Investigator: Dr. S. Vaithiyanathan, Principal Scientist

Co-Investigator: Dr. P. Baswa Reddy

Rumen enzymes produced by the inhabiting microbes available in the liquid and solid content of rumen after slaughter may be of economic importance due to the fact that these can be separated and utilized as exogenous enzymes source for feed industry. Rumen contents were collected from sheep, goats and buffaloes from the Chengicherla slaughterhouse immediately after the evisceration in a cool box and brought to the laboratory for further analysis. The rumen liquor was analyzed for carboxymethylcellulase (CMCase), xylanase. The specific activity of the enzymes (U/mg) was found to be 0.115, 0.248 and 0.243 respectively of CMCase, xylanase and amylase in sheep rumen enzyme concentrate; 0.132, 0.182 and 0.506 respectively of CMCase, xylanase and amylase in goat rumen enzyme concentrate; and 0.086, 0.457 and 0.170 respectively of CMCase, xylanase and amylase in buffalo rumen enzyme concentrate. The maize straw samples (500 mg) were incubated in 40 ml of incubation fluid in 100 ml calibrated glass syringes with or without addition of rumen enzyme concentrate prepared from rumen contents of sheep, goat and buffalo. Gas production and organic matter degradability were determined after 24 hour of incubation at 39°C. Results (Table 1) showed that in the supplementation of sheep rumen enzyme concentrate, 74.08ml, 73.33ml and 64.67ml of gas and 41.02 %, 40.75% and 37.71% degradability of organic matter (DOM) respectively of control, 20mg and 40mg supplementation were observed. In the supplementation of goat rumen enzyme concentrate, 59.00ml, 64.50ml and 66.58ml of gas and 35.70 %, 37.63% and 37.32% degradability of organic matter (DOM) respectively of control, 20mg and 40mg supplementation were observed. In the supplementation of buffalo rumen enzyme concentrate, 74.75ml, 74.58ml and 70.92ml of gas and 39.97 %, 39.52% and 37.10% degradability of organic matter (DOM) respectively of control, 20mg and 40mg supplementation were observed. It was concluded that only goat rumen enzyme concentrate supplementation slightly but not significantly improved the gas production and degradability of organic matter of maize straw under in vitro gas test.

Table 1. Effect of supplementation of rumen enzyme concentrate on gas production and degradability of organic matter in vitro gas test

	Rumen enzyme	Enzyme supplementation		
		Control	20mg	40 mg
[1]Gas (ml)	Sheep	74.08[b]	73.33[b]	64.67[a]
[2]Gas (ml)	Goat	59.00[a]	64.50[a]	63.58[a]
[3]Gas (ml)	Buffalo	74.75[a]	74.58[a]	70.92[a]
[4]DOM %	Sheep	41.02[b]	40.75[b]	37.71[a]
[5]DOM %	Goat	35.70[a]	37.63[a]	37.32[a]
[6]DOM %	Buffalo	39.97[a]	39.52[a]	37.10[a]

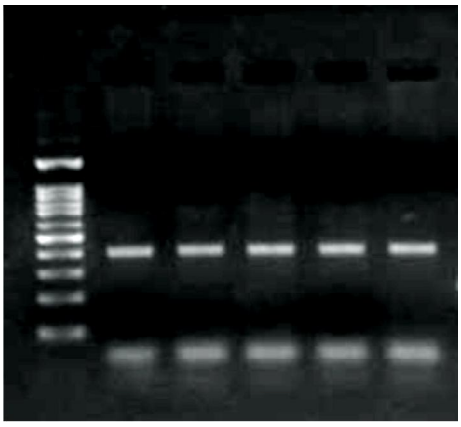
[1]Sheep rumen enzyme concentrate and inoculum made from goat rumen liquor; [2]Goat rumen enzyme concentrate and inoculum made from goat rumen liquor; [3]Buffalo rumen enzyme concentrate and inoculum made from goat rumen liquor; [4]Degradability of organic matter in vitro gas test using sheep rumen enzyme supplement; [5]Degradability of organic matter in vitro gas test using goat rumen enzyme supplement; [6]Degradability of organic matter in vitro gas test using buffalo rumen enzyme supplement.

Project title: Detection of animal fat in edible fats through molecular techniques

Principal Investigator: S. Vaithiyanathan, Principal Scientist

Genomic DNA was extracted from tissues of sheep, goat, buffalo, bullock, pork and PCR was conducted using the primer designed on leptin gene. Genomic DNA was also extracted from animal fat. Plant tissue DNA was extracted from castor, ground nut etc to test primer designed on chloroplast gene and PCR was conducted using the primer designed on chloroplast gene.

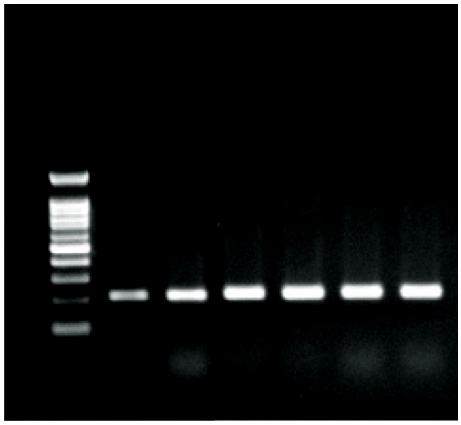
Figure 1. PCR product (leptin gene) from genomic DNA isolated from animal tissue



M 1 2 3 4 5

1- Cattle 2- Buffalo 3- Goat 4- Sheep 5-Pig

Figure 2. PCR product (chloroplast 23S rRNA gene) from genomic DNA isolated from plant tissue



M 1 2 3 4 5 6

1- Caster 2- sesame 3-soya bean 4- Groundnut 5- Mustard

Project title: **Studies on genetic markers, genotypes and detection of mutation for consistent mutton quality**

Principal Investigator: Dr.A.R.Sen Princpal Scientist

Co-Investigators: Dr.S.Vaithiyanathan and Dr.S.Girish Patil

Studies were conducted to explore genotypic pattern of Calpastatin (CAST) gene in local sheep breeds. Longissimus dorsi muscle of 11 Nellore sheep breed was collected from local slaughter house. In the present endeavour, for detection of genotype (Figure 4, Table 1) in this gene, Single stranded conformation polymorphism (SSCP) technique was employed with non-radioactive staining method. Suitable primers for CAST gene were designed. Overall, two pattern of genotypes for the CAST gene namely 1,1 and 1,2 (Figure 1) were observed for the two primers from the collected meat samples. The meat quality traits such as pH, water holding capacity, drip loss %, thaw loss %, cook loss%, shear force value were recorded in eleven samples of Nellore breed. During retyping of all the samples, only two types of genotyping pattern namely 1,1 and 1,2 was observed in the population. In Nellore breed the frequency of 1,1 genotype was 0.64 while that of 1,2 genotype was 0.36. Consequently, the frequencies of alleles 1 and 2 were 0.82 and 0.18 respectively in Nellore sheep. Further, the frequency of alleles 1 and 2 were 0.68 and 0.32 respectively in Deccani sheep.

Sixteen samples of both the breed and genotypes were selected and again amplified (Figure 3) with two primers (CAST 3 and CAST 6 UTR) and sequenced for identification of SNPs. The Genomic DNA of the selected samples has been isolated using liquid nitrogen to improve the yield of the DNA (Figure 2). The neucleotide sequence of two alleles 1 and 2 was aligned using DNA* software to explore mutation in the CAST gene in our sheep population. Four SNPs have been observed at 183, 185, 186 and 187 position of the gene in which allele 1 was differed from allele 2 inferring nucleotide changes by G/A, C/G, A/T and A/C respectively (Figure 5). Out of four SNP's, the SNP at 183rd position reveal the transitional form of mutation while 185th, 186th and 187th position unrevealed the transversion form of mutation. The allele sequences have been submitted to NCBI gene bank (id:1533494). Statistical analysis and conclusion are in progress.

Figure1. The different genotyping pattern (1, 1 and 1, 2) obtained in two populations

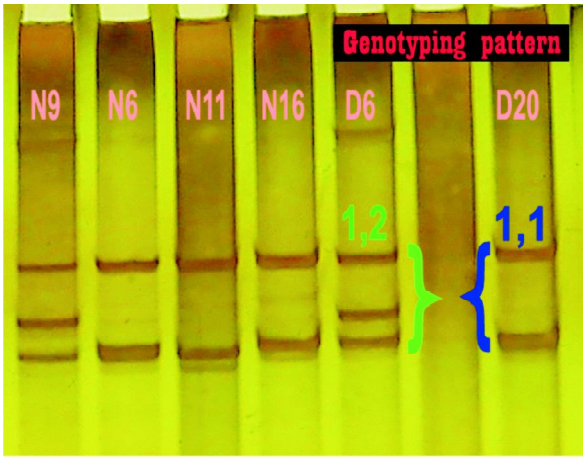


Figure 2. The genomic DNA isolated using Liquid Nitrogen

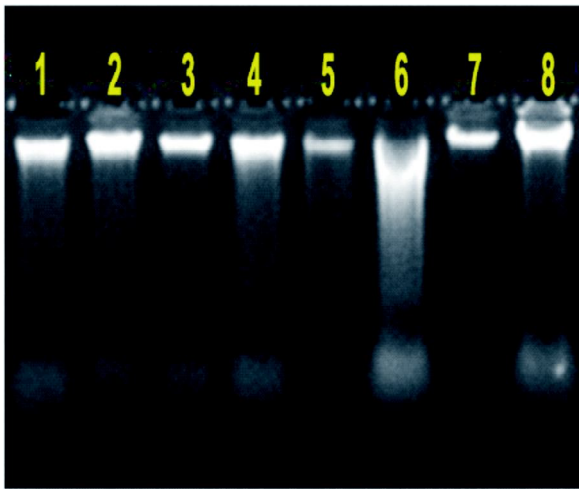


Figure 3. The selected samples amplified using CAST6U and CAST3U Primers

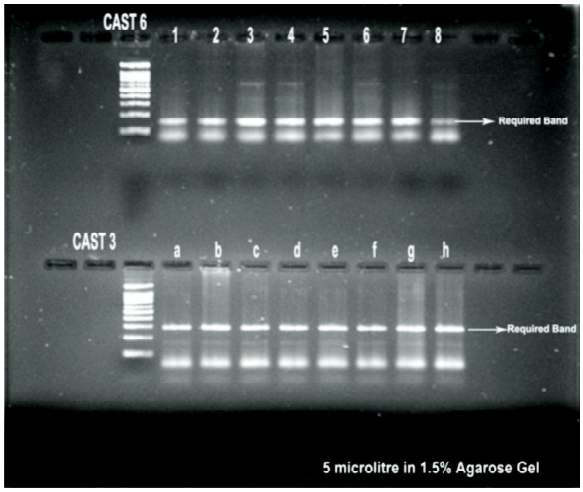


Table 1. Genotyping pattern of Nellore sheep for two pirmers

Nellore CAST 3U		Nellore CAST 6	
N27	1,1	N27	1,2
N28	1,1	N28	1,2
N29	1,1	N29	1,2
N30	1,1	N30	1,1
N31	1,1	N31	1,1
N32	1,1	N32	1,1
N33	1,1	N33	1,1
N34	1,1	N34	1,1
N35	1,1	N35	1,2
N36	1,1	N36	1,2
N37	1,1	N37	1,2

N27 to N37= Animal number

Figure 4. Genotyping pattern of Nellore breed

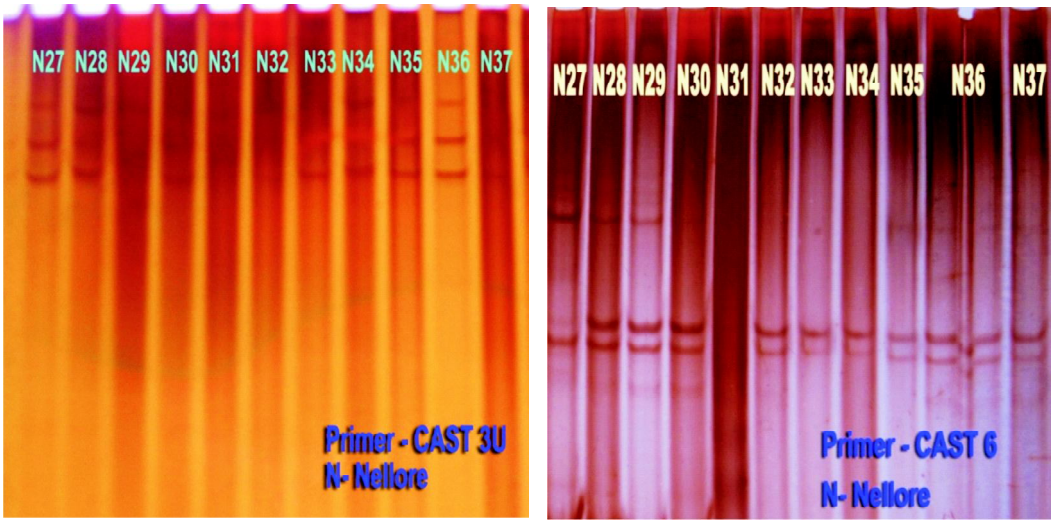


Figure 5: Single nucleotide polymorphism in CAST gene sequences

Project title: **Process development for the production of dried chicken meat**

Principal Investigator: Dr.Y.Babji, Principal Scientist.

Co-Investigator: Dr.I.Prince Devadason

1. Development of palatable products from dried chicken meat and assessment for its acceptability and shelf stability.

Developed three highly sensorially tasteful, microbiologically stable further processed chicken snack products from 6% and 8% soya treated previously sun dried meat powder. The names of the snacks were Y-shaped, pappad shaped and cylindrical shaped snacks and its microbiological ecology and microbiological quality studied with reference to spoilage and pathogenic microbiota and the microbiological counts found in these snacks were well below the laid down standards for dried meat products. Storage stability of these snacks were more than one moth at ambient temperature. Processing technique standardized for each type of snack.

Developed highly sensorially tasteful, microbiologically stable two further processed value added murukkus (Petal, triangle shaped chicken meat snacks) from 3.35 kg deboned chicken meat after being subjected to drying by a tray dryer at 77.12 °C for less than 6 hours. The microbial ecology and quality of the products were studied in reference to spoilage and pathogenic microflora and the counts observed in these products were well below the standards laid down for the dried meat products and the products were popularized. Storage stability of these snacks was a little over one month at ambient temperature. Processing technique standardized for each type of snack.

2. Studies on microbiological stability, proximate composition, water activity and sensory quality of tray died chicken meat using an original spice mix during its preparation.

A 300 gram deboned chicken meat mixed with 2% salt and 1% spice mix was tray dried for 6 hrs at 0, 2, 4, and 6 hrs intervals. Moisture, water activity, sensory evaluation and microbiological parameters studied during the dried meat production. The moisture percent after 35.35 hrs tray drying was 2.82, water activity was 0.273 and sensorially the dried meat sample was highly acceptable and the colour of the meat was dark brown. The microbial counts-aerobic plate counts, psychrotrophs, coliforms,

enterobacteriaceae, faecal streptococci, lactic acid bacteria, pseudomonas, proteolytic bacteria, Staphylococcus aureus and yeast and mould counts ranged between log 4.2 –4.5 during zero day after 6 hours of drying.

3.Studies on microbiological stability, proximate composition, water activity and sensory quality of sun died chicken meat with or without curry leaf powder during its preparation

Fresh chicken purchased from local market divided in to two lots of 1000 grams each. One lot mixed with salt (2.5%), turmeric powder (0.3%), pepper (0.3%), and spice mix (1.25%) served as a control without curry leaf powder and another lot treated with similar additives served as a treatment where 0.7% curry leaf powder was added. Both the samples were sundried for 6 hrs with intervals at 0, 2, 4, and 6 hrs. Moisture content of control and treatment after 6 hrs of sun drying was 11.90% and 11.02%, respectively.

While the protein was 65.99% and 65.00%, for control and treatment, the ash content respectively was 13.09% and 12.99% on day 8th of sun drying. The water activity on day 8 was 0.479 and 0.483 for control and treatment whereas the water activity, respectively on day 11 was 0.419 and 0.412.Both control and treatment were highly acceptable throughout 11 days of sun drying. A 4.0 log/g increase in counts of APC, PPC, Coliforms, Enterobacteriaceae, Lactic acid bacteria, Faecal streptococci, Pseudomonas observed whereas a 4.7 log/cm^2 of yeast and mould recorded on 6th hour of sun drying for these dried meat samples.

4. Determination of the effect of original spice mix and tray drying on moisture, water activity, sensory quality and microbiology during production of tray dried meat.

A 2.446 kg fresh deboned chicken meat mixed with 2% salt and 1.2% spice mix was tray dried for 72 hours at 77.12 °C. During production of dried chicken meat, moisture, water activity, sensory evaluation, yield and microbiology carried out. The moisture content was 2.188%, water activity 0.210; sensorially the product was highly acceptable. The yield was about 27.36%.The aerobic plate counts, psychrotrophs, coliforms, enterobacteriaceae, faecal streptococci, lactic acid bacteria, *Staphylococcus aureus*, and yeast and mould were log 3.4, 3, <2, 3.6, 3.6, 3.7, 4, 3.7, 3.4 and 3.8, respectively on 11th day in dried meat product.

5. Development of palatable products from dried chicken meat and assessment for its acceptability and shelf stability.

Developed highly sensorially tasteful, microbiologically stable five further processed value added chicken meat snacks from sun dried chicken meat powder prepared from 5.35 kg fresh chicken meat along with spice mix of 14 ingredients at 77.12 °C for less than 6 hours. The names of the products were Y-Shape and pappad shape snacks, cylindrical and star shaped snacks and large crunchy snacks. The microbial ecology and quality of the products was studied in reference to spoilage and pathogenic microflora and the counts observed in these products were well below the standards laid down for the dried meat products. Processing technique standardized for each type of snack.

6. Determination of effect of original spice mix on quality characteristics of tray dried chicken meat during production.

A 5.974 kg fresh deboned chicken meat mixed with 2% salt, 1.2% spice mix was tray dried at various stages such as after mixing ingredients, after 4 hrs, 6 hrs, 8 hrs, 10 hrs, 12 hrs, 14 hrs, 16 hrs, 20 hrs, 22 hrs, 24 hrs, 26 hrs, 30 hrs, 32 hrs, 34 hrs, 36 hrs, 38 hrs, 40 hrs, and 42 hrs at 77.12°C. Proximate composition, water activity, microbiology, yield and sensory evaluation determined during production of dried chicken meat. The moisture of the dried meat after 42 hrs of tray drying was 3.8 %, water activity 0.364 and the yield was 22.87% after 38 hrs of tray drying.

The dried meat samples were highly acceptable up to 42 hrs of drying and the colour of the samples was dark brown. The initial aerobic plate counts after mixing chicken meat with spice ingredients was log 4.3/g and the counts kept on reduced after 4, 6, 12, 18, 26 and 36 hrs of drying. However, much steep decrease occurred after 36 hrs of drying to log /g 2.77 whereas after 18, and 26 hrs, the counts reduced to 3.17/g and 3.39/g. Around log/g 3.9 of psychrotrophs, coliforms, enterobacteriaceae, faecal streptococci were observed after mixing meat with ingredients, however, no growth observed in any of these counts after 4, 6, 8, 12, 18, 26, 36 hrs of tray drying. A count log/g 4.2 was observed in lactic acid bacteria, pseudomonas, and proteolytic bacteria after mixing meat with spice ingredients later these counts showed decline at 36 hrs of drying. Drying significantly reduced *Staphylococcus aureus* counts by 1.42 logs/g after 4, 6, 12, 18, 26, and 36 hrs after drying. The initial (after mixing ingredients) counts of yeast and moulds were 4.0 log/g and thereafter the counts decreased by 1.0 log/g at 36 hrs of drying.

7. Development of palatable products from dried chicken meat and assessment for its acceptability and shelf stability

Developed highly sensorially tasteful, microbiologically stable two further processed value added chicken snacks from tray dried chicken meat powder produced from 11.65 kg deboned chicken meat with an optimum quantity of spice mix followed by tray drying at 77.12 °C for less than 6 hours The names of the snacks were small murruks and plus shaped murruks /crunchy snacks. The microbial ecology and quality of the products was studied in reference to spoilage and pathogenic microflora and the counts observed in these products were well below the standards laid down for the dried meat products. Processing technique standardized for each type of snack and products were popularized. Further, a shelf life of over 6 months achieved for tray dried fresh chicken meat (11.65 kg, dried at 77.12°C for less than 6 hrs) during ambient storage with highly acceptable sensory quality and very low microbiological counts.

Project title: **Studies on prevalence of Brucellosis in slaughtered ruminants at Municipal abattoir, Hyderabad and its public health significance in abattoir personnel**

Principal Investigator: Dr. C. Ramakrishna. Senior Scientist

Co-Investigators: Dr. M. Shashi Kumar, Dr. G. Venugopal and Sri. P. Mooventhan

The project has been taken up with 3 main objectives of studying the prevalence of Brucellosis in ruminants slaughtered at Municipal abattoir, Hyderabad, abattoir personnel who are in direct / indirect contact with animals and to increase awareness in abattoir personnel about the methods of transmission of Brucellosis from animals to human beings and its prevention.

Prevalence in slaughter animals

A total of 3,796 sera samples collected from 1,931 Sheep and 1,865 Goats during the period from April, 2011 to March, 2012, were screened for the presence of antibodies against *Brucella* infection by agglutination test. Overall, the percentage of small ruminants (Sheep and goats) positive for Brucellosis was 10.43% (396 out of 3,796). The percentage of Brucellosis in goats (12.06%; 225 out of 1865) was higher than sheep (8.86%; 171 out of 1,931).

Prevalence in abattoir personnel

Sera samples from a total of 413 meat workers (mainly butchers) of Sheep and Goats were collected at Hyderabad, Medak, Tirupati and Warangal areas. All the sera samples were analyzed by agglutination test. All the positive samples by agglutination test were confirmed by Tube agglutination test (TAT). Out of 413 meat workers, sera samples belonging to 74 persons (17.92%) showed presence of antibodies either by agglutination test or by TAT.

Awareness programmes

A total of 6 awareness programmes on Brucellosis were conducted as mentioned below. The methods of transmission of disease from animals to abattoir personnel and disease preventive measures were explained to them. Hygiene kits and brochures prepared in Telugu and English were distributed to them.

S. No	Date	Place	No. of abattoir personnel screened	No. of abattoir personnel positive for Brucellosis	Percentage
1	11-01-12	Rudraram	42	4	09.52
2	14-02-12	Warangal	168	19	11.31
3	18-02-12	Chengicherla	97	20	20.62
4	24-02-12	Kazipet	51	24	47.06
5	02-03-12	Tirupati	12	2	16.67
6	27-03-12	Hanamkonda	43	5	11.63
Total			413	74	17.92

Project title: **Development of Ready to Eat (RTE) meat products in retort pouch by thermal processing**

Principal Investigator: Dr. I. Prince Devadason, Scientist (SS)

CoInvestigator: Dr. Y. Babji

Kheema is a traditional meat delicacy in India. It has lots of potential for domestic as well as export trade. In view of the among features, Chicken and mutton kheemas were prepared in their traditional way and were retort processed in transparent as well as in non-transparent pouches by water immersion and steam air circulation at a F_o Value of 6.5.

The processing time in water immersion method and was by steam air processing were 67 Min and 52 Min respectively. These products were kept at ambient temperature and their physic-chemical, sensory, textural, microbiological and nutritional qualities were evaluated at monthly intervals. There were no significant difference existing between storage period starting from 0 day to 10th month on pH, TBARS and Tyrosine value. The sensory studies also revealed that these products were highly acceptable till 10 months. There were no traces of microbes in any of these pouches.

Figure 1. Sensory Quality of Chicken kheema in retort pouches

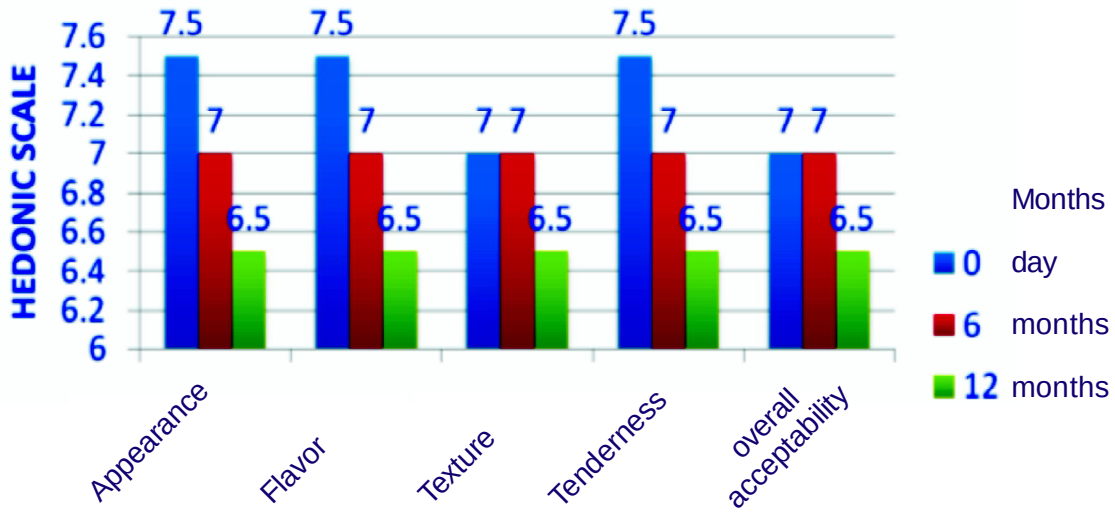


Figure 2. Ready to Eat chicken kheema in transparent retort pouches which are stable at ambient temperature for more than 12 months.

Project title: Estimation of pesticide residues from poultry feeds and foods

Principal Investigator: Dr. M. Muthukumar, Scientist (SS)

Co Investigators: Dr. S.Vaithiyanathan, and Dr.C.Narendra Reddy, ANGRAU, Hyderabad

Assessment of performance of gas chromatograph

The performance of gas chromatograph was assessed in terms of Limit of detection (LoD), limit of quantitation (LoQ) and linearity. The limit of detection i.e. the lowest quantity of a substance in a defined matrix where positive identification can be achieved using a specific method was 0.001 ppm. The LOQ i.e. the lowest quantity of a substance in a defined matrix where positive identification and quantitative measurement can be achieved using a specific method. The LOQ was 0.01 ppm.

S.No	Name	Time [Min]	Quantity	Height [µV]	Area [µV.Min]	Area %
1	Endosulfan sulfate	21.71	1.24	149.9	13.3	1.244
2	Alpha-HCH	22.93	5.22	486.0	39.1	5.225
3	Gama-HCH	24.70	3.87	325.3	29.0	3.873
4	Delta-HCH	24.94	6.62	568.7	49.6	6.625
5	Beta-HCH	26.50	6.30	542.1	47.2	6.301
6	Heptachlor	29.44	4.57	322.4	34.3	4.573
7	Aldrin	31.98	5.89	378.6	44.2	5.893
8	Heptachlor epoxide	35.06	5.73	394.6	43.0	5.734
9	Dieldrin	39.33	6.04	368.4	45.3	6.045
10	DDE	39.70	6.03	457.9	45.2	6.028
11	Endrin	40.68	5.05	304.1	37.8	5.050
12	Endrin aldehyde	42.42	4.39	304.2	32.9	4.386
13	Endosulfan	42.62	3.89	261.9	29.2	3.893
14	DDD	44.16	2.45	195.4	18.4	2.453
15	DDT	44.78	4.04	261.4	30.3	4.044

Detection and quantification of pesticide residues in meat products:

In total 125 samples including chicken muscle, liver, fat, feed, water samples were collected and processed for estimating pesticide residues. Overall 15.2 % of samples were showed presence of pesticide residues. Among the samples, feed (25 %) and fat (28.57 %) showed higher level of contamination. Among the pesticides, residues of endosulfan were more frequently observed. However, the levels of these pesticide residues were lower than the maximum residue limit prescribed by FSSA (2006)

Table 1. Incidence of pesticide residues in various chicken tissues, egg, feed and water samples

Sample	Total number of sample analysed	Number of samples contaminated with pesticide residues
Muscle	22	2 (1.6 %)
Liver	22	2 (1.6 %)
Fat	21	6 (4.8 %)
Egg	20	3 (2.4 %)
Feed	20	5 ((4 %)
Water	20	1 (0.8 %)
Total	125	19 (15.2 %)

Table 2. Concentration of various pesticide residues (ppm) in chicken tissues, egg, feed and water samples

Name of pesticide compound	Muscle	Liver	Fat	Egg	Feed	Water	Total no.of positive samples	Overall concen-tration	MRL (PPM)
DDT	0.033 (4.54)	BDL	0.044 (9.52)	BDL	BDL	BDL	3	0.0385	7
HCH	0.0335 (9.09)	0.038 (4.54)	0.0475 (9.52)	0.03 (5.0)	0.020 (10.0)	BDL	5	0.0338	2
Endosulfan	0.0325 (9.09)	0.022 (9.09)	0.0463 (28.57)	0.0483 (15.0)	0.0394 (25.0)	0.020 (5.0)	19	0.0348	0.2
Aldrin	BDL	BDL	BDL	BDL	0.02 (10.0)	BDL	1	0.02	0.2

MRL - Maximum Residue limit as per Food Safety and Standards Act, 2006

BDL - Below detectable level.

PPM - Parts per million

Project title: **Development of suitable packaging methods for meat and meat products**

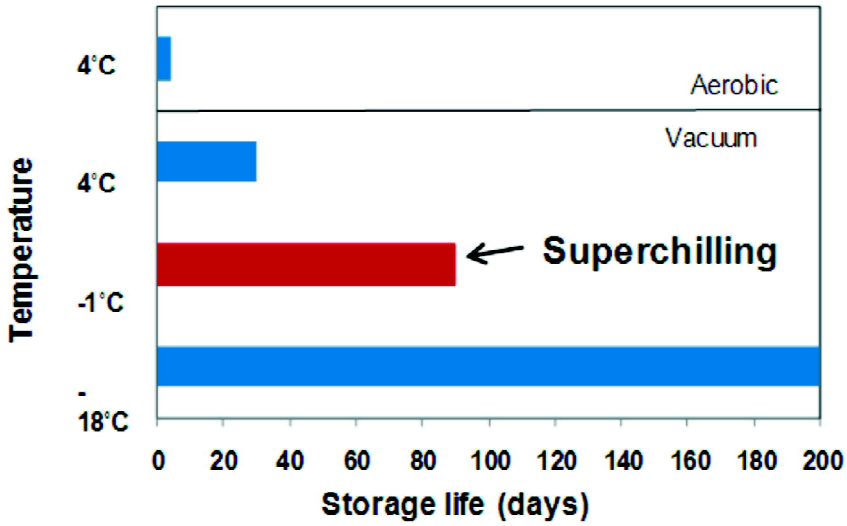
Principal Investigator: **Dr. B.M. Naveena, Scientist (SS)**

CoInvestigators: Dr. A.R. Sen, Dr. M. Muthukumar, Dr. C. Ramakrishna and Dr. Y. Babji

Study I: Novel superchilling and vacuum packaging technology for improving the shelf-life of buffalo and sheep meat.

Fresh meat is highly perishable and requires well established cold chain for prolonged storage and distribution and to provide safe, wholesome and quality meat to consumers. This invention was carried out with an objective to extend the shelf-life of fresh buffalo meat steaks using vacuum packaging and superchilling (-1 ºC) process without freezing and to compare its efficacy with that of existing chilling (4 ºC) and freezing (-18 ºC) methods. An innovative blast chilling followed by storage at -1.5 ºC was optimized under this experiment. Superchilling resulted in uniform, smaller ice crystals on the surface of meat which insulates the product from minor temperature abuse during storage. The superchilling was efficient in maintaining the freshness of buffalo meat steaks without adversely affecting any physico-chemical, sensory and microbial quality parameters up to 90 days storage (Figure 1). This novel process may be utilized by the buffalo meat processors and exporters for efficient storage and intercontinental transport of fresh buffalo meat as an alternative to freezing technology with less labour, space, energy and premium price for the produce.

Figure 1. Shelf-life of vacuum packaged buffalo meat steaks stored at refrigeration (4 ºC), superchilling (-1.5 ºC) and freezing (-18 ºC) temperature.



Study II: Effect of grind size and modified atmosphere packaging on colour and lipid oxidation of ground buffalo and sheep meat during storage under superchilling condition

Lipid oxidation and myoglobin redox stability are interrelated and oxidation of one will exacerbate the other. To better understand this hypothesis and to test the effect of grinding/mincing and modified atmosphere packaging (MAP), the present study was conducted in buffalo and sheep meat stored under superchilling conditions (-1 ºC). Fine mincing (7 mm) resulted in higher (P<0.05) lipid and myoglobin oxidation compared to mincing by 13 mm plate (coarse) of a meat mincer. The MAP of ground buffalo and sheep meat using 70% O_2 + 20% CO_2 + 10 N_2 resulted in lower (P<0.05) lipid oxidation and % metmyoglobin formation (Figure 2 and 3) as compared to aerobically packaged samples. The sensory colour and discolouration scores revealed that MAP packaged ground buffalo and sheep meat patties (Figure 4) have a display life of 15 days in contrast to 5 days for aerobic samples under superchilling conditions. Myoglobin oxidation and colour deterioration are the limiting factors for the shelf-life of aerobically packaged ground buffalo and sheep meat. Therefore, combination of MAP and superchilling is effective in prolonging the storage and or/display life of fresh ground meats.

Figure 2. Effect of grind size and modified atmosphere packaging (MAP) on % metmyoglobin formation in ground buffalo meat patties during storage under superchilling condition. (Standard error bars are indicated, *n=5)*

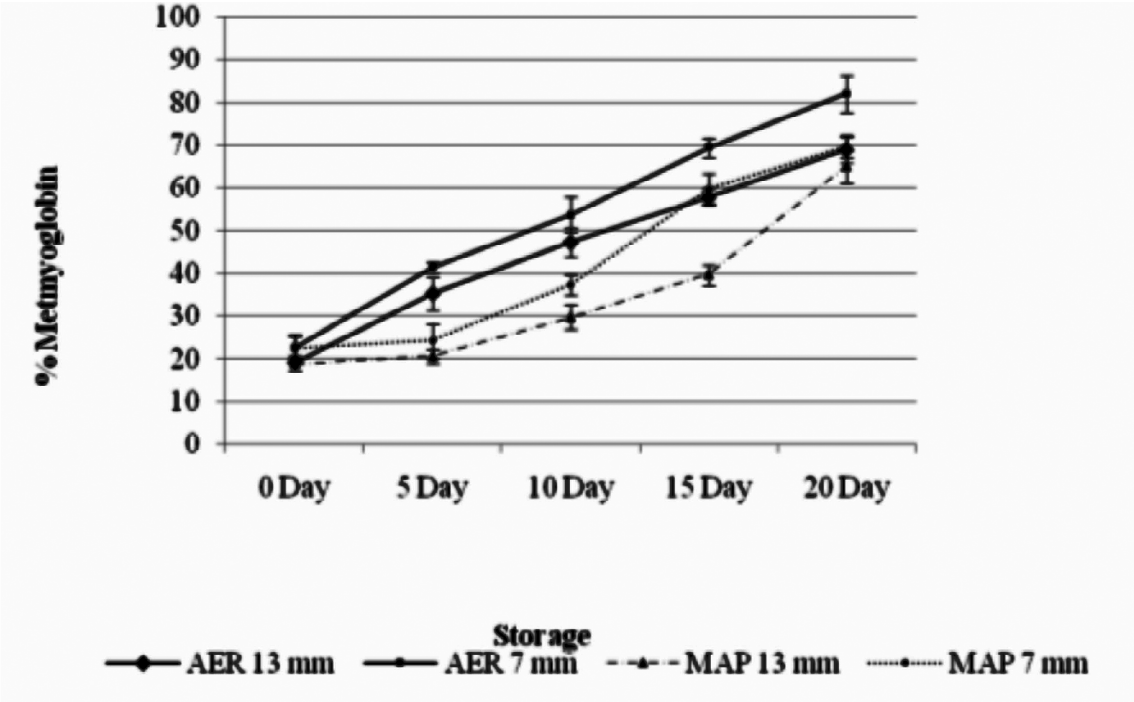


Figure 3. Effect of grind size and modified atmosphere packaging (MAP) on % metmyoglobin formation in ground sheep meat patties during storage under superchilling condition. (Standard error bars are indicated, *n=5)*

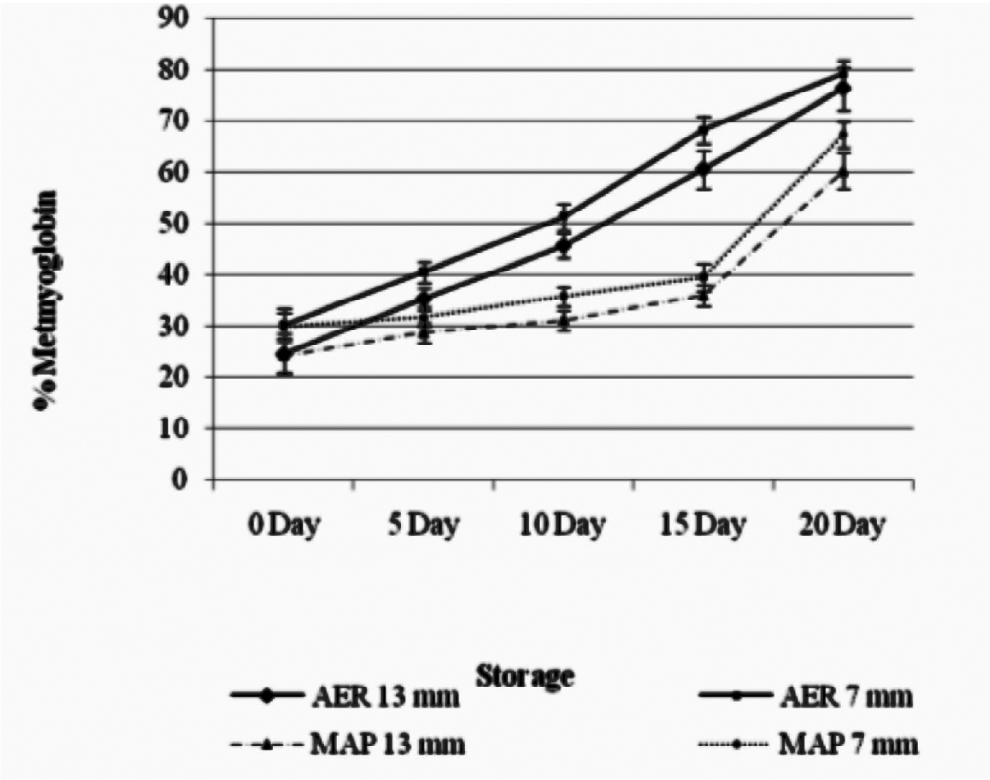


Figure 4. Effect of grinding (7 mm plate) and modified atmosphere packaging (MAP) on colour stability of ground mutton patties after 15 days of superchilling storage.

Study III: Quality characteristics and composition of emu meat

Keeping in mind, the keen interest among emu farmers and consumers to know about emu meat, this need based research work was carried out to evaluate the proximate composition, physico-chemical properties, textural and histological characteristics, lipid and microbial quality of emu meat. The proximate composition indicated higher protein and ash content and lowest fat content in emu meat compared to meats from other meat animals. The pH, water holding capacity, collagen content and solubility, protein extractability, muscle fibre diameter and Warner-Bratzler shear force values are similar to the earlier reports for meats from other food animals (Table 1). The emu meat is dark cherry red in colour with significantly higher myoglobin content and the myoglobin is more prone for oxidation as evidenced by higher initial metmyoglobin content. The initial thiobarbituric acid reactive substances (TBARS) values and % free fatty acids in emu meat were higher compared to meats from other species. The sodium dodecyl sulfate polyacrylamide gel electrophoresis results also indicated similarities of emu meat proteins with other meats. The initial total plate counts are also similar to those reported for other meat animal species. The study shows the potential of emu meat as a new source of low fat, quality meat proteins, however, more studies are required to elucidate the effect of age, sex, muscles, pre-slaughter and post-slaughter factors on different carcass and meat quality characteristics.

Table 1. Physico-chemical properties, texture, and microbial quality of emu meat

Physico-chemical Properties	Mean ± SD
pH	5.69 ± 0.29
Water holding capacity (%)	69.80 ± 2.88
Metmyoglobin (%)	33.03 ± 3.75
Texture parameters	
Collagen content (mg/g tissue)	66.46 ± 2.19
Collagen solubility (% total collagen)	24.30 ± 1.61
Warner-Bratzler shear force (Newtons)#	29.56 ± 1.41
Muscle fibre diameter#	62.06 ± 2.39
Microbial quality	
Water activity (aw)	0.886 ± 0.02
Total plate counts (log cfu/g)	3.54 ± 0.37

Values are mean ± standard deviation of five replicates (n=5) except # (n=25)

Project title: Effect of Zn and Se levels in Sheep diets on meat quality"

Principal Investigator: Dr. P. Baswa Reddy Scientist (SS)

Co Investigators: Dr. D.B.V. Ramana, Senior Scientist, CRIDA, Dr. A. R. Sen, and Dr. B. M. Naveena.

As a collaborative project between NRC on Meat and Central Research Institute for Dry land Agriculture (CRIDA), a feeding trial was conducted in Sheep at HRF of CRIDA to study the effect of feeding different levels of Selenium in the diet on the growth performance, immunity and mat quality.

Twenty four weaned native ram lambs have been purchased from the farmers near Shadnagar, Mahaboobnagar district and transported to Hayatnagar Research Farm of CRIDA. They were tagged and initially sent out for grazing along with existing sheep flock of CRIDA. They were dewormed and then divided into four groups with six animals in each group. They were then kept in the shed as groups and sent for grazing in the day time. The grazing time has been reduced gradually until they completely acclimatized to confinement. Once they completely acclimatized to confinement, they were offered experimental feeds. Four experimental concentrate feeds were formulated with different Selenium levels by incorporating Sodium selenite in the feed as per the composition given in the table-1. In the morning every day, animals in each group are group-fed with respective concentrate feed @ 1% of body weight. Ad libitum roughage was offered in the form of chopped maize straw to all the animals. A record of feed offered and the feed left over is maintained to arrive at the feed consumed. Weights of animals are recorded at fortnightly interval. Blood samples of all the animals are collected at the beginning to screen for the initial blood parameters.

To study the effect of Selenium levels in the diet on the immunity of the animals, all the animals have been challenged with Entero Toxemia (ET) antigen and again a booster dose was given on the 15th day of initial challenge. Blood samples are collected at regular intervals for evaluation of Humoral immune response. At the end of the feeding trial, representative animals from each group will be slaughtered to study the carcass characteristics and the meat samples will be evaluated for their quality parameters.

Table 1. Composition of concentrate mixtures

Ingredients	Group 1	Group 2	Group 3	Group 4
Maize (%)	40	40	40	40
Wheat Bran (%)	32	32	32	32
Soybean meal (%)	25	25	25	25
Min mix.(Agrimin) (%)	2	2	2	2
Salt (%)	1	1	1	1
Vit.mix (g/100 Kg)	40	40	40	40
Na_2 Se O_3 (g/100kg)	0	0.1	0.2	0.4

Table 2. Blood parameters of animals in different groups at the beginning of the experiment

S.No	Parameters	Group 1	Group 2	Group 3	Group 4
1.	Na (mEq/l)	146.04 ±0.5	146.86±0.72	147.1±0.87	143.62±0.24
2.	K (mEq/l)	4.55±0.31	4.57±0.12	4.7±0.02	4.76±0.12
3.	Chloride	99.1±0.4	99.1±0.0	100.72±0.93	100.26±1.28
4.	Ca^{2+} (mg/dl)	9.84±0.07	10.46±0.04	11.24±0.23	11.29±0.32
5.	Total Protein (g/dl)	6.42±0.07	6.60±0.98	5.96±0.11	6.11±0.18
6.	Albumin (g/dl)	3.10±0.12	3.11±0.16	3.41±0.04	3.07±0.20
7	Globulin (g/dl)	3.31±0.19	2.37±0.03	2.56±0.08	3.03±0.38
8.	Creatinine (mg/dl)	1.30±0.05	1.25±0.12	1.29±0.07	1.18±0.09
9.	Glucose (g/dl)	63.60±2.05	65.13±0.66	68.46±1.73	53.87±1.97
10.	Blood Urea N (mg/dl)	15.29±0.89	19.99±0.86	17.46±0.70	17.75±1.13

Inter institutional Project with CRIDA: In vitro evaluation of enteric methane mitigation options for livestock fed with coarse crop residues as basal diet

Principal Investigator: D. B. V. Ramana, Senior Scientist, CRIDA

Co-Investigator: P. Baswa Reddy,

Typical relationship between head-space gas pressure and gas volume from 20 bottle read on 8 occasions during 24h incubation period are recorded. Cumulative gas production profiles from the fermentation of sorghum stover with (@10%) or without supplementation of *Stylosanthes hamata, Leucaena leucoceplala and Glyricidia sepium* leaf meal are quantified. Cumulative gas production (ml / g OM fermented) was maximum in sorghum stover without supplementation and minimum in *Leucaena leucoceplala* meal supplementation. Organic matter (OM) disappearance (%) and extent of digestibility was maximum with *Leucaena* leaf mal supplementation and minimum in sorghum stover without supplementation The results of the present study indicate the possibility of anthropogenic emission reduction by supplementation of locally available leaf meal to the livestock being fed with coarse crop residues.

ICAR Lal Bahadur Shastri Outstanding Young Scientist Award 2010 challenge research project, 'Developing traceability model for Indian buffalo meat industry for quality assurance and augmenting exports' (2011 – 2014)

Principal Investigator: Dr. Girish Patil, S., Scientist (Senior Scale)

Traceability of meat is the ability to follow the movement of meat through specified stage(s) of production, processing and distribution *i.e.* throughout the value chain. Implementing traceability system will drastically enhance consumer confidence and will also boost meat & meat product export

opportunities. In India, no initiative has been taken and focused effort has been made in this regard. Hence, there is an urgent need to develop traceability mechanism for Indian buffalo meat industry and to fulfil this need research project, 'Developing traceability model for Indian buffalo meat industry for quality assurance and augmenting exports' was submitted to ICAR and the project was approved under Lal Bahadur Shastri Outstanding Young Scientist 2010 challenge research project with a project funding of Rs 35.00 lakh of which Rs 5 lakh is sanctioned towards getting International training. Project fund was released in April 2012.

Project title: Developing Educational Training Modules and Awareness Programs to Enhance the Meat Sector Development

Principal Investigator: Shri. P. Mooventhan, Scientist

Co-Investigators: Dr. M. Muthulakshmi, and Dr. K. Susitha

1. As per the RAC, IRC and Director suggestions, two different interview schedules prepared with appropriate variables for Elite group (Agricultural Research Scientist), Butchers and consumers.

2. Data collected from above respondents (Meat Consumers and ARS) with respect to following independent and dependent variables.

- Socio-economic profiling,
- Meat consumption pattern,
- Meat quality awareness,
- Awareness in meat safety and
- Knowledge in meat processing and value addition

3. Data collected from above respondents (Meat Industry Workers) with respect to following independent and dependent variables.

- Socio-economic Profile
- Need Identification
- Social Issues
- Innovativeness
- Mass Media Exposure
- Intervention Diagnosis for Meat Industry Workers
- Job Satisfaction

4. Relevant PRA tools were successfully utilized to explore the felt need of the butchers and

consumers. Collected data extracted and categorized in different format for analysis. Appropriate statistical analysis were used to analysis the data. Results were interpreted and conclusion has been drawn.

5. *Hyderabadi Haleem* production documented.

6. Clean meat production from chicken and sheep documented.

7. Several Strategic participatory visit made to Hyderabad municipality slaughterhouse to examine the innovativeness, mass media exposure, socio-economic profiling and for educational training module and awareness programme development for further research strengthening.

Prevailing pattern of meat consumption among scientific community

1. Most of the population interested to consume Chicken meat (79%)

2. Significant population willing to buy meat as fresh (86%)

3. Majority of the respondents consider the flavour (98%) and texture (92%) of meat as important meat quality parameters.

4. With respect to innovativeness, most of the butchers population (174) fall under the category of "I prefer to wait and take my own time"

With respect to mass media exposure, majority of butchers population (42%) fall under the category of television viewers followed by Mobile communication (30%).

Table - 1. Prevailing consumption pattern of different meat among scientific community

Sr. No	Type	Response
1	Most favourite cut-up parts in chicken	Leg
2	Preferred mutton/goat meat from	Male and Young
3	Preferred form of mutton/goat meat	With bone
4	Most favourite cut-up parts in sheep/goat	Shoulder
5	Preferred form of pork	Cut-up parts
6	Preferred form of fish	Live one - Sea fish followed by inland
7	Interest to consume Offals/by-products	Yes
8	Preferred Offals/by-products in chicken	Liver
9	Preferred Offals/by-products in sheep/goat	Liver, Intestine and Heart
10	Time of meat purchase	On the same day
11	Criteria for meat shop selection	Cleanliness and previous experience
12	Preference to buy packed meat	No

Figure 1. Job satisfaction among butchers

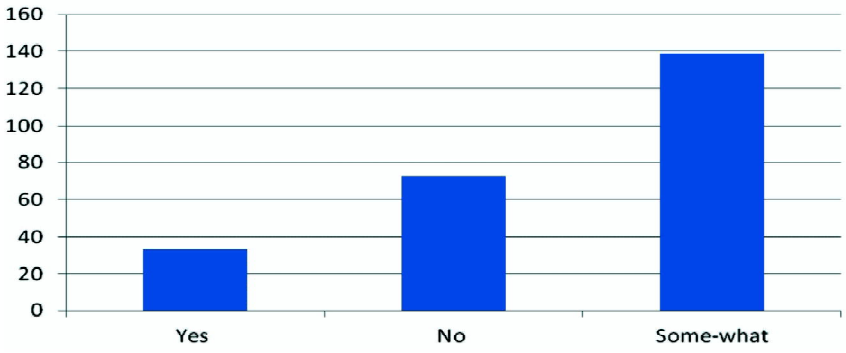
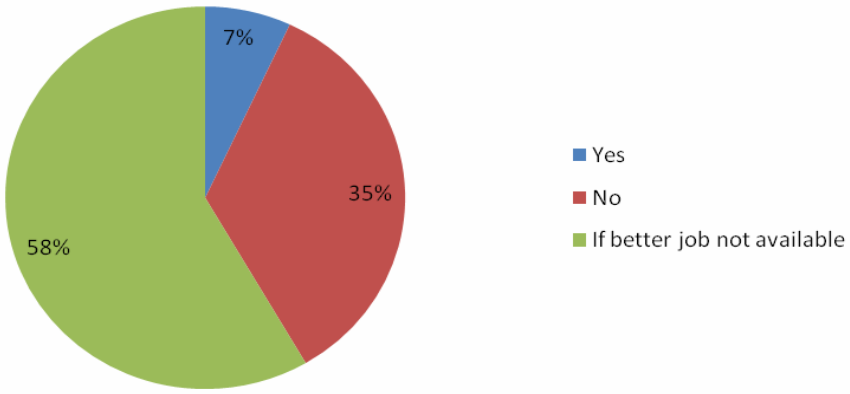


Figure 2. Willingness to induct future generation into meat business



Project title: Simple means of spent hen meat preservation and transportation for processing purposes

Principal Investigator: Dr. R.S. Rajkumar, Scientist

Co- Investigators: Dr. I. Prince Devadason, Dr. M. Muthulakshmi and Dr. K. Susitha

An economical method for transporting spent hen meat from farm to processing plant and proper utilization of spent hen has been evolved in this project. To achieve this objective a technology has been developed to preserve the spent hen meat using salt and ice mix. Several experiments have been done in various groups by treating the spent hen meat with salt (5%, 7.5% and 10%) and spice mix (2%, 3% and 4%). All the treatments were stored separately in the slashed ice and at room temperature.

The quality of the meat was analyzed in the 24, 36 and 48 hrs intervals and found that spent hen meat treated with 10% salt in ice mix for 24 hrs is the best combination for the preservation of the spent hen meat. Various value added meat products were also been prepared using spent hen meat and were evaluated for the sensory attributes.

Figure 1. Mean +SE of TPC (log/g)of salt treated spent hen meat kept in Ice and Room temperature (RT) during storage periods

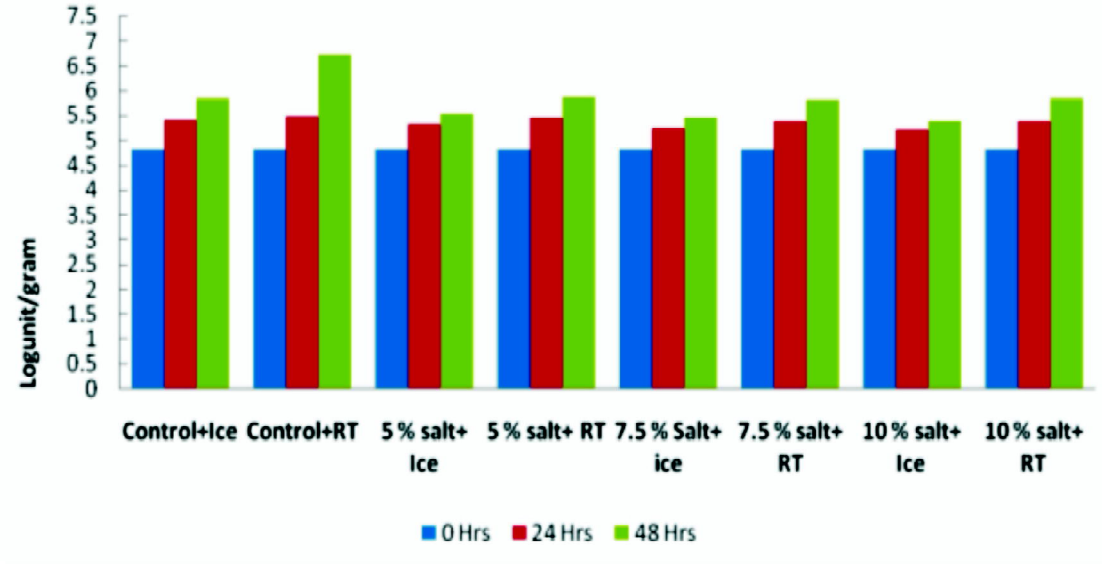


Figure 2. Mean + SE of Yeast and Mould count of Spice Mix (SM) treated spent hen meat kept in ice and Room temperature (RT) during storage periods

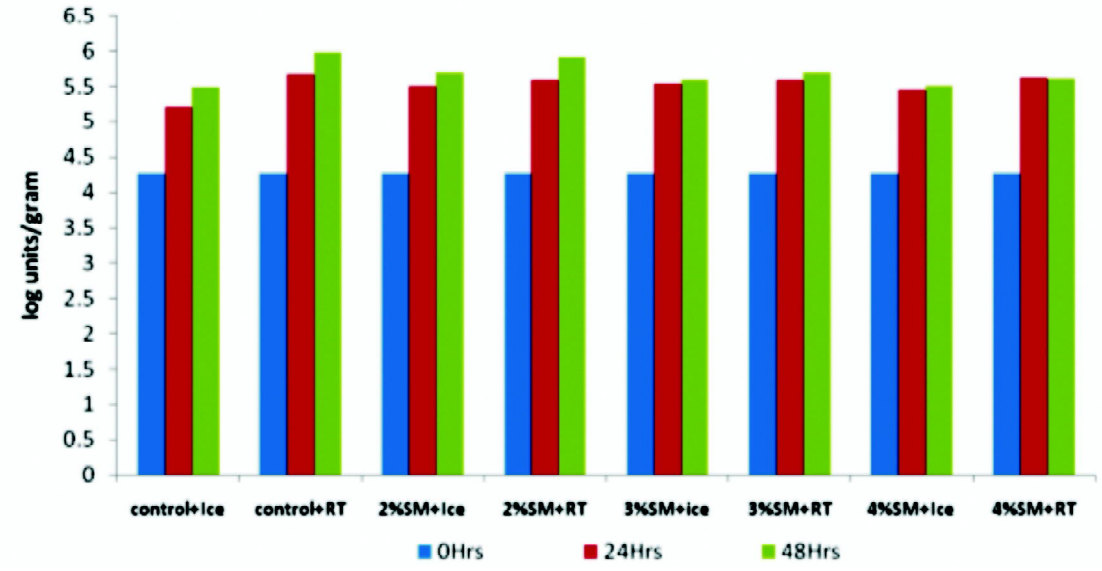


Figure 3. Mean +SE of coliform count (log/g)of salt treated spent hen meat kept in Ice and RT during storage periods

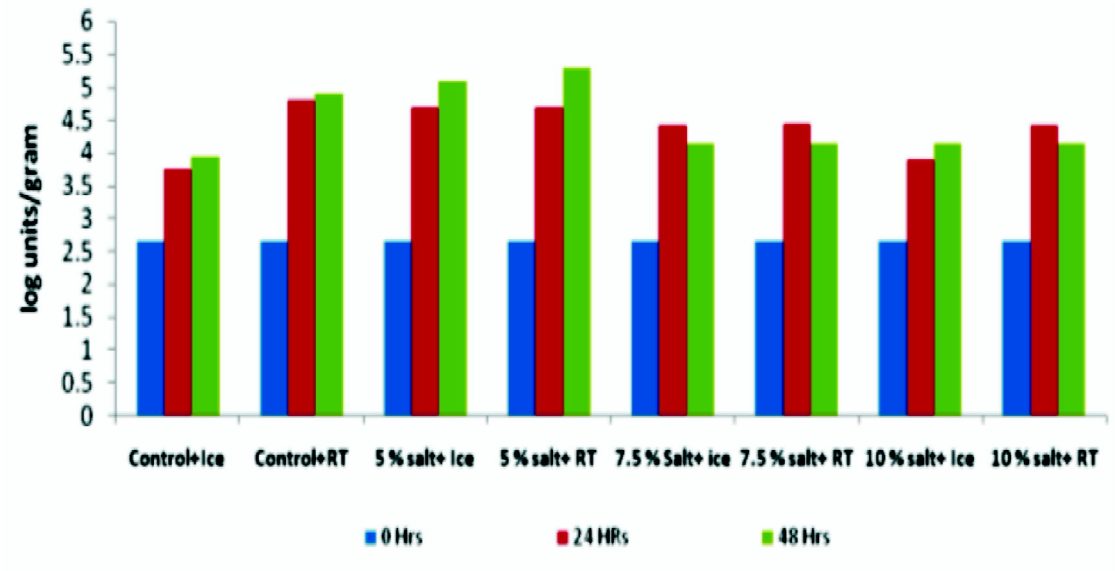


Figure 4. Mean + SE of TPC of Spice Mix (SM) treated spent hen meat kept in ice and Room temperature during storage periods

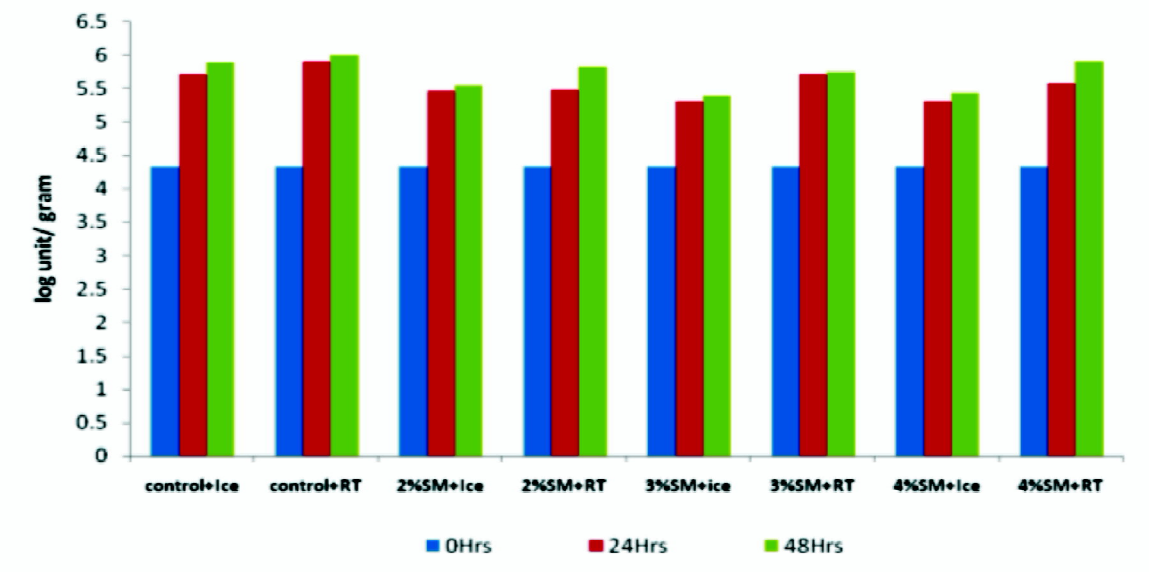
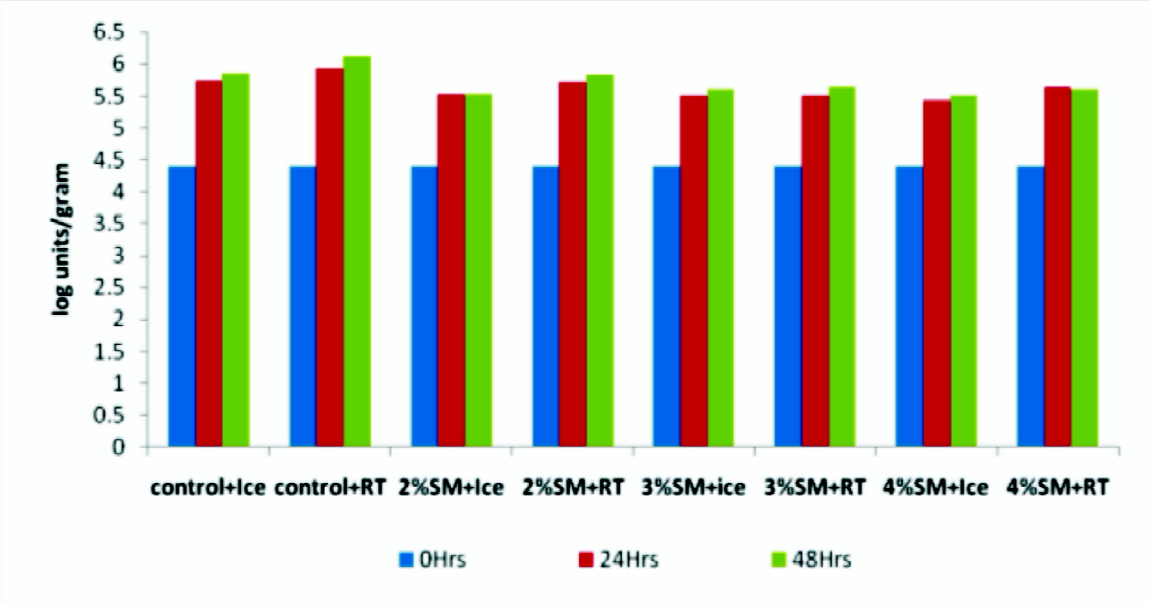


Figure 5. Mean + SE of Yeast and Mould count of Spice Mix (SM) treated spent hen meat kept in ice and Room temperature during storage periods



Project title: Development of small scale entrepreneurial project for production of processed meat

Principal investigator: Dr. M. Muthulakshmi

Co Investigators: Dr. Girish patil, S., Dr. R. S. Rajkumar and Shri. P. Mooventhan

Experiment 1: Carcass characteristics and meat qualities of spent sheep

Carcass characteristics and meat qualities of eight spent female sheep (Deccani) were evaluated. Live weight, dressed weight and non carcass component weight and percentage of spent female sheep are shown in figure 1. Average live wt. (kg) of spent female sheep was 22.75±0.51. Dressing percentage was 43.33±0.83. The cut of parts, meat and bone yield of spent sheep carcass are presented in table Fig 2. The average total meat was 5.937 Kg. Meat bone ratio is 2:1. Cut of parts, meat and bone yield of spent sheep and Meat qualities of spent sheep are presented in figure 2 and table 1. The Shear Force Value (N/cm^2) of spent sheep meat was 32.77±2.34.

Figure 1. Dressing percentage and non-carcass components of spent sheep

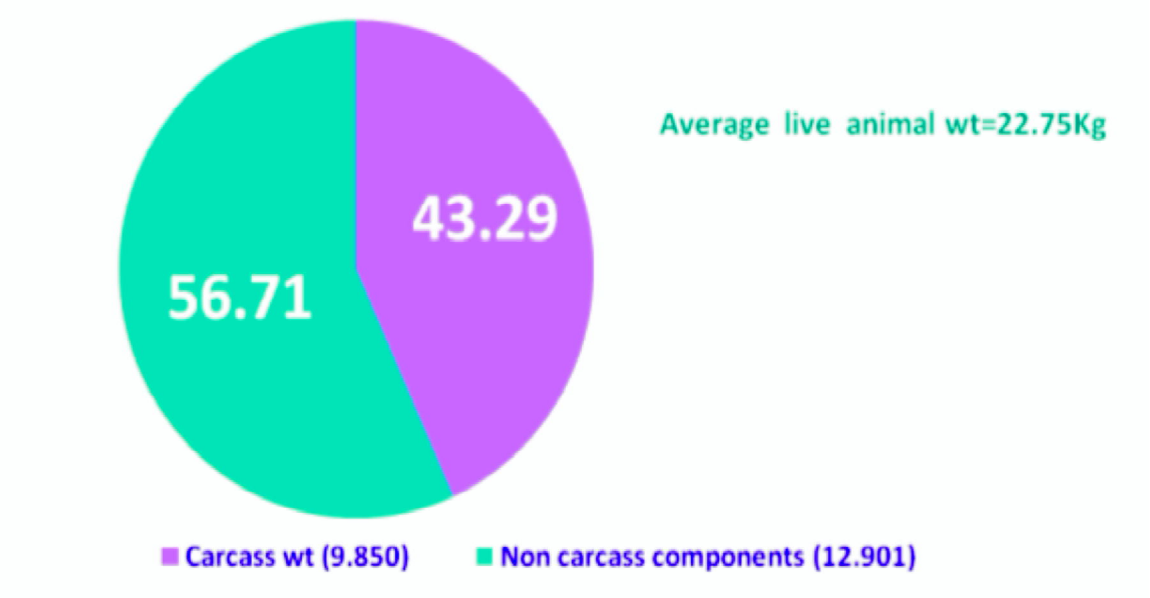


Figure 2. Cut of parts, meat and bone yield of spent sheep carcass

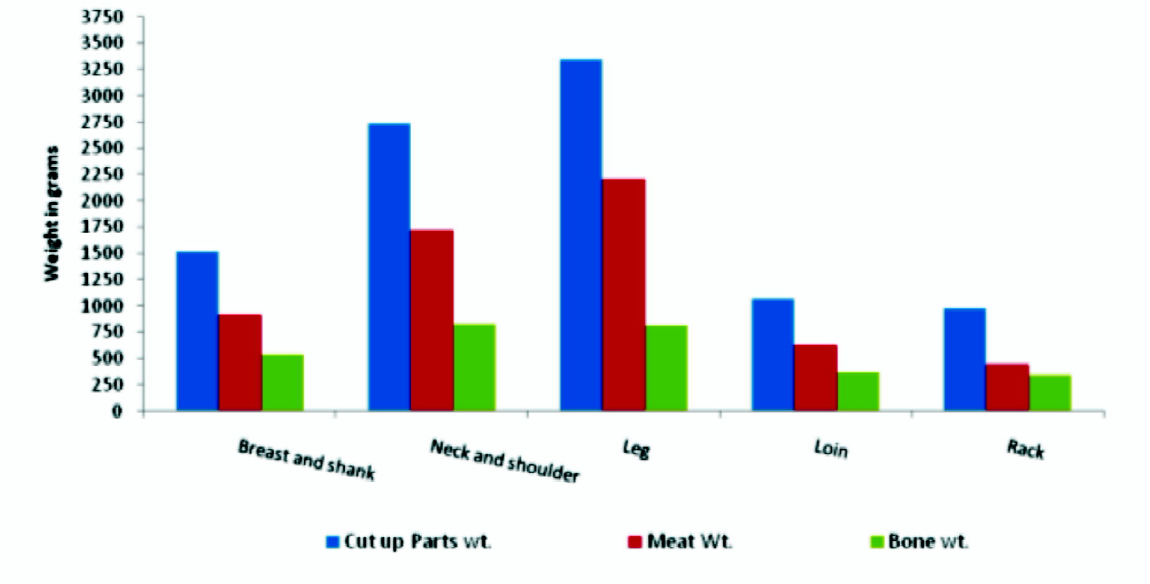


Table 1: Meat qualities of spent sheep

Parameters	Value
pH	5.62±0.97
SFV(N/cm^2)	32.77±2.34
WHC (%)	67.00±4.09
Myoglobin (%)	2.96±0.70
Met mb (%)	40.00±4.47
Muscle fibre diameter (µm)	79.15±4.90
Hydroxy proline content (mg/g)	31.0±0.28
% total protein extractability	53.14±2.98
% of water soluble protein extractability	12.87±1.46
% of salt soluble protein extractability	40.26±2.22
Moisture (%)	72.16±3.61
Protein (%)	21.83±1.91
Fat (%)	2.66±0.33
Ash	3.35±0.75
Cooking yield (%)	79.53±1.22

Experiment 2: Carcass characteristics and meat qualities of spent goat

Carcass characteristics and meat qualities of 10 spent female goats were evaluated. Live weight, dressed weight and non carcass component weight and percentage of spent female goat are shown in figure 3. Average live wt. (kg) of spent female goat was 24.38±0.51. Dressing percentage was 43.03±0.83. The average total meat was 6.24 Kg. Meat bone ratio is 1.97:1. The cut of parts, meat and bone yield of spent goat carcass are presented in table Fig 4. Meat qualities of spent goat are presented in table 2. The Shear Force Value (N/cm^2) of spent goat meat was 29.45±1.36.

Figure 3. Dressing percentage and non-carcass components of spent goat

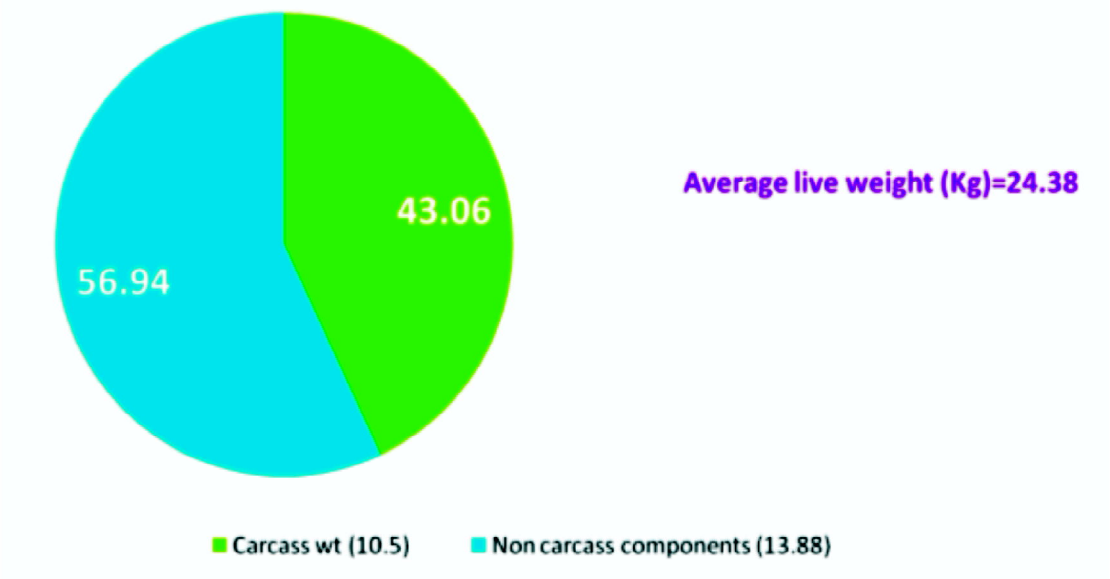


Figure 4. Cut of parts, meat and bone yield of spent goat carcass

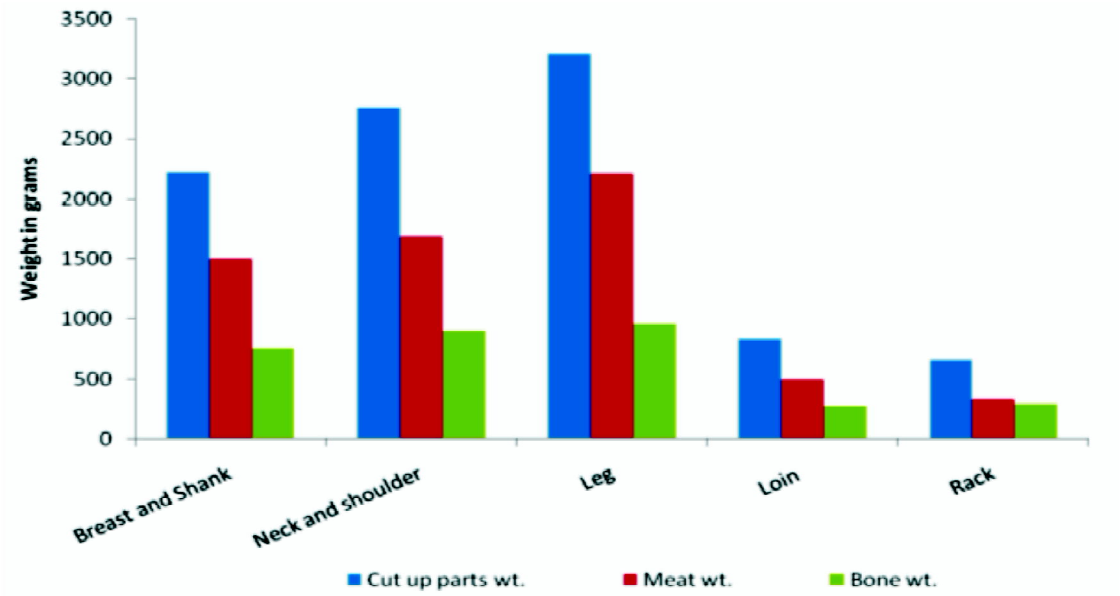


Table 2. Meat qualities of spent goat

Parameters	Value
pH	5.91±0.09
SFV (N/cm^2)	29.45±1.36
WHC (%)	26.71±4.94
Muscle fibre diameter (µm)	54.90±1.72
% Mb	2.85±0.24
% met Mb	23.99±2.17
Hydroxy proline content (mg/g)	29.0±0.28
% Total protein extractability	50.85±2.42
% Sarcoplasmic protein extractability	11.471.28
% Myofibrillar protein extractability	39.38±1.85
Cooking yield (%)	70.35±2.54
Moisture (%)	73.43±1.06
Protein (%)	20.06±0.55
Ash (%)	3.56±0.15
Fat (%)	2.95±0.12

Experiment 3: Development of new products

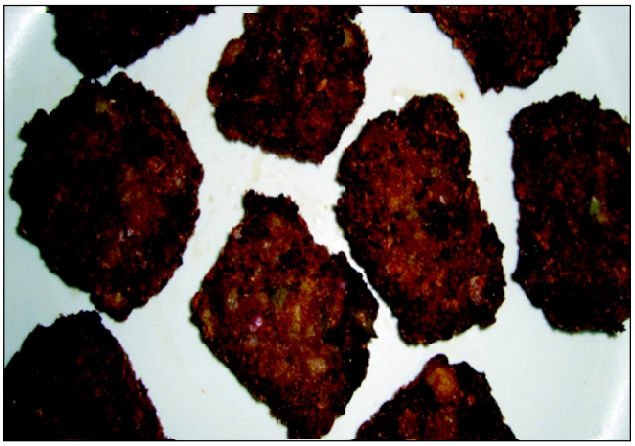
Developed various value added meat products using spent hen meat, spent sheep and spent goat viz., broiler meat incorporated spent hen meat nuggets, cooked skin incorporated chicken meat nuggets, baby *kebabs*, emulsion *samosa*, chicken block slice fried rice, *amchur* meat pickle, mutton cutlet, mutton *seedai*, meal maker and crispies (pappads). Spent hen meat nuggets (1), Broiler meat incorporated spent hen meat nuggets (2) the second one obtained higher sensory score and lower SFV. Raw skin (a), Steam cooked skin (b), and Pressure cooked skin(c) incorporated nuggets from spent hen meat developed and analysed. Last one obtained higher sensory score and lower SFV.

Table 3: Qualities of spent hen nuggets incorporated with steam and pressure cooked skin

Parameter	Raw skin incorporated nuggets	Steam cooked skin incorporated nuggets	Pressure cooked skin incorporated nuggets
pH	6.5	6.5	6.5
TBA	0.2	0.2	0.1
SFV (µm)	7.1[c]	6.7[b]	6.2[a]
Cooking yield	97.3	97.2	97. 2
Hardness	63.1[c]	60.7[b]	57.3[a]
Adhesiveness	0.0	0.0	0.0
Chewiness	44.2	50.2	77.8
Cohesivness	0.8	1.1	1.4
Gumminess	45.7	52.4	71.4
Springiness	0.9	1.4	1.3
Appearance	6.8	7.1	7.2
Flavour	6.8	7.0	6.8
Juiciness	6.4	6.8	7.0
Texture	6.8	7.0	7.0
Overall acceptability	6.7	7.0	7.0

Selected meat products developed in this project

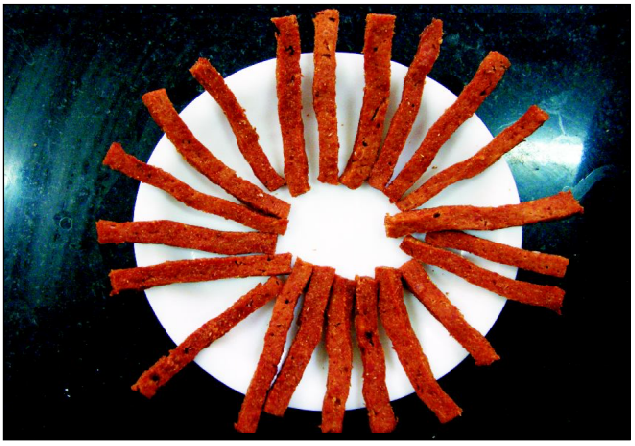
Cheken meal maker



Mutton cutlet

Mutton seedai

Emulsion samosa



Chevon finger chips

Chevon pappads

II. Externally funded projects:

National Agricultural Innovation Project (Component II)

A Value chain for Clean Meat Production from Sheep

Lead Institute: National Research Centre on Meat, Hyderabad

Partner Institutions: Sri Venkateshwara Veterinary University, Tirupati; Mandava Foundation, Venkatachalam, Nellore; Department of Animal Husbandry, Nellore and Al kabeer Exports Pvt. Ltd., Hyderabad

Consortium Leader: Dr. G. Venugopal, Director, (Acting) NRC on Meat

Consortium Principal Investigator: Dr. Girish Patil. S., Scientist (SS)

Co Principal Investigators: Dr. C. Ramakrishna, Senior Scientist;

Dr. P. Baswa Reddy, Scientist (SS);

Dr. B. M. Naveena, Scientist (SS);

Dr. M. Venkateswarlu, Associate Professor, Veterinary College, Hyderabad;

Dr. P. Srinivasulu Naidu, Veterinary Officer, Mandava Foundation, Venkatachalam

Associated Scientists: Dr.S.Vaithiyanathan, Principal Scientist,

Dr.A.R.Sen, Principal Scientist,

Dr.Y.Babji, Principal Scientist

Dr.I.Prince Devadason, Scientist SS, and

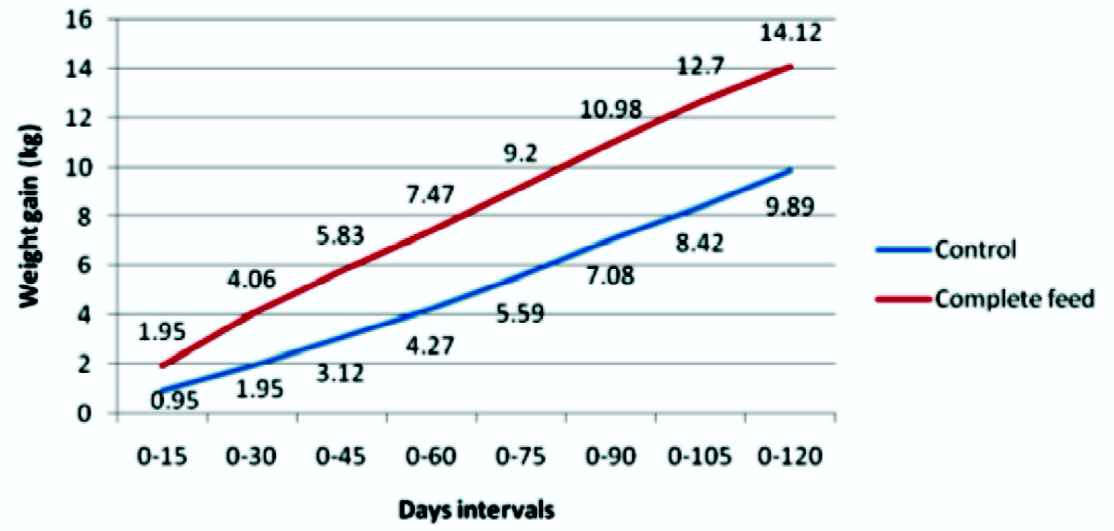
Dr.M.Muthukumar Scientist, SS

Augmenting Quality Meat and Byproducts Production through Nutritional Intervention for Growing Lambs to Optimum/heavy Live Weights

Under the project two Rural Feed Processing Units were established in the year 2011 – 12. First one RFPU was established at Gudur, Chennur Mandal, Nellore district, Andhra Pradesh and complete feed is being produced by utilizing the locally available crop residues which is being supplied to sheep farmers for growing ram lambs to larger weight.

Four hundred and thirty ram lambs have been reared to larger weight by feeding the complete feed and another six hundred ram lambs are being reared to larger weight. 46.64 tons of maize straw, 33.08 tons of ground nut haulms and 6.64 tons of black gram straw were procured. 40 tons of complete feed was produced at 50:50 ratio of crop residues and concentrate mix and supplied sheep farmers for rearing ram lambs.

Effect of supplementation of complete feed on weight gain (kg) of Nellore ram lambs enrolled after weaning stage



Inauguration of Rural Feed Processing Unit at Chennur, Gudur mandal, Nellore on 25th August 2011

Second Rural Feed Processing Unit was successfully established at Livestock Research Station, Mahaboobnagar, Andhra Pradesh with the help of Consortia partner SVVU, Tirupati and complete rations (mash form) are being prepared by using different crop residues which is being supplied to sheep farmers for growing ram lambs to larger weight. Seven hundred and fifty ram lambs are being reared to larger weight by feeding complete feed and one thousand & five hundred animals are being reared by feeding supplementary feed in Mahabubnagar and Anantpur district of Andhra Pradesh.

Rural Feed Processing Unit established at LRS, SVVU, Mahabubnagar

Dr. Prabhakar Rao, Vice Chancellor, SVVU, Tirupati distributing feed to sheep farmers on 26th Dec 2011

Experiments were conducted on comparison of growth parameters and carcass characteristics of ram lambs reared on extensive, semi intensive and intensive method. Animals also yielded high carcass weight in intensive and semi intensive system as compared to that of extensive system. Ram lambs reared on semi intensive and intensive method yielded profit of Rs 1086.68 and Rs 1218.77 respectively. Farmers are elated with the results and the RFPUs will continue to serve the sheep farmers in years to come.

1) Research on Designing & Establishment of Model Slaughterhouses for Popularizing Clean Meat Production

Under the project a Model sheep slaughterhouse was successfully established at Sri Venkateswara Veterinary University, Tirupati (consortia partner) under NAIP project for popularizing clean meat production. It was inaugurated by Dr. K. M. L. Pathak, DDG (AS), ICAR, New Delhi on 02nd March 2012. Slaughterhouse has capacity of slaughter up to fifty animals per day and will mainly serve the purpose of providing hands on training to entrepreneurs, meat handlers, municipal officials, students and other stakeholders of the industry.

2) Research on Developing Appropriate Technologies for Value Addition to Meat from Heavy Weight Lambs and Spent Sheep

Range of products were developed from sheep byproducts. Of which 'shelf stable sheep rumen crackle' was successful. Products were shelf stable at room temperature even up to one year. Technology was transferred an entrepreneur Mr. Yadagiri for commercialization. Other products developed are rumen nuggets, mutton bone soup, sheep liver fry etc.

3) Training and Awareness Creation about Efficient Lamb Production, Processing and Utilization

Eight awareness workshops/training programmes on various areas including sheep rearing, slaughtering, packaging, establishment of abattoirs etc. were organized to sheep farmers, butchers, municipal officials etc in different parts of Andhra Pradesh. About seven hundred stakeholders were benefited under the program.

Training program on Scientific sheep slaughter practices and meat packaging technologies 20th June 2011

Collector, Mahabubnagar addressing in the Interactive workshop in Mahabubnagar on 22nd December 2011

Awareness workshop on 'Clean meat production' at Warangal on 02nd February 2012

Dr. K.M.L. Pathak, DDG (AS) releasing NAIP calendar on 02nd March 2012 at SVVU, Tirupati

Dr. K.M.L. Pathak, DDG (AS) distributing kits to butchers on 02nd March 2012 at SVVU, Tirupati

Participants of training program on 'Hygienic meat production in municipal abattoirs' organized for municipal officials on 08th to 10th February 2012

National workshop on

'Strategies for Modernization/Upgradation of Service Abattoirs In India'On 16th & 17th March 2012

National Workshop on 'Strategies for modernization/upgradation of service abattoirs in India' was organized on 16th & 17th March 2012 by National Research Centre on Meat, Hyderabad under National Agricultural Innovation Project, 'Value chain for clean meat production from sheep'. Workshop was inaugurated by, Dr. Janardhan Reddy, I.A.S, Commissioner & Director, Municipal Administration, Government of Andhra Pradesh. The Chief Guest in his inaugural address stated that slaughterhouses are not given due importance in AP and expressed his willingness to take necessary action in this direction. He has complimented NRC on Meat for taking lead in developing strategies for modernising the slaughter houses. Dr. Nagendra Sharma, Former Vice Chancellor, SKUAST & Former Director IVRI, Izatnagar, stressed the importance of modernisation of service abattoirs and pointed out the significance of the value addition, waste disposal and by-product utilisation. Dr. Sushil Kumar, Former Director NDRI, Karnal outlined the socio-economic development and knowledge base of the meat industry workers linked with by product utilisation. and Dr. A. T. Sherikar, Former Vice Chancellor, M,A.F.S University, Nagpur expressed about problems and challenges of Indian meat sector. Further, he stressed that; one holistic mission mode programme is required to upgrade the meat sector. Dr. S.K. Ranjhan, Director,Hind Agro, U.P.skeletonised the challenges, problem, issues and present status of the meat industry in the country. About sixty participants across the country comprising of experts from the field of Meat Science technology, Veterinary public health,Industry,SAU's, NMPPB have participated in the workshop. Dr. G. Venugopal, Director (Acting), NRC on Meat, in his welcome address briefed the objectives of the National Workshop and highlighted the achievements of NRC on Meat. Dr. Girish Patil, S., Scientist (SS) & CPI (NAIP) presented the overview of the workshop while Dr. S.Vaithiyanathan, Principal Scientist presented vote of thank.

Dr. Janardhan Reddy, I.A.S. Commissioner & Director, Municipal Administration inaugurating the national workshop

All the participants were distributed in to five groups to deliberate on the following focal areas. After a day long detailed deliberation each group has come out with specific and implementable recommendations which were presented in the plenary session.

1) Strengthening the infrastructure in service abattoirs

2) Effective wastes disposal

3) Profitable utilization of animal by-products

4) Implementing quality protocols in service abattoirs

5) Developing strategies for marketing and awareness creation

Valedictory ceremony

Closing ceremony of the workshop was held on17th March 2012 Dr. V. Prabhakar Rao, Vice Chancellor, Sri Venkateswara Veterinary University, Tirupati was the Chief Guest. Dr. Rao appreciated the approach and method of conducting the workshop and commended the experts who have congregated at NRC on Meat for the first time and for coming out with implementable recommendations for modernization of service abattoirs.

Dr. V. Prabhakar Rao, Vice Chancellor, Sri Venkateswara Veterinary University, Tirupati was the Chief Guest at the Valedictory function

Publications

Research papers

Gopal Krishna, G.Gopi Krishna, C.Gopal, S.Jahageerdar, P.Ravichandran, S.Kannappan, S.M.Pillai, S.Paulpani,R.P.Kiran, R.Saraswati, G.Venugopal, Dilip Kumar, T.Gitterle, Carlos Lozano, Morten Rye,Ben Hayes (2011). Genetic parameters and survival in Penausmonodon cultured in India. *Aquaculture*, 318:74-78.

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Lead papers

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Institute Technology Management Unit (ITMU) of NRC on Meat

National Research Centre on Meat, Hyderabad has commercialized its technologies for production of various value added meat products through hands-on-training programs followed by signing MoU for licensing of technical knowhow with different entrepreneurs. Many consultancy projects have been formulated and processed. Time to time, Institute ITMU is providing information on success story, technology dissemination etc. to South Zone Headquarter of ITMU at Kochi, Kerala and are liaison with Council for business development.

MoU Licensing:

National Research Centre on Meat, Hyderabad has commercialized its meat processing technologies viz. emulsion technology, cured and smoked products technology, enrobed technology etc. The following licensing has been signed with different entrepreneurs.

S.No	Date	Name of the Firm/ Person	MoU/ Licensing of Technical knowhow
1.	06.05.2011	Innofoods, Mallapur Hyderabad	MoU for technical knowhow "Technology for Emulsion Based Meat and Meat Products"
2.	18.06.2011	Trishul Bar and Restaurant, Amberpet, Hyderabad	Licensing of technical knowhow "Emulsion Based Meat and Meat Products"
3.	20.07.2011	Elite foods, Hyderabad	Licensing for " Process Technology for Emulsion Based Meat Products"
4.	24.02.2012	Mr. Mohammed Abdul Azeem, Tolichowki, Hyderabad	Technology transferred "Packaging Technology for Meat and Meat Products"

Trainings organized in NRC meat for entrepreneurs:

National Research Centre on Meat, Hyderabad has conducted training programs entitled as "Chicken Product Processing for Small Scale unit" on a regular basis in six sessions and 97 participants has completed this training program. Besides this, several other training programmes are being organized in this year:

S.No	Date	Name of the Training programme	Number of participants
1.	6th to 8th April, 2011	Chicken product processing for small scale Unit	40
2.	20th June, 2011	Slaughter and packaging of mutton	9
3.	20th to 22nd July, 2011	Chicken product processing for small scale Unit	15
4.	26th to 28th	Chicken product processing for small scale Unit	12
	July, 2011		
5.	21st to 23rd November, 2011	Chicken product processing for small scale Unit	6
6.	21st to 23rd December, 2011	Chicken product processing for small scale Unit	15
Total Participants			**97**

Consultancy, Bankable project report and Technical Guidance:

The institute is supporting the entrepreneurs by giving consultation, Bankable project reports and giving technical guidance on modern slaughtering, establishment of sheep and goat farms as well as in meat packaging and ready to eat meat product processing. The detailed report has been given below:

S.No	Date	Name of the Firm	MoU for consultancy projects
1	20.03.2012	M/S Krishna emu farm products Pvt. Ltd, Vijayawada A.P	Emu slaughtering, processing, packaging and storage for better marketing

Director (Acting), NRC of Meat, exchanging the MOU for Consultancy Services of “Slaughtering, Packaging and processing of emu meat”

S.No	Date	Name of the Firm	Technical guidance
1	12.09.2011	G.Ramanna Kumar, Hyderabad	Slaughtering, meat packaging and ready to eat meat product processing
2.	13.09.2011	Prowell India, Hyderabad	Establishing sheep and goat slaughter house
3	20.04.2012	Ashfaq Hussain, Hyderabad	Establishment of sheep rearing farm

Public/ Private Partners:

i) Contract Research

Contract research on "Evaluation of Oxican in enhancing shelf life of meat and meat products" with private partner has been taken up:

Sl No	Date	Name of the Firm	Contract Research
1	15.11.2011	Kancor Ingredients, Ernakulam Kerala	Evaluation of Oxican in enhancing qualities and shelf life of meat and meat products

ii) Analytical services

Center has developed several Polymerase Chain Reaction based techniques for identification of species and sex of meat. Other than Molecular techniques the institute is well established with analysis of meat and meat product samples and these analytical services are provided to the clients on chargeable basis.

Sl No	Date	Nature of samples	Source
1	17.05.2011	Cooked meat sample for species identification	Asstt Director, Veterinary Hospital, Amalapuram, A.P.
2	12.11.2011	Buffalo meat for free fatty acid analysis	Al-Qureshi Exports, Mumbai
3.	12.01.2012	Kadaknath meat samples for total meat quality analysis	APTDC, Hyderabad to act as Inspection body for GI application

Client is getting Bankable Project report from Director (Acting)

Revenue generated by ITMU

Particulars	Amount (Rs)
Technology License Fee	42926.00
Training and Sample analysis	96500.00
Total	**1,39,426.00**

Technology promotion Events/ Exhibitions/ Camps organized / Participation by ITMU

The NRC on Meat participated in FOOD-360ºexhibition at Novotel Exhibition Centre, Hyderabad from November 20-22, 2011.

Scientists interacting with visitors

The NRC on Meat put up a stall at Poultry India-2011, organised by Indian Poultry Equipment Manufacturers Association at Hitex Exhibition Centre, Madhapur, Hyderabad from 23-25, November 2011.

NRC Meat stall at Poultry India-2011, Hi-Tex Exhibition ground, Hyderabad

NRC Meat has exhibited its technologies at the Agri Tech 2012 conducted by the Lions club, Palakol, West Godhavari, AP on 7 &8th January 2012.

A exhibition stall arranged on the occasion of PUSA Krishi Mela at IARI New Delhi from 1st - 13rd March, 2012

An exhibition stall arranged on the occasion of Agri, Horticulture, Dairy and Processing India Expo 2012 at Secunderabad 24th - 26th March, 2012

Meeting cum Workshop

Zonal Technology management – Business Planning and Development Unit South Zone has conducted AgriP 2012 Annual Meeting- cum-workshop on 24-25th February, 2012 at CIFT Kochi. On behalf of NRC Meat ITMU unit Dr.I.Prince Devadason,Scientist-Senior Scale have shared NRC Meat ITMU activities, success stories and technology disseminations etc. to the participants.

Success stories

Entrepreneur trained at NRC on Meat, Mr. Vamshi opening a new Restaurant “Hotel spicy” at Hanamkonda, Warangal, A.P.

- Mr. Narsimha Rao, L. Samba Siva Rao, Vamshi and Mr. Sai have successfully started poultry products processing business in Hyderabad and Warangal districts respectively.
- In addition to these entrepreneurs, Ms. Jhansi Rani and Smt. K Saraswati who were already in the meat processing business and have undergone training at NRC Meat have also introduced new range of products trained at NRC on Meat. M/S Trishul Restaurant, Amberpet, Hyderabad and M/S Inno Foods, Mallapur, Hyderabad. NRC Meat was successful in creating employment opportunities and increasing their livelihood.

Transfer of technology

Director, NRC on Meat exchanging MoU document with Mr. Shaju, V.A., Manager (R&D), Kancor Ingredients Ltd., Ernakulam, Kerala

Packaging technologies for improving the shelf-life of fresh buffalo meat has been transferred to a private entrepreneur Mr. Mohammed Abdul Azeem through the agreement signed on 24/03/2012. Director (Acting), NRC Meat exchanging MoU document with Mr. Mohammed Abdul Azeem

Agricultural knowledge management unit

The Agricultural Knowledge Management Unit (AKMU) has been established at NRC on Meat to strengthen Information Management Culture using modern tools within the National Agricultural Research Information System (NARS) so that agricultural research becomes more efficient and effective.

Objectives

- To put information close to managers and scientists.
- To enhance accessibility to research information.
- To build the capacity to organize, store, retrieve and use the relevant information into the agricultural research infra-structure.
- To share the information over NARS and
- To improve the capacity to plan, execute, monitor and evaluate research programs.

Major Activities

- Leased line internet connectivity to all Scientists / Officers of NRCM
- Database development, up-date and management of research and institute activities.
- Website up-dating and maintenance for mass reach of research information through online mode.
- Computers- upkeep, up-gradation and training of institute personnel.
- Creation of meat and meat products information base with user friendly modern information communication technology gadgets.
- Production of educational multimedia aids on meat products, meat processing technology and consumer preference.
- Providing better internal communication and maintenance of EPABX system.
- Maintenance of visitors details.

Supporting Activities

- Assisting in development of Management Information System (MIS) research, teaching and training activities.
- Information Technology support to Library, Administration and Accounts.
- Local Area Networking connectivity maintenance.

Training programs / workshops / awareness programs / industry meet etc.

Entrepreneurship training programme on *"Poultry processing for small scale entrepreneurs"* was held at NRC Meat from April 6-8, 2011

Entrepreneurs trained at NRC on Meat along with Sri. D. Ram Reddy (President, A.P. Poultry Breeders Association) and faculties of NRC on Meat

The 5th entrepreneurship training program on *"Value added chicken products processing for small scale entrepreneurs"* was organised at NRC Meat from July 26 to 28, 2011.

Learning by doing-Participants of the entrepreneurship training program learning emulsion making technology

Stakeholder's workshop to prioritize NRC Meat research programmes for XII plan was organised on 5th November, 2011

Participants of stakeholder's workshop

Exclusive training programme on value added emu meat products processing was organised at NRC Meat during November 21-23, 2011.

Participants of 7th entrepreneurship training program on value added meat products held during 21-23 December, 2011

Participants of 7th entrepreneurship training program

Industry meet and butchers training was organised at NRC Meat in collaboration with National Meat and Poultry Processing Board (NMPPB) on 18th February, 2012.

Smt. Rupali Banerjee Singh, CEO, National Meat and Poultry Processing Board, MoFPI is elaborating the initiatives of meat board

Dr.G.Venugopal, Director, NRC Meat addressing the importance of hygienic slaughter to the butchers

NRC on Meat organised the *"Brucella awareness camp"* at Warangal municipal slaughterhouse premises on 27.03.2012

Important meetings / events / held at NRC on Meat

- Fourth research advisory committee (RAC) meeting of NRC on Meat for the year 2010-11 was held on 23-05-2011.

- Institute Research Council (IRC) meeting for the year 2010-11 was held on 22/06/2011 at the seminar hall of NRC on Meat.

Hindi Sapta

NRC on Meat has celebrated **"Hindi Sapta"** during 14-21 Sep'11. The entire scientific faculty, technical, administrative and contractual staff has actively participated. In a week long programme competitions were designed exclusively forscientists for active involvement. Essay writing, elocution, translation, dictation etc., competitions besides other cultural activities were organized. Some guest speakers from outside ICAR system were invited to deliver talks on importance of Official language and its role in day to day administration. On 21 sept'11 valedictory programme was conducted and winners were given prizes by the Director, NRC on Meat, Hyderabad.

Hindi saptha was celebrated during 14-21 September, 2011

- NRC on Meat observed the vigilance week from 31-10-2011 to 5-11-2011

Consultative group meeting on preparation of EFC memorandum for the 12th plan has been conducted on 25th January, 2012.

- Institute management committee meeting was held at NRC on Meat on 25th January, 2012.

Institute foundation day

Institute foundation day was celebrated on 22nd February, 2012.

Dr.G.Venugopal, Director, NRCM delivering his welcome address

Dr.S.L.Goswami, Director, NAARM has delivered the foundation day lecture on “Augmenting meat production for food, nutrition and livelihood security”.

Prof.Dr.J.Abraham, Former Director, Centre of Excellence on Meat Science, Veterinary College, Mannuthy, Kerala delivered a special lecture on “Role of NRC on Meat in making meat industry vibrant and visible”.

Participation in the ICAR South Zone inter institutional sports meet

NRC on meat to actively participated in the ICAR South Zone inter institutional sports meet held at Hyderabad during 27TH Feb TO 2nd Mar, 2012. The NRC on Meat contingent has participated in chess, carom, cycling, badminton, table tennis, shot-put, track events etc.

Visits abroad

- Dr. N. Kondaiah, Director, NRC on Meat and Member, National Meat and Poultry Development Board visited as a member of Indian delegation under the chairmanship of Shri. Ajit Kumar, Joint Secretary, Ministry of Food Processing Industries, Govt. India to Zoetermeer, Netherlands from April 18-22, 2011.
- Dr. R.S. Rajkumar presented a poster on *"Campylobacter contamination in small scale poultry dressing units of Northern India: PCR amplification of 16s rRNA gene for rapid detection"* at 16th International Workshop on Campylobacter, Helicobacter and related organisms (CHRO) Vancouver, British Colombia, Canada from 28/08/2011 to 01/09/2011.

- Dr. B.M. Naveena has presented invited short-paper on *"Further processing for improving tenderness of meat"* at Ist International Summer School on Ageing and Packaging of Meat held at International Competence Centre on Meat Quality, Max-Rubner Institute, Kulmbach, Germany from October 18-21, 2011.

Administrative staff training

- Shri.N.Gopal, Administrative officer undergone training programme for administrative officers and accounts and finance officers of ICAR at NAARM and NASC Complex, New Delhi from 12th March to 1st July, 2012.
- Shri.B.P.P.R.Vittal, Personal Secretary to Director, has attended training course for trainers from 8-12th August 2011.
- Shri.M.N.V.Rao, Junior Accounts Officer and Shri.M.Sridhar, Assistant (on deputation) undergone capacity building programme for administrative personnel of S&T Departments of Government of India from September 12-30, 2011.

Awards & recognitions

- Dr. I. Prince Devadason, Scientist (SS), became member of international advisory board of international journal of applied science and technology.
- Dr. Girish Patil, S., Scientist, National Research Center on Meat, Hyderabad has been awarded with 'Lal Bahadur Shastri Young Scientist Award 2010' by Indian Council of Agricultural Research.

- Dr. R.S. Rajkumar was elected as Executive Body Member of Indian Poultry Science Association (IPSA).
- Shri. Chandrasekar, AAO, NRC Meat has been elected as General Secretary, CJSC, ICAR.

Membership of professional bodies

- Dr. I. Prince Devadason, Dr. B.M. Naveena , Dr. M. Muthukumar and Dr.R.S.Rajkumar became Life Member in National Meat and Poultry Processing Board (NMPPB), Ministry of Food Processing Industries, New Delhi.
- Dr. B.M. Naveena, Dr. R.S. Rajkumar and Dr. K. Susitha became Full member, World's Poultry Science Association.
- Shri. P.Mooventhan became life Member in the Soc**iety of Extension Education**, Agra

New entrants / retirements / transfer / promotion

- Smt. C.Padmaja, Personal Assistant joined NRC on Meat on 02.06.2011.
- Shri. Gopal joined as Administrative officer on 7th October, 2011.
- Dr. N. Kondaiah, has completed his 5 years term as Director at NRC on Meat and was transferred to Project Directorate on Poultry, Hyderabad with effect from 16/12/2011.

- Dr. G. Venugopal, Principal Scientist of this centre has taken over the charge as acting director of NRC on Meat from 16/12/2011.
- Shri. Satyanarayan, Skilled supporting staff (SSG-II) got retired on 31-03-2012.

Distinguished Visitors

Thirty participants from BASIX Academy for Livelihoods and Micro-Banking Practice (B-A-LAMP) on a study program on "Value chain of milk, fruits and vegetables" from Mali and Burkina Faso (Supported by the World Bank) visited NRC on Meat on 06-09-2011.

Dr. B. S. Prakash, ADG (AN&P), ICAR, New Delhi, interacting with scientists during his visit to NRC on Meat, Hyderabad on 25.01.2012.

List of visitors to NRC on Meat between 01.04.2011 to 31.03.2012

Date	Visitor
25-05-2011	Dr.J.N.Boara, Director, CPDO (WR), Aarey Milk Colony, Mumbai
17-11-2011	Shri.Ganeshwara Rao, M.D, KEPPL, Vijayawada
17-11-2011	Shri.N.Purushotham Rao, Vice President, Emu welfare association, Hyderabad
24-01-2012	Shri.M.V.S.Nagi Reddy, Governing body member, ICAR
17-03-2012	Dr.Nagendra Sharma, Former Director and Vice-Chancellor, NDRI, Acting Director IVRI, Director, CIRG, Makdoom, VC, SKUAST, J&K
17-03.2012	Prof.V.Prabhakar Rao, Vice-Chancellor, Sri Venkateswara Veterinary University, Tiruptahi
17-03-2012	Dr.Sushil Kumar, Former Director and Vice-Chancellor, NDRI, Karnal

Scientific, Technical and Administrative staff

Dr. G. Venugopal	Director (Acting)
Scientific	
Dr. S. Vaithiyanathan	Principal Scientist
Dr. A.R. Sen	Principal Scientist
Dr. Y. Babji	Principal Scientist
Dr. C. Ramakrishna	Senior Scientist
Dr. I. Prince Devadason	Scientist (SS)
Dr. B. M.Naveena	Scientist (SS)
Dr. M. Muthu Kumar	Scientist (SS)
Dr. P. Baswa Reddy	Scientist (SS)
Dr. S. Girish Patil	Scientist (SS)
Shri. P. Mooventhan	Scientist
Dr. R. S. Rajkumar	Scientist
Dr. K. Susitha	Scientist
Dr. M. Muthulakshmi	Scientist
Technical	
Ms. Kanchana Kommi	Technical Assistant T-3
Shri. Phanikumar	Technical Assistant T-3
Shri. B.V.D. Srinivasa Rao	Technical Assistant T-2
Shri. Pushpesh Khulbe	Technical Assistant T-1
Shri. M.D. Srininivas	Technical Assistant T-1
Administration	
Shri. N. Gopal	Admn. Officer
Shri. Chandrashekar	Asst. Admn. Officer
Shri. B.P.R. Vithal	Personal Secretary
Smt. G. Prameela Bai	Assistant
Shri. M.N.V. Rao	Junior Accounts Officer
Shri. M. Sridhar	Assistant
Smt. C. Padmaja	Personal Assistant
Shri. T. Devender	Upper Divisional Clerk
Supporting Staff	
Shri. U. Satyanarayana	SSG-II*

*Retired on 31/03/2012

Committees

Quinquiennial Review Team		
1	Dr. Sushil Kumar, Ex-Director, NDRI, Karnal	Chairman
2	Dr. A.S. Bawa, Director, DFRL, Mysore	Member
3	Dr. A. Subba Rama Naidu, Retd. Scientist F & Head, CLRI, Chennai	Member
4	Dr. A.S.R. Anjaneyulu, Retd. Scientist, NRCM, Hyderabad	Member
5	Dr. M.V.Subba Rao, National Project Consultant, FAO, New Delhi	Member
6	Dr. A.R.Sen, Principal Scientist, NRCM, Hyderabad	Member Secretary

Institute Management Committee		
1	Dr. G. Venugopal, Director (Acting), NRCM, Hyderabad	Chairman
2	Director, Dept. of Animal Husbandry, A.P	Member
3	Director, Dept. of Animal Husbandry, U.P	Member
4	Dean, Faculty of Veterinary Science, SVVU, Tirupati	Member
5	Shri Rohit Pawar, Executive Director, M/s Baramati Agro Ltd., Pimpali, Baramati, Maharashtra	Member
6	Shri. Ahmed Alam Khan, M.D. M/s Super Dairy Farm, Satar Bhag, Musheerabad, Hyderabad	Member
7	Dr. A.S.R. Anjaneyulu, Retd. Emeritus Scientist, NRCM, Hyderabad	Member
8	Dr. Y. Babji, Principal Scientist, NRCM, Hyderabad	Member
9	Dr. T. Kotaiah, M.D. Indbro Research & Breeding farms (P) Ltd., Hyderabad	Member
10	Dr. Nagendra Hegde, Bharat Biotech Foundation, Genome Vally, Shameerpet, Hyderabad	Member
11	Dr. B.S. Prakash, ADG, (AN&P) ICAR, New Delhi	Member
12	Shri. Shridharan, AFAO, NRCM, Hyderabad	Member
13	Shri. N. Gopal, AO, NRCM, Hyderabad	Member Secretary

Research Advisory Committee		
1	Dr. A.T.Sherikar, Ex-VC, Maharashtra Animal & Fisheries University, Nagpur	Chairman
2	Dr. B.C.Pattanaik, Ex-Director, CSWRI, Avikanagar	Member
3	Dr. Robinson J. Abraham, Prof&Head, Dept. of Meat Sci.&Tech., MVC, Chennai	Member
4	Dr. V.D.P. Rao, Ex-Prof & Head, GBPUAT, Pantnagar	Member
5	Dr. D.N.Rao, Ex-Head, Dept. of Meat, Fish & Poultry, CFTRI Mysore	Member
6	Dr. G. Gopala Rao, Ex-Joint Marketing Advisor, Directorate of Marketing & Inspection, Guntur	Member
7	Dr. G. Venugopal, Director (Acting), NRCM, Hyderabad	Member
8	Dr. B.S. Prakash, ADG, (AN&P) ICAR, New Delhi	Member
9	Shri Rohit Pawar, Executive Director, M/s Baramati Agro Ltd., Pimpali, Baramati, Maharashtra	Member
10	Shri Ahmed Alam Khan, M.D. M/s Super Dairy Farm, Satar Bhag, Musheerabad, Hyderabad	Member
11	Dr. S. Vaithiyanathan, Principal Scientist, NRCM, Hyderabad	Member Secretary