ANNUAL REPORT
2016-17

ICAR-NATIONAL RESEARCH CENTRE ON MEAT
Chengicherla, Boduppal Post, Hyderabad - 500 092
ISO 9001:2008 Certified Organization


ICAR-NRC ON MEAT
Heartily Welcomes
Date: 31st August, 2016
Dr. Jaykrushna Jena
DDG (Fisheries Science)
NRCMeat
Dr.V.V.KULKARNI
Dr. HABIBAR RAHMAN

ANNUAL REPORT

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भाकृ अनुप
ICAR

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NRCMeat

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ICAR-National Research Centre on Meat
Chengicherla, Boduppal Post
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Editorial Committee :
Dr. M. Muthukumar
Dr. B. M. Naveena
Dr. Rituparna Banerjee
Dr. L. R. Chatlod
Dr. G. Kandeepan
Dr. Suresh K. Devatkal

Technical assistance in Hindi translation :
Sri Chandrashekhar
Smt. Udgir Swaroopa Rani

Published by :
Dr. V. V. Kulkarni
Director
ICAR - National Research Centre on Meat
Chengicherla, Boduppal Post
Hyderabad 500092

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PREFACE

I am extremely happy to present the Annual Report of ICAR-National Research Centre on Meat, Hyderabad for the year 2016-17, which happens to be the 10th year of establishment of the Centre at its new campus in Chengicherla, Hyderabad. In fact, 2016-17 was an eventful year for the Centre and it is my proud privilege to introspect the achievements and to set new goals and challenges for the upcoming years.

I am elated to mention that, the Institute was accredited by Food Safety and Standards Authority of India as a referral laboratory for analysis of meat and meat products. The Institute has reached a new height by inaugurating its "NRCM-AgriBusiness Incubator" at the hands of Dr. Habibur Rahman, DDG (AS) and Dr. Joykrushna Jena, DDG (Fisheries). The centre will definitely catalyse the agri-business ventures by supporting the entrepreneurs with viable technologies, consultancy, venture capital funding, infrastructure and other facilities.

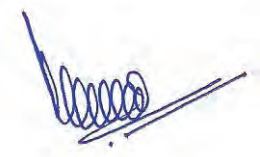
Focussed and theme based research projects were given priority and the untiring endeavour of the scientific staff has helped to sanction three new extramural research projects on 'Setting-up of Food Testing Laboratory-Species and Sex Identification of Meat' (MoFPI), 'Species identification to check adulteration of cheaper quality meat in meat products' (FSSAI) and 'Training and capacity building in sheep and goat value chain' (National Livestock Mission). In addition, projects on quantification of animal body fat in milk fat using DNA-based molecular techniques, meat species identification using OFFGEL electrophoresis and mass spectrometry, omega 3 fatty acids and selenium enriched chicken/sheep meat through nutritional supplementation and post-harvest incorporation, extraction and purification of bioactive compounds like CLA and bioactive peptides from meat and by-products, estimating the antimicrobials levels in different muscle foods, prevalence of zoonotic sarcocystosis, development of smart packaging nano-sensor for monitoring quality and safety of meat have been undertaken. Besides externally funded projects from DBT, APEDA, MoFPI, FSSAI and RKVY

(total project cost 348.87 lakhs), the Institute is also working on contract research project with Indbro Research and Breeding Farms Pvt. Ltd., Hyderabad.

To increase the effectiveness of the research findings and to reach a wider audience, the Institute has successfully conducted an ICAR sponsored 10 days short course on "Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants". Continuing its entrepreneurship development, the Institute has provided 4 entrepreneurship trainings on "Value added meat products processing" to 45 trainees. Two days' workshop on "Methods for isolation of foodborne bacterial pathogens from foods and clinical samples with special reference to *Listeria monocytogenes*" was organised on 5-6th October, 2016 at the Centre in collaboration with ICAR-National Institute of Biotic Stress Management, Raipur. Fifty two butchers from Telangana and Andhra Pradesh and six veterinary officials from Ladakh were trained on clean meat production. In our efforts to disseminate and share the scientific knowledge, four MoUs are signed with M/s Kaavo Meat by Cool chef, Thadani House, Mumbai, M/s Shri Ramalingeshwara Agro Foods Pvt Ltd., Hyderabad, M/S Pro Chicken, Hyderabad and M/s Farm Fresh Pork Products and Farms, Vijayawada, A.P. for providing technical knowhow on establishment of value added meat products processing unit, establishment of rendering plant for utilization of slaughterhouse by-products, establishment of retail meat shop and manufacturing of processed meat products, respectively.

The institute showcased its technologies at several exhibitions viz. Meat Tech Asia-2016 in Bangalore; India Lab Expo, Poultry India Expo, National Agripreneurs Convention in Hyderabad, Krushi Kumbh in Uttar Pradesh. Besides aforesaid activities, the Institute has celebrated numerous programmes viz. World Veterinary Day, Independence Day, Vigilance Awareness Week, Hindi Diwas, Republic day, Institute foundation day, Swachhta Pakhwada etc.

I appreciate the earnest efforts of editorial team for bringing out this Annual Report. I sincerely acknowledge the support of all the staff of NRC on Meat, Hon. DG, ICAR, DDG and ADG and Principal Scientists at the Animal Science Division of ICAR, RAC, IMC and QRT members. The Centre would continue to endeavour for further improving its usefulness to the cause of the society.



(V.V.Kulkarni)

Director

प्रस्तावना

मुझे आईसीएआर-राष्ट्रीय मांस अनुसंधान केंद्र, हैदराबाद की वर्ष 2016-17 की वार्षिक रिपोर्ट को प्रस्तुत करते हुए अपार हर्ष हो रहा है, क्योंकि यह संस्थान के अपने नए परिसर चेंगीचर्ला, हैदराबाद मे स्थापना का दसवां वर्ष है। वास्तव में, 2016-17 इस केंद्र के लिए एक यादगार घटनाओं वाला वर्ष रहा है और इस अवसर पर अपनी उपलब्धियों के सिंहावलोकन का मुझे विशेष अवसर प्राप्त हुआ है ताकि हम आने वाले वर्षों के लिए नए लक्ष्य और चुनौतियां तय कर सकें। मुझे यह उल्लेख करते हुए गर्व हो रहा है कि इस संस्थान को भारतीय खाद्य सुरक्षा और मानक प्राधिकरण द्वारा मांस और मांस उत्पादों के विश्लेषण हेतु एक संदर्भ प्रयोगशाला के रूप में मान्यता प्रदान की है। ''एनआरसीएम-एग्रिबिजनस इन्क्यूबेटर'' के उद्घाटन के साथ ही संस्थान ने नई ऊंचाईयों को प्राप्त किया है जिसका उद्घाटन डॉ हबीबर रहमान, उप-महानिदेशक (पशु विज्ञान) तथा डॉ जॉयकृष्णा जेना, उप-महानिदेशक (मात्स्यिकी) द्वारा सम्पन्न हुआ। यह केंद्र अपनी व्यवहार्य प्रौद्योगिकी, परामर्शी सेवाओं, उद्यम पूजीं निधिकरण, बुनियादी संरचना तथा अन्य सुविधाओं के माध्यम से कृषि-व्यवसाय उद्यमियों के लिए निश्चित रूप से उत्प्रेरक का कार्य करेगा।

केंद्र द्वारा संकेंद्रित और थीम आधारित अनुसंधान परियोजनाओं को प्राथमिकता दी गई और केंद्र के वैज्ञानिक स्टाफ के अथक प्रयासों के कारण तीन नई बाह्य वित्त पोषित अनुसंधान परियोजनाओं की स्वीकृति में मदद मिली है इनमें ''खाद्य परीक्षण प्रयोगशाला की संस्थापना-मांस की प्रजाति और लिंग की पहचान करना'' (एमओएफपीआई); ''मांस उत्पादों में सस्ते गुणवत्ता वाले मांस की मिलावट को रोकने के लिए प्रजातियों की पहचान'' (एफएसएसएआई) तथा ''भेड़ और बकरी मूल्य श्रृंखला में प्रशिक्षण और क्षमता निर्माण'' (राष्ट्रीय पशुधन मिशन) सम्मिलित हैं। इसके अलावा, डीएनए-आधारित आण्विक तकनीकों का प्रयोग करते हुए दूध वसा में पशु शरीर की चर्बी की मात्रा पर परियोजनाएं, ऑफजॅल इलेक्ट्रोफोरेसिस तथा मांस स्पेक्ट्रोमेट्रि का उपयोग करते हुए मांस प्रजातियों की पहचान, पोषणीय संपूरण तथा पोस्ट-हार्वेस्ट समावेशीकरण, निष्कर्षण तथा ओमेगा 3 फैटी एसिड तथा सेलेनियम सवंर्धित चिकन/भेड़ के मांस तथा मांस एवं

उपउत्पादों से जैवसक्रिय यौगिकों जैसे सीएलए तथा जैवसक्रिय पेप्टाइडों, विभिन्न प्रकार की मांसपेशियों (मसल) वाले खाद्य में एंटिमाइक्रोबियल स्तरों का आकलन, पशुजनित सर्कोसिस्टोसिस का प्रचलन, मांस की गुणवत्ता और सुरक्षा के लिए स्मार्ट पैकेजिंग नेनो-सेंसर का विकास पर कार्य किया गया। इसके अलावा, डीबीटी, एपीडा, एमओएफपीआई, एफएसएसएआई तथा आरकेवीवाई (कुल परियोजना लागत 348.87 लाख) की बाह्य वित्तपोषित परियोजनाओं सहित संस्थान संविदा अनुसंधान परियोजना पर भी इंडब्रो अनुसंधान एवं प्रजनन फार्म प्राइवेट लिमिटेड, हैदराबाद के साथ भी कार्य कर रहा है।

अनुसंधान उपलब्धियों की प्रभाविता को बढ़ाने तथा अधिक लोगों तक पहुंचने के लिए, संस्थान ने ''प्रजातियों की पहचान द्वारा मांस उत्पादों की गुणवत्ता और सुरक्षा के आकलन तथा रासायनिक अपशिष्टों तथा सूक्ष्मजैविक परिष्करण की पहचान और जांच'' पर आईसीएआर प्रायोजित 10 दिवसीय लघु पाठ्यक्रम का संचालन किया। उद्यमशीलता विकास के अपने कार्यक्रम को जारी रखते हुए संस्थान ने ''मूल्यवर्धित मांस उत्पादों के परिष्करण '' पर 45 परिक्षणार्थियों को 4 उद्यमशीलता प्रशिक्षण प्रदान दिए। ''लिस्टीरिया मोनोसाइटोजीन्स के विषेश संदर्भ के साथ खाद्य एवं क्लिनिकल नमूनों से खाद्यजनित बैक्टीरियल रोगाणुओं को पृथक करने की विधियां'' पर आईसीएआर- राष्ट्रीय जैविक दबाब प्रबंधन संस्थान, रायपुर के सहयोग से इस केंद्र पर 5-6 अक्टूबर, 2016 के दौरान दो दिवसीय कार्यशाला का आयोजन किया गया। तेलंगाना और आंध्र प्रदेश से 52 कसाईयों तथा लद्दाख से 06 पशुचिकित्सा अधिकारियों को स्वच्छ मांस उत्पादन पर प्रशिक्षित किया गया। वैज्ञानिक ज्ञान के प्रसार और शेयर करने के हमारे प्रयासों में मूल्यवर्धित मांस उत्पादन प्रोसेसिंग यूनिट को संस्थापित करने के लिए तकनीकी ज्ञान प्रदान करने, वधशाला के उप-उत्पादों के उपयोग हेतु रेंडरिंग संयंत्र की संस्थापना, खुदरा मांस की दुकानों की स्थापना तथा संसाधित मांस उत्पादों के निर्माण हेतु मैसर्स कावो मीट बाई कूल सैफ, थडानी हाउस, मुम्बई, मैसर्स श्री रामलिंगेश्वर एग्रो फूड्स प्राइवेट लिमिटेड, हैदराबाद, मैसर्स प्रो चिकन, हैदराबाद तथा मैसर्स फार्म फ्रेश पोर्क प्रोडक्ट्स एंड फार्म, विजयवाडा, आंध्र प्रदेश के साथ चार समझौता ज्ञापनों (एमओयू) पर हस्ताक्षर किए।

संस्थान ने अपनी प्रौद्योगिकियों को बैंगलोर में मीट टैक एशिया 2016; हैदराबाद में इंडिया लेब एक्सपो, पोल्ट्री इंडिया एक्सपो, नेशनल एग्रिप्रिन्योर कन्वेंशन, उत्तर प्रदेष में कृषि-कुंभ सहित कई प्रदर्शनियों में प्रदर्षित किया। उपरोक्त क्रियाकलापों के अलावा, संस्थान ने कई कार्यक्रमों जैसे विश्व पशु चिकित्सा दिवस, स्वतंत्रता दिवस, सतर्कता जागरूकता सप्ताह, हिंदी दिवस, गणतंत्र दिवस, संस्थान संस्थापना दिवस, स्वच्छता पखवाड़ा आदि मनाया गया।

मैं, इस वार्षिक रिपोर्ट के प्रकाशन में संपादकीय टीम के प्रयासों की दिल से सराहना करता हूं। मैं, राष्ट्रीय मांस अनुसंधान केंद्र के स्टाफ, माननीय महानिदेशक, आईसीएआर तथा आईसीएआर के पशु विज्ञान प्रभाग के उप महानिदेशक, सहायक महानिदेशक तथा प्रधान वैज्ञानिक, आरएसी, आईएमसी, तथा क्यूआरटी सदस्यों द्वारा दिए गए सहयोग के प्रति उनका आभार प्रकट करता हूं। यह केंद्र अपनी सामाजिक भूमिका में और अधिक सुधार के लिए अपनी उपयोगिता के प्रयासों को निरंतर जारी रखेगा।

EXECUTIVE SUMMARY

In our efforts to augment sustainable meat animal production, meat processing, value addition and ensuring safety of muscle foods, ICAR-National Research Centre on Meat, Hyderabad is undertaking research and development projects, entrepreneurship development, consultancy, transfer of technologies, skill development, awareness programmes, exhibitions, contract research, workshops, stake-holders meeting, MoU/Agreements and several other activities. During the period from April 2016 to March 2017, three new external funded projects were initiated and several equipment were procured. The new Agri-business Incubator (ABI) facility was inaugurated by Dr. Habibur Rahman, DDG (AS) and Dr. Joykrushna Jena, DDG (Fisheries). The Centre has interacted with various State Government and Central Government organisations, line Departments and other stakeholders to identify the problems and missing links in the meat value chain to formulate new projects. The Institute has successfully conducted one ICAR sponsored short course, 4 entrepreneurship trainings, 2 butcher trainings, two trainings to sheep farmers under RKVY project and four MoU's were signed with entrepreneurs. Successfully organised the IRC, IMC and RAC meetings.

The summary of the Institutes activities during the period from April 2016 to March 2017 is presented below:

Research and development

- The PCR assay using mt D loop and mtCyt b species specific primers have been developed to detect adulteration of more than 5.0% cattle/buffalo tallow into milk fat (cow ghee). The Taqman real time PCR assay was also developed for detection of DNA from cattle and buffalo tallow at 1% level.
- In-gel (2-dimensional gel electrophoresis, 2DE) and OFFGEL-based proteomic method for authenticating raw and cooked water buffalo (*Bubalus bubalis*), sheep (*Ovis aries*) and goat (*Caprus hircus*) meat and their mixes was developed. The study demonstrated that authentication of meat from a complex mix of three closely related species requires identification of more than one species-specific peptides due to close similarity between their amino acid sequences.
- Protein hydrolysates extracted from buffalo liver exhibited significantly higher DPPH radical scavenging activity suggesting the presence of antioxidant peptides.

- Isolation of DNA from sarcocysts extracted from buffalo meat/oesophagus and PCR-RFLP showed the presence of *S. fusiformis, S. taeniata* and *S. buffalonis*. The zoonotic *S. hominis* could not be found in the present study.
- Supplementing selenium in the sheep feed in the form of Seleno-methionine has the highest levels of incorporation of Selenium into different muscles and organs.
- Organic certification of fodder has been carried out and after due inspection and auditing, third year organic scope certificate has been awarded for the fodder as per the NPOP standards of India.
- A highly sensitive RP-HPLC method indicated a limit of quantification for enrofloxacin and ciprofloxacin at 36.27 and 30.38 μg/kg respectively in buffalo meat samples.
- Natural indicators extracted from red cabbage, pomegranate and *Bauhinia purpurea* have shown their potential to develop nano sensor strips in indicator metabolite model system with ammonia and trimethylamine released during meat storage.
- A superchilling cabinet has been developed with respect to temperature, humidity and air–flow to optimize the superchilling condition of dressed carcass or meat in order to improve their quality and storage stability.
- No significant difference was observed in the blood loss percentage and meat quality parameters between stunned vs non stunned sheep.
- Mould for preparing burger patty was developed and also filed for industrial design (Application No. 290498).
- A novel process for preparation of succulent seekh kebab with uniform size and smooth exterior employing sausage stuffer was developed and the same was applied for process patent (Application No. 201741020037).

Training, workshop and extension activities

- ICAR short course on "Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants" was organized from 3 to12 January, 2017.
- Paid hands-on entrepreneurship training programme (4 No's.) on "Development of value added meat products" were successfully conducted. Total of 45 entrepreneurs from various states of India were trained.
- Training programme on "Tallow species Identification" was organized from 26 to 30th September, 2016.
- Four trainings on "Clean Meat Production" were conducted at NRC on Meat during 26-27th April, 22-23rd June, 7-8th September, 2016 and 23-27th January, 2017. Total of 58 butchers participated.

- Four training programmes for sheep and goat farmers, meat handlers and field veterinarians were organized under National Livestock Mission programme.
- Two days' workshop on "Methods for isolation of food borne bacterial pathogens from foods and clinical samples with special reference to *Listeria monocytogenes*" was organised during 5-6th October, 2016 in collaboration with ICAR-National Institute of Biotic Stress Management, Raipur
- Total of 4 brochures under ABI, 2 brochures under NLM projects and 21 research articles were published.

MoUs and consultancy

- Two MoU's were signed for licensing of technologies with entrepreneurs.
- Two consultancy projects were signed for establishment of meat products processing unit and rendering plant.

Institutional activities and distinguished visitors

- IRC, RAC, and IMC meetings were conducted to review the achievements and progress of the Institute.
- World Veterinary Day, Independence Day, Vigilance Awareness Week, Hindi Diwas, Republic day, Institute foundation day, Swachhta Pakhwada were celebrated.
- As a part of 'Swachh Bharat Mission', massive cleaning programmes were carried out throughout the year.

Several dignitaries including Dr. Habibur Rahaman, DDG (AS), Dr. Joykrushna Jena, DDG (Fisheries), Dr. Rameshwar Singh, PD, DKMA, Honourable MLA, Shri M. Sudheer Reddy of Medchal and various other experts visited the Centre.

Major achievements

NRC on Meat has developed the protocols for organic fodder and organic sheep production and recently received organic livestock certification from accredited certifying agency as per NPOP norms.

कार्यकारी सारांश

दीर्घकालिक पशु मांस उत्पादन को बढ़ाने के हमारे प्रयासों, मांस प्रसंस्करण, मूल्य वर्धन तथा मांस खाद्यों की सुरक्षा को सुनिश्चित करने के लिए आईसीएआर- राष्ट्रीय मांस अनुसंधान केंद्र, हैदराबाद अनुसंधान और विकास परियोजनाएं, उद्यमशीलता विकास, परामर्शी परियोजनाएं, प्रौद्योगिकी हस्तांतरण, कौशल विकास, जागरूकता कार्यक्रम, प्रदर्शनियां, संविदात्मक अनुसंधान, कार्यशालाएं, सहभागियों की बैठक, एमओयू/करार तथा कई अन्य कार्यक्रमों को संचालित कर रहा है। अप्रैल 2016 से मार्च 2017 के दौरान इस अवधि में तीन नई वाह्य वित्त पोषित परियोजनाओं को प्रारंभ किया गया और कई उपकरणों की खरीद की गई। नई एग्रि-बिजनस इनक्यूबेटर (एबीआई) सुविधा का उद्घाटन डॉ. हबीबर रहमान, उपमहानिदेशक (पशु विज्ञान) तथा डॉ जॉयकृष्णा जेना, उपमहानिदेशक (मात्स्यिकी) द्वारा किया गया। इस केंद्र ने नई परियोजनाओं को तैयार करने हेतु समस्याओं तथा मांस मूल्य श्रृंखला में मिसिंग संपर्कों की पहचान के लिए राज्य सरकारों तथा केंद्र सरकार के संगठनों, समकक्ष विभागों तथा अन्य सहभागियों के साथ परस्पर विमर्श किया है। संस्थान ने आईसीएआर प्रायोजित अल्पकालीन पाठ्यक्रमों, 4 उद्यमिता प्रशिक्षणों, 2 कसाई प्रशिक्षणों, आरकेवीवाई परियोजना के तहत भेड़ पालकों के लिए दो प्रशिक्षण तथा चार समझौता ज्ञापनों (एमओयू) पर उद्यमियों के साथ हस्ताक्षर किए। आईआरसी, आईएमसी तथा आरएसी की बैठकों को सफलतापूर्वक आयोजित किया गया।

अप्रैल 2016 से मार्च 2017 तक की अवधि के दौरान संस्थान के क्रियाकलापों का सारांश नीचे दिया गया है:

अनुसंधान तथा विकास

- दूध वसा (गाय के घी) में 5.0 प्रतिशत से अधिक गो पशु /भैंस के टेलो के मिलावट की जांच करने के लिए mt D loop तथा mtCyt b तथा प्रजाति विशिष्ट प्राइमरों का उपयोग करते हुए पीसीआर से (परख) को विकसित किया गया है। एक प्रतिशत स्तर पर गोपशु और भैंसो के टेलो से डीएनए की जांच के लिए टकमान रियल टाइम पीसीआर से (परख) को विकसित किया गया।

- भैंस (बुबालस बुबेलिस), भेड़ (ओवि सेरीज) तथा बकरी (केप्रस हर्कस) के मांस के कच्चे और पके मांस तथा उनके मिश्रण को प्राधिकृत करने हेतु (दो-विमात्मक जॅल इलेक्ट्रिोफोरेसिस) तथा ऑफजॅल -आधारित प्रोटियोमिक विधि को विकसित किया गया। इस अध्ययन से यह प्रदर्शित होता है कि इन तीन घनिष्ट रूप से सम्बद्ध प्रजातियों के जटिलमिश्रण से मांस के आथेंटिकेशन के लिए एक से अधिक प्रजातियों के विशिष्ट पेप्टाइडों की पहचान की आवश्यकता होती है क्योंकि उनके एमिनो अम्ल अनुक्रमों में काफी समानता पाई जाती है।
- भैंस के यकृत से निष्कर्षित हाइड्रोलाइसेट्स प्रोटीन ने उल्लेखनीय तौर पर उच्च डीपीपीएच रेडिकल स्केवेंजिंग सक्रियता प्रदर्शित की जो कि एंटीऑक्सीडेंट पेप्टाइडों की उपस्थिति को बताती है।
- भैंस के मांस/ग्रासनली से निष्कर्षित सर्कोसिस्ट से डीएनए के पृथक्करण तथा ने एस. फ्यूजीफार्मिस, एस. टेनियाटा तथा एस. बफेलोनिस की उपस्थिति प्रदर्शित की। प्रस्तुत अध्य्यन में एस. होमिनिस को नहीं पाया गया।
- भेड़ के आहार में सेलेनो-मेथिओनिन के रूप में सेलेनियम संपूरण देने पर विभिन्न पेशियों और अंगों में सेलेनियम के समावेश का स्तर सर्वोच्च था।
- चारे के जैविक प्रमाणन का कार्य किया गया तथा विधिवत जांच और ऑडिटिंग के पश्चात भारत के एनपीओपी मानकों के अनुसार चारे के लिए तीसरे वर्ष जैविक स्कोप प्रमाणपत्र प्रदान किया गया।
- एक अत्यधिक संवेदनशील विधि ने भैंस के मांस के नमूनों में क्रमश: 36.27 तथा 30.38 पर एनरोफ्लोक्सेसिन और सिप्रोफ्लोक्सेसिन के प्रमात्रीकरण हेतु एक सीमा का संकेत दिया।
- रेड कैबेज, अनार तथा बहूनिया परपूरिया से निष्कर्षित प्राकृतिक संसूचकों ने इंडिकेटर मेटाबोलाइट मॉडल सिस्टम में नेनो सेंसर स्ट्रिप्स को विकसित करने में अपनी संभावनाओं को प्रदर्शित किया है।

- मांस की गुणवत्ता तथा भंडारण स्थिरता में सुधार के लिए ड्रेस्ड शव या मांस की सुपरचिलिंग स्थिति के इष्टमिकरण हेतु तापमान, आर्द्रता तथा वायु-प्रवाह के संबंध में एक सुपर चिलिंग कैबिनट को विकसित किया गया।
- सचेत बनाम अचेत भेड़ों के बीच मांस के गुणवत्ता मानदंडों तथा रक्त ह्रास प्रतिशतता में कोई उल्लेखनीय अंतर नहीं पाया गया।
- बर्गर पैटी तैयार करने के लिए सांचे (मोल्ड) को विकसित किया गया और इसके औद्योगिक डिजाइन हेतु आवेदन दाखिल किया गया (आवेदन संख्या 290498)।
- सॉसेज स्टफर का उपयोग करते हुए एकसमान आकार तथा चिकनी सतह वाले लजीज सींक कबाब को तैयार करने के लिए एक नई प्रक्रिया विकसित की गई और उसके प्रोसेस पेंटेट के लिए आवेदन किया गया (आवेदन संख्या 201741020037द्ध।

- प्रशिक्षण, कार्यशालाएं तथा प्रसार गतिविधियां:
  - इस संस्थान में ''प्रजातियों की पहचान द्वारा मांस उत्पादों की गुणवत्ता और सुरक्षा के आकलन तथा रासायनिक अपशिष्टों तथा सूक्ष्मजैविक संदूषकों की पहचान और जांच''पर आईसीएआर प्रायोजित लघु अवधि के पाठ्यक्रम का संचालन 3 से 12 जनवरी, 2017 के दौरान किया गया।
  - ''मूल्य वर्धित मांस उत्पादों का विकास'' पर भुगतान आधारित (पेड) व्यावहारिक उद्यमशीलता प्रशिक्षण कार्यक्रम (4) का सफलतापूर्वक आयोजन किया गया। इसमें भारत के कई राज्यों के 45 उद्यमियों को प्रशिक्षित किया गया।
  - ''टेलो प्रजातियों की पहचान'' पर 26 से 30 सितम्बर, 2016 के दौरान एक प्रशिक्षण कार्यक्रम का आयोजन किया गया।
  - 'स्वच्छ मांस उत्पादन' पर राष्ट्रीय मांस अनुसंधान केंद्र पर क्रमश: 26-27 अप्रैल, 22-23 जून, 7-8 सितम्बर, 2016 तथा 23-27 जनवरी, 2017 को चार प्रशिक्षण कार्यक्रमों का आयोजन किया गया। इनमें कुल मिलाकर 58 कसाईयों ने सहभागिता की।
  - राष्ट्रीय पशुधन मिशन कार्यक्रम के तहत भेड़ और बकरी पालक किसानों, मांस के कारोबार से सम्बद्ध लोगों तथा क्षेत्रीय पशुचिकित्साधिकारों के लिए चार प्रशिक्षण कार्यक्रमों का आयोजन किया गया।

- ‘‘लिस्टिीरिया मोनोसाइटोजीन्स के विशेष संदर्भ सहित खाद्य एवं क्लिनिकल नमूनों से खाद्यजनित बैक्टीरियल रोगाणुओं को पृथक करने की विधियां‘‘पर आईसीएआर- राष्ट्रीय जैविक दबाब प्रबंधन संस्थान, रायपुर के सहयोग से इस केंद्र पर 5-6 अक्टूबर, 2016 के दौरान एक दो दिवसीय कार्यशाला आयोजित की गई।
- एबीआई के अंतर्गत कुल चार ब्रोशर, एनएलएम परियोजनाओं के तहत 2 ब्रोशर तथा 21 शोध पत्रों को प्रकाशित किया गया।

• एमओयू तथा परामर्शी सेवाएं
  - उद्यमियों को प्रौद्योगिकी के लाइसेंस के लिए दो एमओयू पर हस्ताक्षर किए गए।
  - मांस प्रसंस्करण यूनिट तथा रेंडरिंग संयंत्रों की संस्थापना के लिए दो परामर्शी परियोजनाओं पर हस्ताक्षर किए गए।

• संस्थागत क्रियाकलाप तथा विशिष्ट आगंतुक
  - संस्थान की उपलब्धियों और प्रगति की समीक्षा के लिए आईआरसी, आरएसी, आईएमसी बैठकों का आयोजन किया गया।
  - ‘विश्व पशुचिकित्सा दिवस, स्वतंत्रता दिवस, सतर्कता जागरूकता सप्ताह, हिंदी दिवस, गणतंत्र दिवस, संस्थान संस्थापना दिवस, स्वच्छ पखवाड़ा का आयोजन किया गया।
  - ‘स्वच्छ भारत मिशन‘के एक हिस्से के रूप में, पूरे वर्ष व्यापक स्वच्छता कार्यक्रम चलाया गया।

• इस दौरान कई विशिष्ट जनो ने इस केंद्र का दौरा किया जिसमें डॉ हबीबर रहमान, उप-महानिदेशक (पशु विज्ञान) तथा डॉ जॉयकृष्णा जेना, उपमहानिदेशक (मात्स्यिकी), डॉ रामेश्वर सिंह,पीडी,डीकेएमके, मेडचल के माननीय एमएलए, श्री एम. सुधीर रेड्डी सहित कई विशेषज्ञों ने इस संस्थान का दौरा किया।

• प्रमुख उपलब्धियां

राष्ट्रीय मांस अनुसंधान केंद्र ने जैविक चारे और जैविक भेड़ उत्पादन पर प्रोटोकॉल को विकसित किया है तथा हाल ही में ऑर्गनिक इंडिया से ऑर्गनिक लाइवस्टॉक सार्टिफिकेशन (जैविक पशुधन प्रमाणपत्र) प्राप्त किया है।

1. INTRODUCTION

'Meat consumption is regarded as a good marker for economic development'

India has been witnessing impressive growth in meat production with an annual production of 6.6 million tonnes during the year 2015-16. The growth in the meat sector is led by poultry industry, whose market size is expected to grow tenfold by 2050. Poultry's share in total meat consumption stands at 28%, as against 14% years ago. If the domestic market is growing rapidly, the industry's exports have been booming. India retains its top spot as the world's largest exporter of buffalo meat and has extended its lead over the next highest exporter, Brazil. India exported 2.4 million tonnes of buffalo meat in the year 2015, compared to 2.0 million tonnes by Brazil and 1.5 million by Australia. India's buffalo meat exports have been growing at an average of nearly 14 per cent each year since 2011, and fetching India as much as $4.8 billion in 2014. The Indian processed meat market is also witnessing a revolutionary change and several multinational companies are introducing globally known products in the Indian markets. E-commerce in India is projected to reach USD 100 billion by 2020, and a big players like Tata and Reliance have already ventured into the sector to tap the potential, but the grocery category makes up only a small share of the market. Tata's site my247market.com, offers fresh and chilled chicken, mutton, fish and prawn in certain areas of Mumbai. Consumers can buy speciality chicken products and orders are delivered in temperature controlled vans. There are a number of other start-ups, including BigBasket, AaramShop, LocalBanya, Grofers and Ekstop, offering services to local areas. Prices are 10-15% higher than in-store prices.

In order to promote and develop food processing sector, the Government of India has allocated nearly a billion dollars under the twelfth five-year plan (2012-17) to implement various schemes and financial assistance in the form of grants-in-aid is provided to entrepreneurs and state government agencies for projects like mega food parks, cold chain management, research and development, quality assurance, and skill development.

In its efforts to contribute towards organised meat sector development in the country, ICAR-NRC on Meat has expanded its research activities and working with wider approach addressing all the issues right from meat animal production, meat quality, safety to consumption. The Centre is playing a pivotal role for conducting basic and applied research in various aspects of meat production, processing, quality control and marketing; developing appropriate and relevant processing technologies for different value added meat products for improved palatability and enhancing product shelf life; providing need based training for scientific, managerial and technical personnel in meat and allied sectors; establishing a liaison with industry, trade, regulatory and developmental organizations operating in meat sector; providing consultancy services to entrepreneurs. NRCM-Agribusiness Incubator (ABI), a pioneering initiative in the domain of meat processing, is serving as a single window for providing incubation support services to the entrepreneurs in meat processing and developing their businesses.

The Centre is focused to serve public needs and is expected to provide lead in developing the meat industry.

2. VISION, MISSION and MANDATE

VISION

NRC on Meat as a premiere institute 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

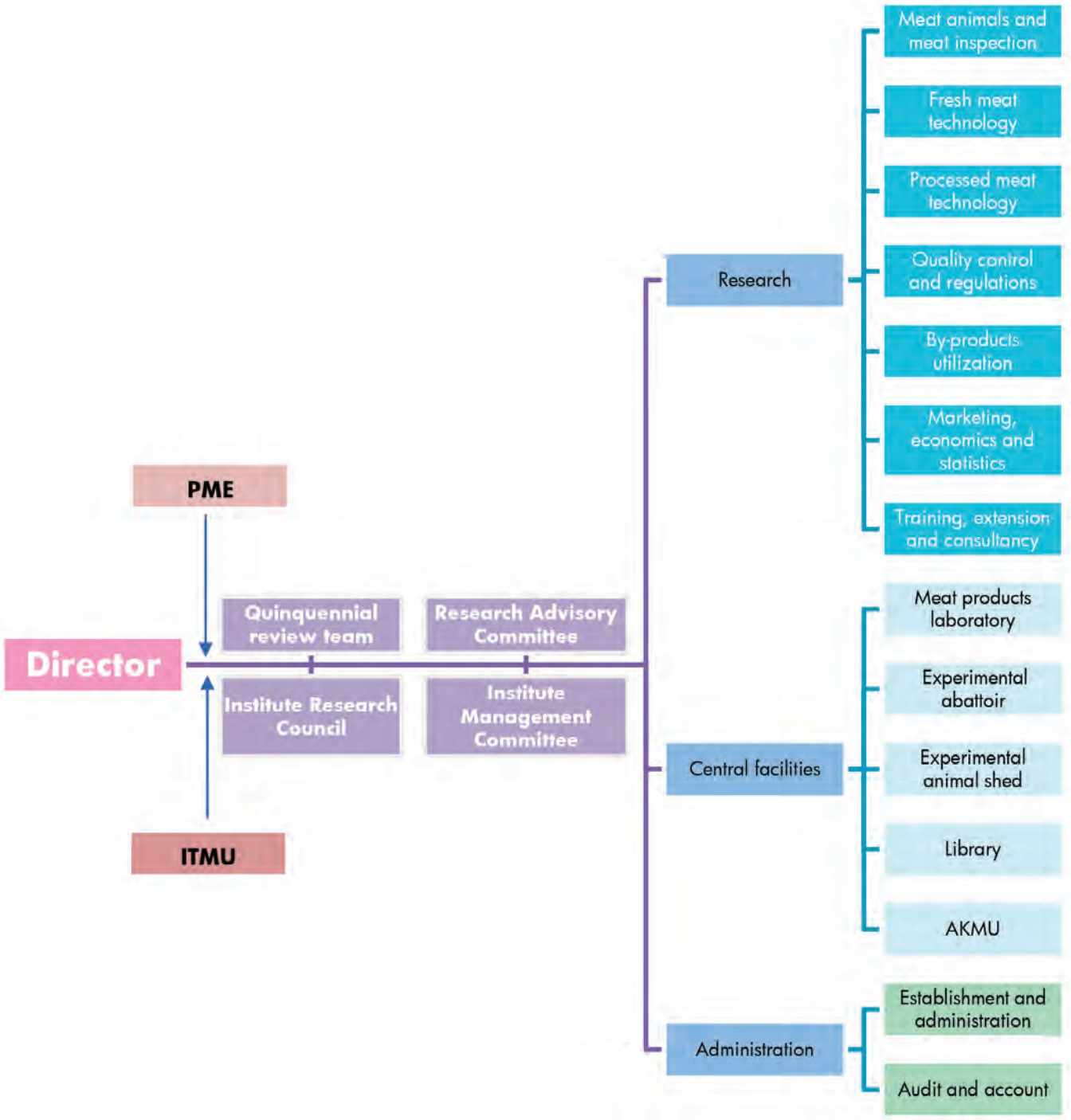
MANDATE

Basic and applied research in meat science and technology for meat production, processing, value addition and utilization

Capacity development for different levels of personnel in meat sector

National repository of information in meat and allied sectors

3. ORGANIZATIONAL SET UP



4. STAFF STRENGTH

Staff	Sanctioned	Filled
Scientific	15	15
Technical	05	04
Administrative	14	07
Skilled Supporting	2	0
Total	36	26

*As on 31st March, 2017

5. BUDGET (In Lakh)

S. No.	Head	Plan		Non Plan	
		Sanctioned	Utilized	Sanctioned	Utilized
1	Establishment	-	-	390	384.90
2	Contingencies	69	68.99	121	120.77
3	Equipment	18	18	2	1.96
4	Furniture and Fixtures	9	8.96	-	-
5	Library	-	-	-	-
6	Works	144.15	144.14	-	-
7	TA	4	3.97	4	4
8	HRD	2	1.89	-	-
9	P Loans& Advances	-	-	-	-
10	Pension & ORB	-	-	45	45
11	NEH	-	-	-	-
	Total	246.15	245.94	562	556.63

S. No.	Name of Institute	XII Plan				2017-18 to 2019-20
		Approved outlay	Actual released	Actual expenditure	% of Outlay	Proposed outlay
	ICAR-NRC on Meat	1300	1014.45	946.88	93.34	2162

6

RESEARCH HIGHLIGHTS

I. Extra Mural Projects

Sr. No.	Project title	Funding agency	Budget (Lakhs)
1	Effect of buffalo slaughter and meat export policy on livestock, milk, draught power and eco-balance in India	APEDA	47.00
2	Detection and quantification of animal body fat (tallow)/vegetable fat in milk fat/ ghee	MoFPI	98.40
3	Studies on prevalence of zoonotic sarcocystosis in export buffalo meat	APEDA	19.00
4	Identification of species-specific peptide biomarkers using high throughput proteomic approaches	DBT	34.00
5	Creation of awareness on clean meat production and value addition	RKVY	17.00
6	Agribusiness incubator (ABI) centre	ICAR	85.00
7	Production of selenium enriched functional meat through nutrient supplementation in sheep	MoFPI	51.22
8	Training and capacity building in sheep and goat value chain	National Livestock Mission, DADF, GoI and DAH, GoTS	15.00

II. Institute Projects

Sr. No.	Project title
1	Development of technology for extraction, purification and characterization of CLA (conjugated linoleic acids) from meat industry by-products
2	Identification of important bioactive peptides from meat and slaughterhouse by-products
3	Organic meat production system for sustainable sheep husbandry and promotion of consumer health
4	Determination of fluoroquinolone residues in buffalo meat samples
5	Development of smart packaging nano-sensor for monitoring quality and safety of meat
6	Feasibility assessment of slaughter units for small ruminants
7	Effect of superchilling and cryoprotectants on quality and storage stability of meat
8	Effect of electrical stunning on physiological stress responses and meat quality in sheep
9	Study on prevalence, characterization and antibiotic resistance of *Campylobacter, Salmonella, E.coli* and *L. monocytogenes* in raw meat and ready to eat meat products

6. Research Highlights

I. Extra Mural Projects

Project Title	:	**Effect of buffalo slaughter and meat export policy on livestock, milk, draught power and eco-balance in India**
Project leader	:	**Dr. V. V. Kulkarni,**
PI	:	**Dr. M. Muthukumar**
Co-PI	:	**Dr. C. Ramakrishna, Dr. Suresh K. Devatkal, Dr. P. Baswa Reddy & Smt. K. Varalakshmi**

The collection, compilation and analysis of primary data from stakeholders viz, farmers, animal traders, AH officials, livestock market staff/officials, meat export plants and consumer of Andhra Pradesh (Undivided), Punjab, Gujarat and Maharashtra has been completed. In total, primary data were collected from 467, 753, 668 and 512 stakeholders of Andhra Pradesh (Undivided), Gujarat, Maharashtra and Punjab, respectively. Out of 1875 farmers surveyed, 50 % of them had an opinion that the population of productive (milch) buffalo is increasing over years, whereas 45% opined decrease in population. Further, about 59% farmers said that the milk production is increasing over the years and 34% were reported decrease in milk production. Among 104 animal traders interviewed, the majority of traders (45%) revealed that the export of meat fetches good price for culled buffaloes. About 84% of the domestic slaughterhouse people and 78% of meat traders opined that useful/productive buffaloes were not utilized for meat production. Animal husbandry officials opined that efficient culling of unproductive and low producers is essential in livestock improvement (82%) and farmers do not dispose productive buffaloes for slaughter (70%) and should not ban on slaughter of female buffaloes for meat export (58%). About 69% of buffalo meat consumer suggested to rear buffalo male calves for meat production. The outcome of the study will suggest recommendations for taking up an eco-friendly and sustainable livestock production in the country.

Fig.1. Photos of field survey of buffalo production

Project Title	:	**Detection and quantification of animal body fat (tallow)/vegetable fat in milk fat/ghee**
PI	:	**Dr. S. Vaithiyanathan**
Co-PI	:	**Dr. S. Kalpana & Dr. Rituparna Banerjee**

The present study is aimed at developing a technique based on PCR assay to detect and quantify animal body fat/vegetable fat in milk fat/ghee in known and unknown samples. Under this project, standardized a method to isolate DNA from fat materials such as milk fat (pure cow ghee), tallow (cattle and buffalo) and vegetable fat. The DNA isolated from milk fat/animal body fat/vegetable fat was not good quality in terms of A_{260}/A_{280} ratio. However, the isolated DNA quality was sufficient enough to get amplified by the mitochondrial primers in the PCR assay. In the end point PCR assay using mt D loop and mtCyt b species specific primers have shown that tallow addition above 5% in the milk fat (cow ghee) can be detected (Fig 2). The rbcl PCR assay to detect vegetable fat DNA is under progress. In the Taqman real time PCR assay, DNA from cattle and buffalo tallow can be detected at 1% level. The PCR efficiencies observed were 116 and 128% respectively for cattle and buffalo DNA when one diluted into the other with R^2>0.95 which indicated excellent linearity. It was observed that the correlation analysis of DNA content and tallow percentage in the binary mixture showed linear relationship with R^2>0.96 (Fig 3). Taqman real time PCR assay was validated for the detection of cattle/buffalo DNA in the unknown tallow samples.

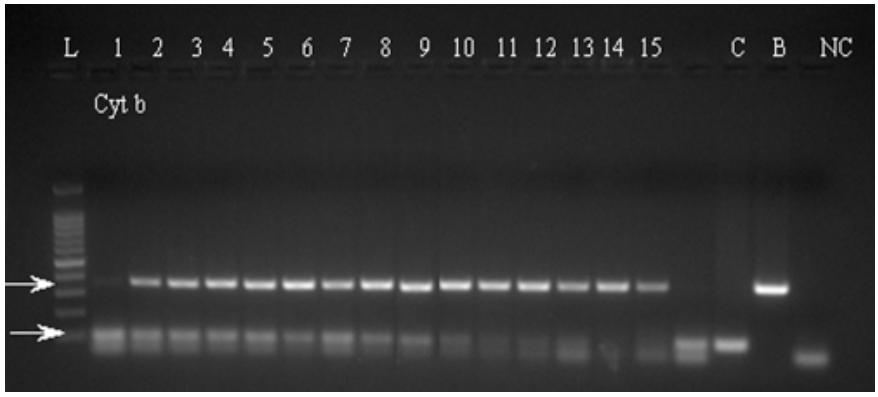


Fig.2. mtCytb duplex (for cattle and buffalo) PCR assay of DNA from binary mixtures

Cow ghee (%) 1=100; 2=95; 3=90; 4=85; 5=80; 6=75; 7=70; 8=65; 9=60; 10=50; 11=40; 12=30; 13=20; 14=10; 15=0

Buffalo Tallow (%) 1=0; 2=5; 3=10; 4=15; 5=20; 6=25; 7=30; 8=35; 9=40; 10=50; 11=60; 12=70; 13=80; 14=90; 15=100; C=cattle and B=buffalo

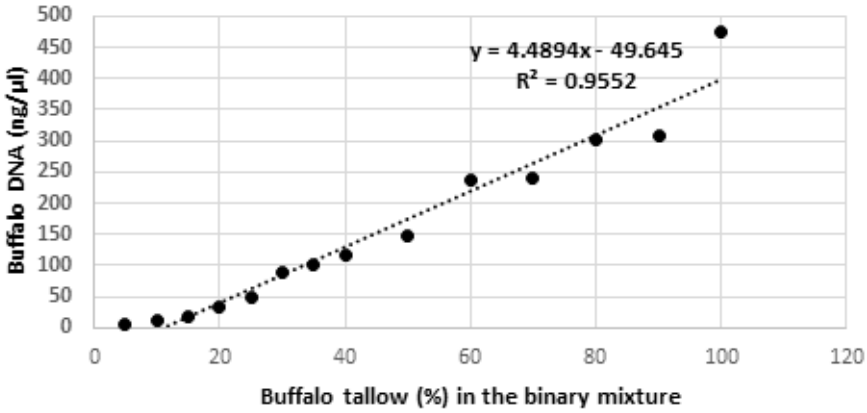


Fig. 3. Buffalo tallow (lab made) percentage as DNA (ng)

Project Title	:	**Studies on prevalence of zoonotic sarcocystosis in export buffalo meat**
PI	:	**Dr. C. Ramakrishna**
Co-PI	:	**Dr. L. R. Chatlod, Dr. S. Vaithiyanathan & Dr. M. Muthukumar**

Randomly, sarcocysts which were visible on naked eye examination of oesophagus and meat / muscle from a total of 168 buffaloes (Hyderabad – 54 buffaloes, Kolkata – 54 buffaloes and Mumbai – 60 buffaloes) were used for isolation of DNA. The average yield of DNA was 220.16 + 19.27ng/µl at Hyderabad city, 204.88 + 27.88 ng/µl at Kolkata city and 344.84 + 44.51ng/µl at Mumbai city. All the 168 DNA samples from 3 different cities were amplified as per the targeted gene in the PCR assay. They were observed on the agarose gel in the gel dock. All the amplicons showed the 900 bp bands which are clearly identified by using the 100kb ladder

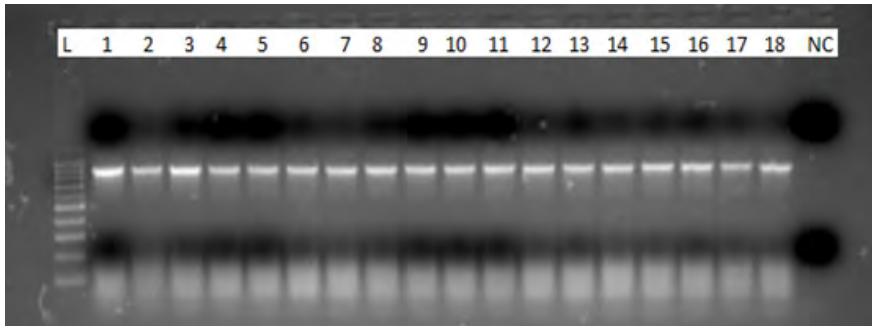


Fig.4. Electrophoretic analysis of amplified DNA samples

(Lane L – 100 kb Ladder; Lane 1 to 18 - different amplified DNA samples; NC – Negative Control)

The RFLP analysis of all the PCR products with 4 different enzymes (BslI, DraI, FokI and RsaI) showed two different fragment patterns. S. fusiformis and S. taeniata represented pattern A and S. buffalonis represented pattern B.

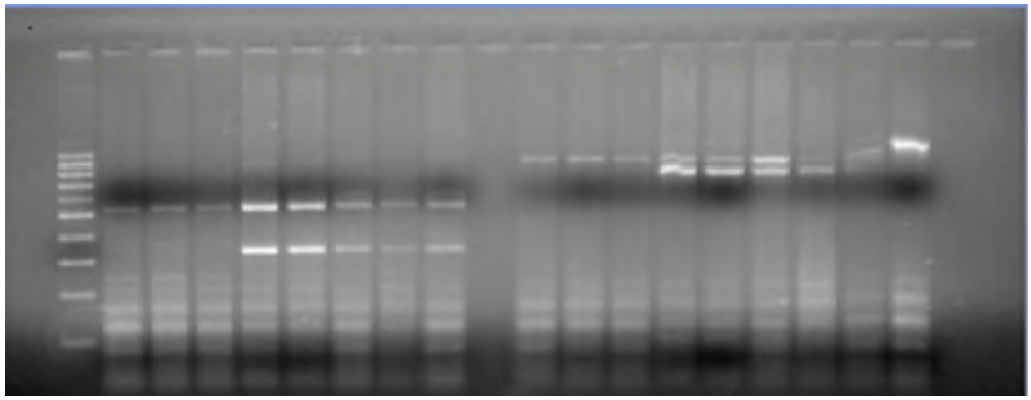


Fig. 5. RFLP fragment pattern of PCR products digested with BslI and DraI restriction enzymes

(Lane L – 100 kb Ladder; Lane 1 to 8 - different amplified DNA samples; UD – Undigested)

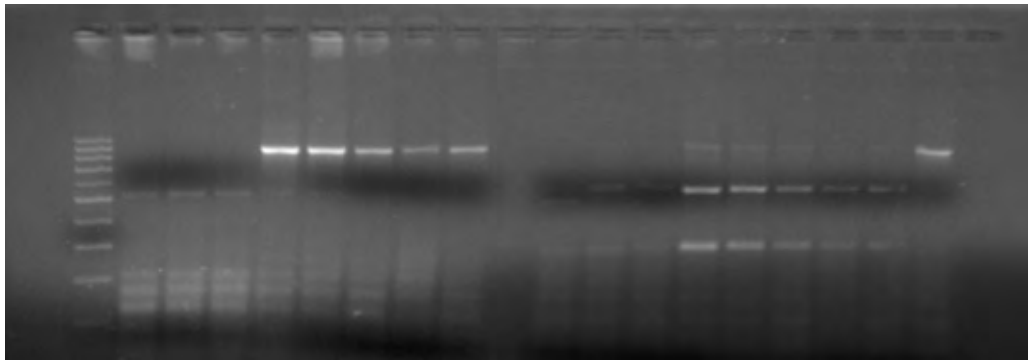


Fig. 6. RFLP fragment pattern of PCR products digested with FokI and RsaI restriction enzymes

(Lane L – 100 kb Ladder; Lane 1 to 8 - different amplified DNA samples; UD – Undigested)

Based on the two different patterns (Pattern A and Pattern B) on RFLP, randomly 3 PCR products from Hyderabad city, 10 PCR products from Kolkata city and 9 PCR products from Mumbai city were used for DNA sequencing. Three species of Sarcocysts were identified i.e, S. fusiformis (Hyderabad – 3; Kolkata – 8; Mumbai – 7); S. *taeniata* (Kolkata – 2; Mumbai – 1) and S. *buffalonis* (Mumbai – 1). The zoonotic S. *hominis* could not be found in the present study.

Project Title : **Identification of species-specific peptide biomarkers using high throughput proteomic approaches**

PI : **Dr. B.M. Naveena**

Co-PI : **Dr. M. Muthukumar**

Fraudulent mislabelling of processed meat products on global scale which could not be detected using conventional techniques demand for sensitive, robust and accurate methods of meat authentication to ensure food safety and public health. In the present study, we developed in-gel (2-dimensional gel electrophoresis, 2DE) and OFFGEL-based proteomic method for authenticating raw and cooked water buffalo (*Bubalus bubalis*), sheep (*Ovis aries*) and goat (*Caprus hircus*) meat and their mixes. The MALDI-TOF MS analysis of proteins separated using 2DE or OFFGEL electrophoresis delineated species-specific peptide biomarkers derived from myosin light chain 1 and 2 (MLC1 and MLC2) of buffalo: sheep: goat meat mix in definite proportions @ 98:1:1, 99:0.5:0.5, 99.8:0.1:0.1 that were found stable to resist thermal processing. In-gel and OFFGEL-based proteomic approach are efficient in authenticating meat mixes spiked at minimum 1.0% and 0.1% level, respectively in triple meat mix for both raw and cooked samples. Relative Quantification of buffalo meat mixed with sheep meat was also done by quantitative label-free mass spectrometry using UPLC-QTOF and PLGS search engine to substantiate the confidence level of the data (Table 1). The study demonstrated that, authentication of meat from a complex mix of three closely related species requires identification of more than one species-specific peptides due to close similarity between their amino acid sequences. The study envisages the robustness of high throughput proteomic approach coupled with OFFGEL electrophoresis as an alternative to DNA-based method for meat speciation and pave the way for future requirements of food safety and authenticity

Table 1. Species-specific peptides identified using label-free approach from a meat mix containing buffalo meat: sheep meat (1.0: 99.0 w/w)

Species	Peptide identified	Mass	Retention time	m/z value	Area under the peak	PLGS intensity	Chromatogram intensity
Raw meat mix							
Buffalo	RFSKEEIKN*	1150.717	39.6898	1150.7054	10243.453	716	2005
Sheep	DRFSQEEIRN	1293.6471	3.8692	647.3272	10504.236	1549	1034
Buffalo	FKEAFLLFDRTGECKI	1973.9855	3.149	658.6667	17426.975	1437	1282
Sheep	KEAFLLYDRTGDGK	1612.8082	4.6988	806.9077	389.481	785	13669
Cooked meat mix							
Buffalo	DRFSKEEIK	1151.733	38.8356	1151.7331	22579.471	1389	1258
Sheep	FSQEEIRNMWAAF	1628.798	3.6394	814.9025	2743.759	2089	12458
Buffalo	EAFLLFDRTGECKIT	1799.9	3.829	900.4554	5495.226	985	8258
Sheep	EAFLLYDRTGDGKI	1597.822	4.9287	799.3993	1416.707	2581	14084

*Species-specific peptides are highlighted in bold letters

Project Title	:	**Agribusiness incubator (ABI)**
PI	:	**Dr. M.Muthukumar**
Co-PI	:	**Dr. Suresh K. Devatkal, Dr. B. M. Naveena, Dr. G. Kandeepan & Dr. Rituparna Banerjee**

The ABI centre is being established with the objects to generate employment opportunities and promote viable enterprises in meat / poultry processing through establishment of an integrated poultry processing plant in a complete value chain and also to undertake scaling up of pilot level meat processing technologies into a commercial level of value chain through skill upgradation, technology transfer, capacity building and handholding of prospective entrepreneurs in agribusiness ecosystem with special emphasis on meat value chain. Facilities for chicken carcass chilling, portioning and packing were established under this project. During the year 2016-17, the ABI Unit has facilitated singing of 2 agreements for providing consultancy for establishment of value added meat products processing unit and rendering plant for utilization of slaughterhouse byproducts. Two MoUs were also signed with entrepreneurs for licensing of technologies for retailing of meat and manufacturing value added meat products. There were 9 training programmes covering clean meat production and development of value added meat products were organized. The technologies developed at this centre were displayed at exhibitions conducted at various parts of the country. Under ABI, four brochures on 'Technology for shelf stable pet food using meat by-products and vegetables', 'NRC on Meat- Agribusiness incubator', 'Handling of meat for quality and safety' and 'Pre slaughter welfare of meat animals' were published during 2016-17.

Fig. 7. NRCM- ABI unit

Research activity under ABI:

Dr. Rituparna Banerjee, Dr. B.M.Naveena and Dr. M. Muthukumar

The effects of three different cooking methods viz. grilling, roasting and smoking on physicochemical parameters (proximate analysis, cooking loss, color, and texture), microstructure, protein degradation, PAH content and sensory properties of seekh-kebabs, an Indian traditional meat product were studied. Moisture content of kebabs was affected by the cooking methods mainly as a consequence of the cooking losses. The highest cooking yield was found in grilled samples. Smoked kebab samples had a lighter surface color and harder texture in comparison to samples cooked by grilling and roasting. Scanning electron microscopic studies revealed more structural damage in smoked kebabs compared to grilled or roasted kebabs. Fragmentation of muscle proteins with higher molecular weight was observed in smoking process. Analysis of polycyclic aromatic hydrocarbons indicated the levels below the limit of detection (0.01mg/kg) for all the kebabs, even though slightly higher levels of LMW PAHs were observed in smoked kebabs. The texture and juiciness were found to be better in grilled samples, but in terms of color, flavor and overall acceptability, smoked kebabs were preferred by the sensory panellists.

Fig. 8. Processing of seekh-kebabs by charcoal grilling, oven roasting and smoking

Under ABI project, mould for preparing burger patty was developed and also filed for industrial design (Application No. 290498). Further, a novel process for preparation of succulent seekh kebab with uniform size and smooth exterior employing sausage stuffer was developed and the same was applied for process patent (Application No. 201741020037).

Project Title : **Production of selenium enriched functional meat through nutrient supplementation in sheep**

PI : **Dr. P. Baswa Reddy**

Co-PI : **Dr. DBV Ramana & Dr. M. Muthukumar**

Selenium is an essential trace mineral for human and animal because it is involved in regulating various physiological functions as an integral part of selenoproteins. It is pertinent in this context to supplement Selenium through foods of animal origin as this will be useful for the health and wellbeing of the animals as well as the consumers of animal foods. Muscle selenium concentrations can be increased by dietary selenium supplementation in livestock feeds and the meat obtained from such animals could be beneficial for human health. In the lights of above facts a research project has been taken up with an objective to produce selenium enriched functional meat through feed supplementation in sheep. Animal feeding experiment has been conducted in sheep by supplementing Selenium in different forms i.e., Sodium Selenite, Seleno-methionine and Selenium enriched yeast @500ppb in the feed and the extent of incorporation of selenium in different muscles and organs has been compared with the control group. The results have clearly indicated that by supplementing selenium in the feed in the form of Seleno-methionine, has the highest levels of incorporation of Selenium into different muscles and organs.

Table 2. Selenium content in muscles and organs (on dry matter basis)

Particulars	Control	Sodium Selenite	Seleno-methionine	Selenium Yeast	p value
LD muscle	44.33+9.27	68.81+9.72	175.65+16.12	44.11+5.2	<0.001
Thigh muscle	113.49+8.24	309.85+97.35	484.04+9.69	121.23+10.98	<0.001
Breast muscle	89.74+16.6	177.4+89.68	233.15+22.07	87.72+6.73	0.066
Kidney	909.78+77.55	937.88+156.31	812.32+169.6	569.32+101.57	0.185
Heart muscle	122.22+19.23	176.33+14.33	264.93+26.41	144.09+11.53	<0.001
Testicles	448.43+25.59	417.04+22.56	581.54+29.35	474.62+32.99	0.004

Animal Feeding | Slaughter | Carcass quality evaluation

Fig.9. Animal feeding, slaughter and carcass evaluation of selenium fed sheep

Project Title : **Training and capacity building in sheep and goat value chain**
PI : **Dr.Baswa Reddy**
Co PI : **Dr. M. Muthukumar**

An externally funded project under National Livestock Mission (NLM) has been sanctioned with the title 'Training and capacity building in sheep and goat value chain'.

Two training programme for Sheep and goat farmers were organized from 22nd to 24th February 2017 and 16th to 18th March 2017. A total of 76 farmers from different districts of Telangana participated in the programme. One day visit to an organized sheep and goat farm was arranged for 'Field Level Demonstration' (FLD). Practical demonstration of sheep rearing different breeds of Sheep and goats, dipping, silage making, preparation of complete feeds (Total Mixed Ration, TMR) etc., were carried out in the farm. All the participants expressed immense satisfaction about the training programme.

Fig. 10. Participants of 'Training and capacity building in sheep and goat value chain'

One day awareness cum practical demonstration programme was organized for meat handlers on 4th March 2017. A total of 53 participants from different municipal slaughterhouses of Hyderabad, retail meat shops etc., attended the programme.

Training programme for field Veterinarians was conducted for four days from 7th to 10th March 2017 to refresh their knowledge and introduce the recent concepts in sheep and goat value chain. The support of Animal Husbandry department of Telangana was taken in selection of the participants. A total of 21 participants from different districts of Telangana state participated in the training programme.

II. Institute projects

Project Title : **Estimation of Antibiotics Residue in Fishes and Poultry**

PI : **Dr. G.Venugopal**

Co-PI : **Dr. M. Muthu Kumar, Dr.P.Baswa Reddy & Dr.S. Kalpana**

Four antibiotics were selected for the study viz., Oxytetracyline, chlortetracycline, ciprofloxacin and enrofloxacin, for the estimation of residues in pond harvested 3 fish species- Catla catla (Catla), Labeo rohita (Rohu) & Pangasinodon hypophthalamus (Pangas) from Kolleru region. In Kolleru region of Andhra Pradesh intensive production system have been practised and as a result there are frequent outbreaks of parasitic and bacterial diseases. To combat bacterial infections rampant use of antibiotics is applied throughout the grow out period. The results indicated that out of total samples 39% were found to be positive and contained residues of one or more antibiotics. In catla fish 44% were positive and residues of ciprofloxacin and enrofloxacin were detected. In case of Rohu about 50 % fishes contained residues of Enrofloxacin while in Pangas fish 22.2 % samples were positive and residues of only enrofloxacin were detected. There were no incidences of Tetracyclines (OTC and CTC) residues occurrence in any of three fish species studied. The maximum residues of 26.2 ppb of Ciprofloxacin and Enrofloxacin 39.1ppb were detected in this study, which are very much below the MRL values of 100ppb as per EU commission.

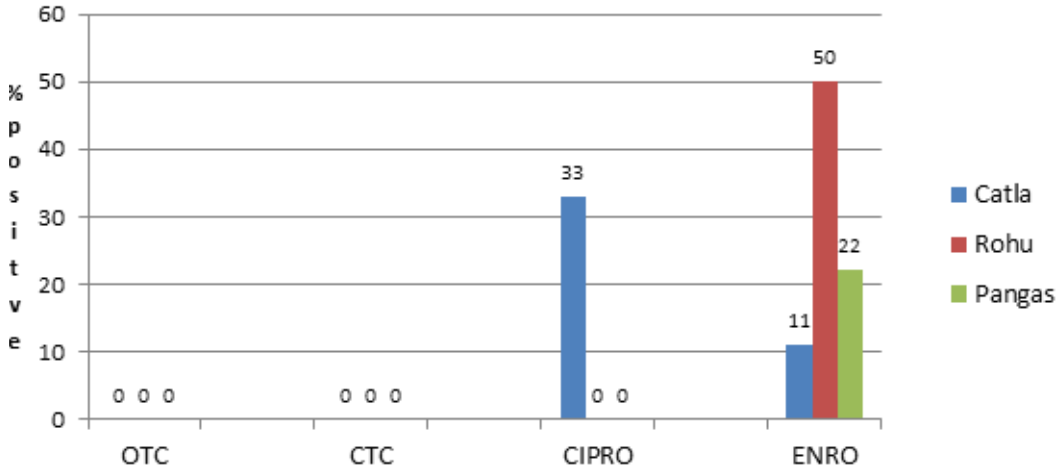


Fig. 1. Antibiotics positive samples in fish species

Project Title	:	**Development of technology for extraction, purification and characterization of conjugated linoleic acids (CLA) from meat industry by-products**
PI	:	**Dr. Suresh K. Devatkal**
Co-PI	:	**Dr. P. Baswa Reddy & Dr. S. Kalpana**

Conjugated linoleic acid is a bioactive compound generally present in ruminant products. This project was undertaken to generate the knowledge on presence of conjugated linoleic acid in ruminant fats. CLA was extracted in reagent alcohol identified by two methods namely UV spectrophotometry (absorbance was measured at 233) and Gas chromatography method (FAME extracts were analysed using Gas chromatography in an accredited laboratory. Agilent J& W, HP-88 Capillary of GC column was employed for the detection of CLA). Further presence of CLA in small ruminant meat was confirmed by GC-MS.

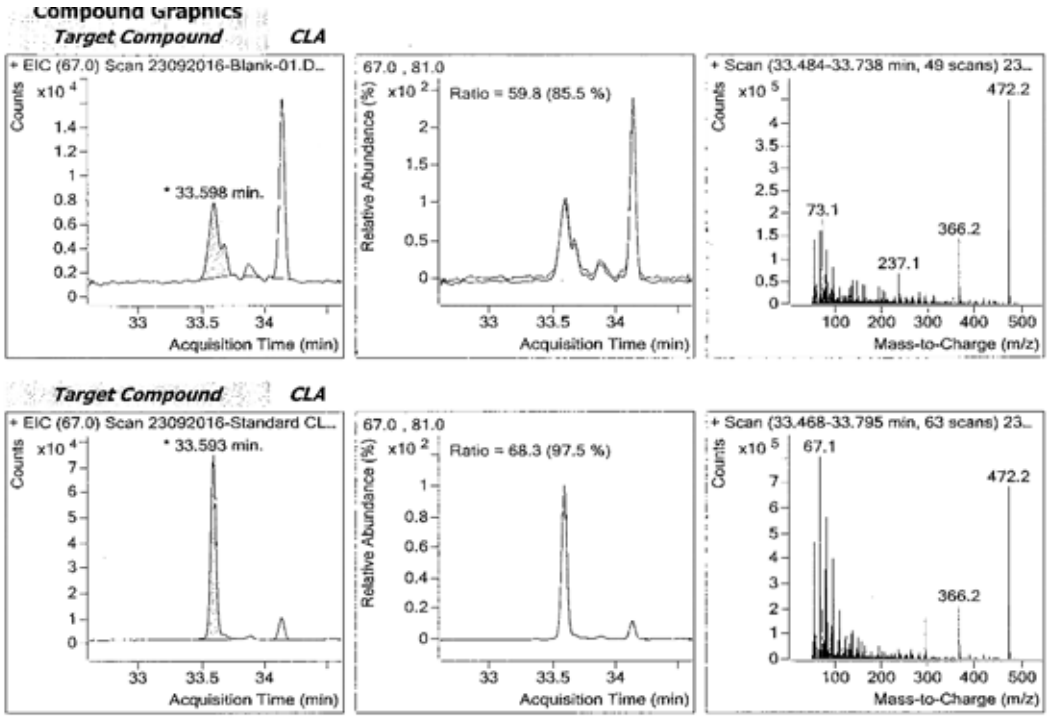


Fig. 2. Identification and conformation of CLA in small ruminant fats by GC-MS

Project Title	:	**Identification of important bioactive peptides from meat and slaughterhouse byproducts**
PI	:	**Dr. B.M. Naveena**
Co-PI	:	**Dr. Suresh Devatkal & Dr. Rituparna Banerjee**

This project was proposed to isolate, purify and characterize few important bioactive peptides from meat and important by-products. Buffalo liver proteins were extracted and digested with Proteinase-K, Pronase-E, Pepsin and Ginger enzyme under different time, temperature and pH conditions. The enzyme: substrate ratio and incubation conditions were standardized. The digested samples were purified using 0.45 and 0.22 micron filters, Amiconfilters and gel filtration chromatography (Sephacryl HR-200). The fractions were separated on SDS-PAGE. The % Degree of Hydrolysis (DH) was evaluated and compared with control. Significant increase in % DH is an indicative of proteolysis and peptide generation. The control and hydrolyzed samples were separated on gel filtration column using Sephacryl HR-200. The SDS-PAGE of crude, filtered and gel filtered fractions indicates significant breakdown in large molecular weight proteins and appearance of small molecular weight peptides. The antioxidant effect of crude and gel filtered fractions (Figure 3) was evaluated using DPPH radical scavenging activity. Few fractions generated from protein hydrolyzed samples indicated significantly higher ($P<0.05$) DPPH radical scavenging activity suggesting the presence of antioxidant peptides. The gel filtered fractions were freeze dried (Figure 4).

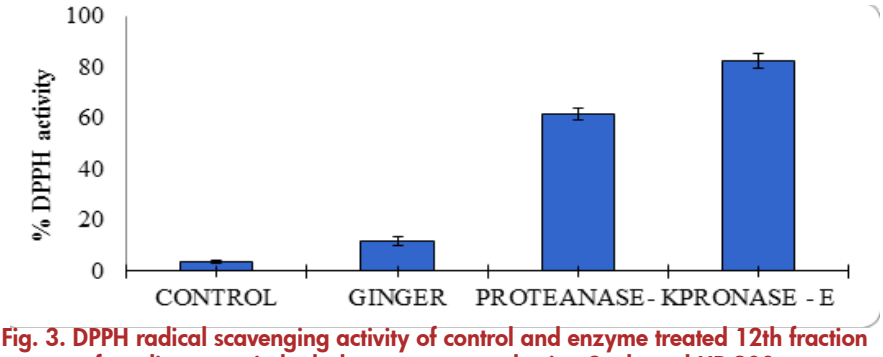


Fig. 3. DPPH radical scavenging activity of control and enzyme treated 12th fraction from liver protein hydrolysates separated using Sephacryl HR-200

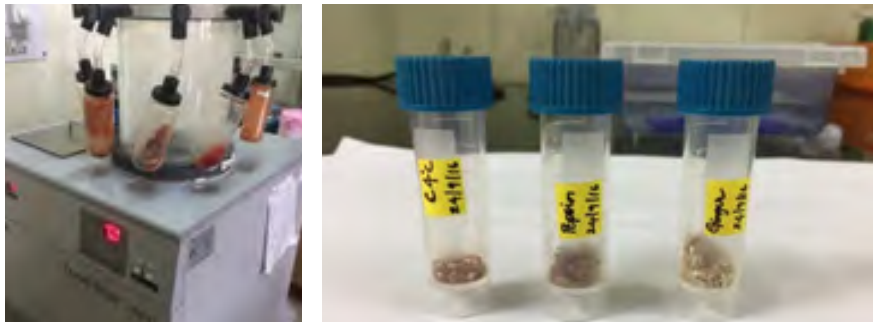


Fig. 4. Freeze drying of purified fractions and freeze dried antioxidant hydrolysates from buffalo liver

Project Title : **Organic meat production system for sustainable sheep husbandry and promotion of consumer health**

PI : **Dr. P. Baswa Reddy**

Co-PI : **Dr. DBV Ramana, Dr.C.Ramakrishna, Dr. M. Muthukumar and Dr.P.K. Pankaj**

Research project on "Organic Meat Production System for Sustainable Sheep Husbandry and Promotion of Consumer Health" has been initiated during the year 2014-15. The programme is being carried out in collaboration with ICAR-CRIDA, Hyderabad at Hayatnagar Research Farm of CRIDA. An area of 0.8 hectares has been earmarked for organic fodder production. CO-4 grass and hedge lucerne has been planted and the fodder is being produced organically without utilization of any chemical fertilizers or pesticides. Organic certification of fodder has been carried out and after due inspection and auditing, third year organic scope certificate has been awarded for the fodder as per the NPOP standards of India. Breeding stock of sheep are being reared under cut and carry system with organically produced fodder. For organic certification of animals, since there is no precedence of organic certification of sheep in India, efforts are being made to finalize the certification protocols. The inspection and auditing of organic sheep farming has been completed and the certificate is likely to be issued soon.

Fig.5. Organic certification of sheep

Project Title : **Determination of fluoroquinolone residues in buffalo meat samples**

PI : **Dr. S. Kalpana**

Co-PI : **Dr. M. Muthukumar**

A highly sensitive RP-HPLC method was standardized using a fluorescent detector (at an excitation wavelength of 280 nm and emission wavelength of 450nm) and C8 column, keeping in view the Codex MRL, for a widely used fluoroquinolone enrofloxacin and its active metabolite ciprofloxacin in buffalo meat samples. The raw data were processed using regression analysis and the limit of quantification for enrofloxacin and ciprofloxacin was found to be

36.27 and 30.38 µg/Kg respectively. Eighty four buffalo meat samples from in and around Hyderabad city were collected and extracted in triplicate. The RP-HPLC analysis of unknown buffalo meat samples were in progress.

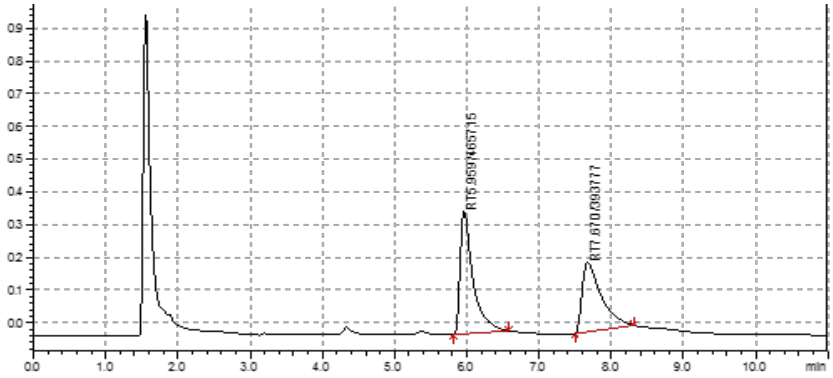


Fig.6. Optimized representative chromatogram of aqueous standards of enrofloxacin and ciprofloxacin at 75 ppb

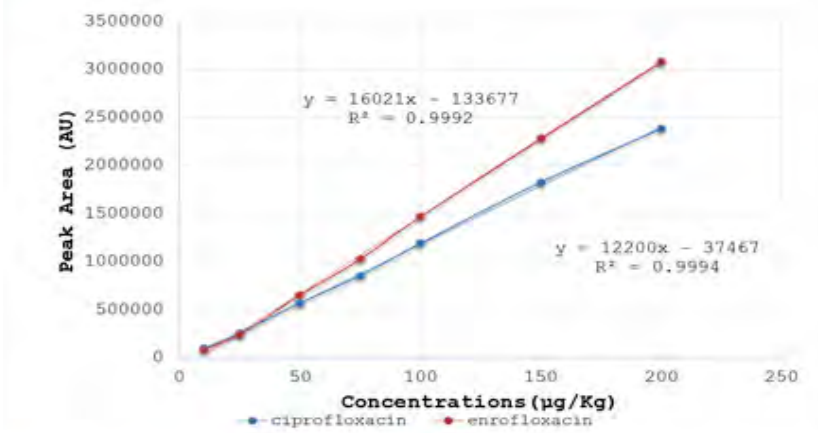


Fig.7. External calibration Curve

Project Title	:	**Development of smart packaging nano-sensor for monitoring quality and safety of meat**
PI	:	**Dr. G. Kandeepan**
Co-PI	:	**Dr. Suresh K. Devatkal & Dr. M.R.Vishnuraj**

The levels of different indicator chemicals, nanomaterial, conjugate and binders are being standardized to develop a chromogen coated strip that changes color on reaction with metabolites released from stored meat. The process such as ultra-sonication, centrifugation, drying etc., and their duration are being standardized. Natural indicator from red cabbage, pomegranate and *Bauhinia purpurea* were extracted and it was found that indicator from red

cabbage was comparatively superior with peak wavelength at 530.5 having absorbance 2.55. Then trials were conducted with different combination of silver nanodispersion, natural indicator with different pH, chemical indicator, ABTS, TiO_2, microcrystalline cellulose and polyvinyl pyrrollidine for coating onto nitrocellulose membrane through centrifugation and followed by drying. The developed strips were studied in indicator metabolite model system with ammonia and trimethylamine simulating the quantity released during the storage of meat. It was observed that color of the strip changed distinctly in chemical indicator based strip as well as in strip prepared from combination of silver nanodispersion, natural indicator with different pH, ABTS and TiO2. This trial was followed by testing the strips in chicken meat system which revealed that chemical based indicator strip changed color from yellow to blue and in natural indicator based strip color changed from dark pink to light pink or purple to pale white. Trials are still in progress for standardizing the different combinations of nanoparticle, conjugate, natural indicator, chemical indicator and binder to optimize appreciable color change due to reaction with the volatile bases in the indicator strip during the storage of chicken meat.

Project Title : **Feasibility assessment of slaughter units for small ruminants**
PI : **Mrs. K.Varalakshmi**
Co-PI : **Dr. M. Muthukumar & Dr. P.Baswa Reddy**

Small ruminant modern abattoirs of small scale (100 heads/day) require an initial investment of Rs. 221.25 & 194.01 lakhs for own and service abattoirs. Medium scale abattoirs (500 heads/day) require Rs. 991 & 940.2 lakhs. Cost of production comes to Rs.323.82/kg with variable cost of Rs.298.13 and fixed cost of Rs. 25.69 and selling price comes to Rs. 356.2/kg at 10% markup for small scale own abattoir. Cost of production on medium scale units comes to Rs.316.39/kg with variable cost of Rs.295.26 and fixed cost of Rs. 21.13 and selling price comes to Rs. 348.02/kg at 10% markup. Variable cost has accounted for largest share with more than 90% i.e 92.07% and 93.32% for small and medium scale own abattoirs whereas fixed costs accounted for 7.93% and 6.68% of total cost of production respectively. Comparison of economics of meat production between own slaughterhouse and service abattoirs showed that slaughter charges comes to Rs. 28.55 per kg of live wt (or 713.8/ sheep weighing 25 kgs) and Rs. 35.18/kg of final product respectively for service abattoirs compared to own slaughter house i.e. Rs. 32.78 (or Rs. 656.95/sheep) and Rs. 40.39/kg of final product. For medium scale units, slaughter charges comes to Rs. 23.09 per kg of live wt (or 577.25/ sheep weighing 25 kgs) and Rs. 28.45/kg of final product respectively for service abattoirs compared to own slaughterhouse i.e. Rs. 26.75 (or Rs. 668.75/sheep) and Rs. 32.96/kg of final product. Investment analysis shows feasibility of slaughter units with NPV of Rs. 312.83 lakhs and IRR of 102% and a B-C ratio of 2.45 for small units. The corresponding

figures for medium units are Rs. 1620.67 lakhs, 119.75% and 2.64. Payback period is estimated as 1.86 and 1.72 and estimated annual undiscounted cash flows are Rs. 116.19 lakhs Rs. 573.58 respectively.

Gross and Net profit margin were found to be 14.74% & 6.58% for small units and 63.18%, 21.58% for medium units. Break Even Analysis showed that BEP comes after slaughter of 5385, 11486 small ruminants which comes at 22.12% & 38.29% of full capacity for own and service abattoirs respectively for small scale units. The corresponding figures for Medium scale units are 24371, & 57554 heads coming at 20.02% and 38.37% for own and service abattoirs respectively. For every 1% increase in markup price (for without product differentiation) the price increases by Rs.3.2 4 and 3.53 in the 1st and 7th year respectively. Similarly, increase in other feasibility measures like Net profit, BCR, NPV, Avg undiscounted and discounted returns will be 0.51%, BCR by Rs. 0.24, Rs. 51.5 lakhs, 11.41 lakhs, Rs. 7.32 lakhs respectively for every 1% increase in markup price. Product differentiation is found to reduce feasibility of small scale units.

Table 1. Slaughter charges in different types of abattoirs (Per kg live wt)

Item of cost	Own				Service			
	Small units (Rs.)	% to total cost	Medium units (Rs)	% to total cost	Small units (Rs.)	% to total cost	Medium units (Rs)	% to total cost
Variable costs	11.93	36.39	9.6	35.89	8.24	34.64	6.55	34.04
Fixed costs	20.85	63.61	17.4	65.05	15.55	65.36	12.69	65.96
Total costs	32.78		26.75		23.79		19.24	
Markup price					4.76*		3.85	
Selling price @10% markup					28.55		23.09	

Table 2. Cost and return structure in different types of abattoirs (Rs/kg of final product)

Item of cost	Own				Service			
	Small units (Rs.)	% to total cost	Medium units (Rs)	% to total cost	Small units (Rs.)	% to total cost	Medium units (Rs)	% to total cost
Variable costs	298.13	92.07	295.26	93.32				
Fixed costs	25.69	7.93	21.13	6.68				
Total costs	323.82		316.39		329.16		327.65	
Markup price	32.38		31.64		32.92		32.76	
Selling price @10% markup	356.20		348.02		362.08		360.41	

Project Title	:	**Effect of superchilling and cryoprotectants on quality and storage stability of meat**
PI	:	**Dr. Rituparna Banerjee**
Co-PI	:	**Dr. B. M. Naveena & Dr. Smrutirekha Mallick**

A superchilling cabinet has been developed with respect to temperature, humidity and air–flow to optimize the superchilling condition of dressed carcass or meat in order to improve its quality and storage stability. The cabinet is provided with probes to measure the temperature of the meat at the surface and at the centre along with a digital display of the temperature. To compare the quality of chilled and frozen meat, a storage study was carried out on 0, 4th and 7th day for chilled meat and on 0, 7, 14.... upto 70 days for frozen meat. pH, water holding capacity (%), instrumental color (L*, a*, b*), % metmyoglobin, Warner-Bratzler shear force, TBA value (mg MDA/kg), total plate count and coliforms (log MPN/g) were evaluated.

Fig. 8. Superchilling cabinet

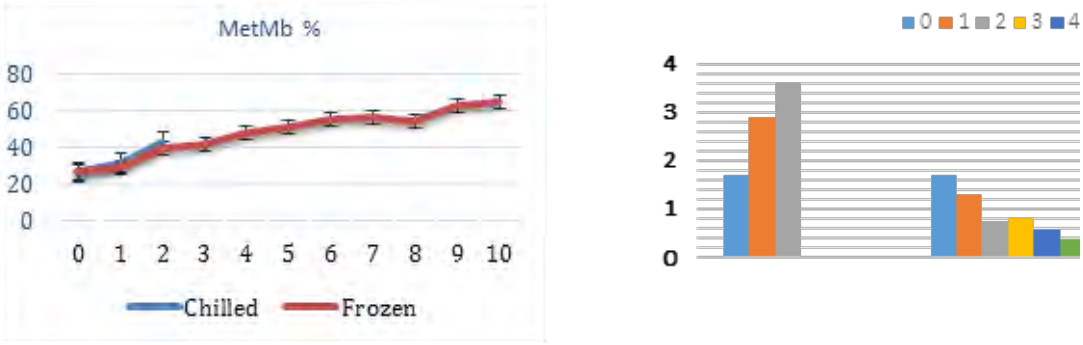


Fig. 9. Changes in MetMb% and coliforms of chicken under chilling and freezing storage

Project Title	:	**Effect of electrical stunning on physiological stress responses and meat quality in sheep**
PI	:	**Dr. Smrutirekha Mallick**
Co-PI	:	**Dr. B. M. Naveena & Dr. P. Baswa Reddy**

Stress reactions to the slaughter procedure influence post-mortem muscle metabolism. Electrical stunning is a humane and acceptable method of stunning. The present study was conducted to evaluate the effect of electrical stunning on the physiological stress parameters and meat quality in sheep. Twenty two sheep were selected and slaughtered. The first group of animals were electrically stunned (110 v for 10 s) before slaughter while the other group was slaughtered without stunning. Bleeding efficiency and meat quality parameters i.e. LD Muscle pH45 min and pH24 hr, instrumental color (*L, a, b*), Warner-Bratzler shear force and water holding capacity of both the group of animals were evaluated. No significant difference was observed in the blood loss percentage and meat quality parameters of stunned vs non stunned sheep.

Fig. 10. Sheep carcasses

Project Title	:	**Study on prevalence, characterization and antibiotic resistance of Campylobacter, Salmonella, E. coli and L. monocytogenes in raw meat and ready to eat meat products**
PI	:	**Dr. L.R.Chatlod**
Co-PI	:	**Dr. B. M. Naveena & Dr. M. Muthukumar**

A total of 293 raw meat samples (chicken -106, mutton - 87, pork - 35 and buffalo - 65) were collected from different retail shops and processed for isolation and identification of *E.coli* and *Salmonella*. Samples were collected in sterile polythene sachets by adopting the standard aseptic measures and transported to lab under chilled condition and immediately processed for isolation. Samples were inoculated in enrichment broth (MacConkey broth for *E.coli* and *Tetrathionate* broth for Salmonella). Incubation was done at 37 0 C for 24h. Enriched inoculum was streaked on selective agar (EMB for *E.coli* and HEA for *Salmonella*). Incubation was done at 37 °C for 24h. Characteristic colonies were picked up on Nutrient agar. Confirmation of the suspected isolates was done by Biochemical tests (IMViC).

The overall incidence of *E.coli* and Salmonella spp. among the analysed meat samples were 18.77% and 4.77 %, respectively. *E.coli* was recovered from 21.6% of chicken, 17.14% of pork, 20.6% of mutton and 12.3% of buffalo meat samples. Salmonella was recovered from 6.6% of chicken, 5.74% of mutton, 2.85% of pork and 1.53% from buffalo meat samples. Biochemically positive samples were sent for serotyping at Central Research Institute, Kasauli, Himachal Pradesh. Predominant serotypes of E. coli were O35, O126, O119 & O2.

7

PUBLICATIONS

7. PUBLICATIONS

7.1. Research Papers

1. Banerjee, R., Jayathilakan, K., Chauhan, O.P., Naveena, B.M., Suresh, K.D. and Kulkarni, V.V. (2016). Vacuum packaged mutton patties: comparative effects of high pressure processing and irradiation. *Journal of Food Processing and Preservation*. doi:10.1111/jfpp.12880
2. Chauhan, P., Das A.K., Kandeepan, G., Nanda, P.K., Pradhan, SR., Kumbhar, V., Yadav, J.P. and Bhattacharya, D. (2016). Effect of Aloe vera gel based extract on the quality of chicken bites. *Journal of Food Processing and Technology* 7(10): 627
3. Girish, P.S., Vaithiyanathan, S., Karabasanavar, N. and Bagale, S. (2016). Authentication of sheep (*Ovis aries*) and goat (*Capra hircus*) meat species using species-specific polymerase chain reaction. *Indian Journal of Animal Sciences* 86 (10): 1172–1175
4. Kandeepan, G. (2016). Quality characteristics of ready to eat dumplings (momo) prepared from yak meat. *Fleischwirtschaft International,* 2: 126-131
5. Mallick, S., Aggarwal, A. and Prakash, B.S. (2016). Seasonal changes in semen quality and correlation with plasma hormone profiles in Karan Fries bulls. *Biological Rhythm Research* 47 6, 967–974
6. Muthukumar, M., Naveena, B.M., Kanchana, K. and Kulkarni. V.V. (2016). Effect of modified soy protein on quality attributes of extended chicken nuggets. *Journal of Meat Science* (Accepted)
7. Naveena, B.M., Panjab, S.K., Shashikumar, M., Krishnaiah, N., Kulkarni, V.V., Deepak, S.J. (2016). Effect of sous vide processing on physicochemical, ultrastructural, microbial and sensory changes in vacuum packaged chicken sausages. *Food Science and Technology International* 23(1): 75-85
8. Naveena, B.M., Usha Rani, K., Praveen Kumar, Y., Kulkarni, V.V. and Rapole S. (2016). Proteomic based approach for characterizing 4-hydroxy-2-nonenal induced oxidation of buffalo (*Bubalus bubalis*) and goat (*Capra hircus*) meat myoglobins. *Proteome Science* 14(18): 1-16
9. Rayala Reddy,V., Ravinder Reddy, V., Panda, A.K., Chinni Preetam, V. and Baswa Reddy, P. (2016) Influence of dietary supplementation of synbiotics as an alternative to antibiotic growth promoters on performance, ultrastructure and histomorphology of gut integrity in broilers. *International Journal of Livestock Research* 6(11) 37-45.
10. Vaithiyanathan, S. and Kulkarni, V.V. (2016). Species identification of cattle and buffalo fat through PCR assay. *Journal of Food Science and Technology* 53:2077–2082

11. Varalakshmi, K. (2016). Role of conventional energy in rural development in India: feasibility analysis of solar drying technology. *International Journal Energy Environmental Engineering 7:321–327*

12. Vishnuraj, M.R., Kandeepan, G., Vivek Shukla, Sanjay Kumar, Arvind, S., Singh, B.P., Bhattacharya, D. and Sharma, H. (2016). Development and evaluation of an enzyme based time temperature integrator (TTI) for monitoring meat quality. *Journal of Meat Science* (Accepted)

7.2 Review/ Technical / Popular articles

1. Vishnuraj, M.R., Kandeepan, G., Rao, K.H., Chand, S. and Kumbar, V. (2016). Occuv rrence, public health hazards and detection methods of antibiotic residues in foods of animal origin: A comprehensive review. *Cogent Food and Agriculture* 2: 1235458. http://dx.doi.org/10.1080/23311932.2016.1235458

7.3. Presentation in Conference/Symposia/Seminar

a. Lead papers/Invited lectures

1. Banerjee, R., Naveena, B.M., Mallick, S. and Muthukumar, M. (2017). Polycyclic aromatic hydrocarbons in meat and meat products. ICAR-Sponsored training on Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants, January 3-12, 2017, NRC on Meat, Hyderabad.
2. Kalpana, S. (2016). New insights and multidisciplinary approaches in toxicological studies. 36th Annual conference of society of toxicology (STOX), August 3-5, 2016. Amity University, Noida.
3. Kandeepan, G. (2016). Meat processing, value addition, quality control and market specifications. Training on Entrepreneurship development through value addition of livestock products for middle level veterinary officers of southern states, 13-17, June, 2016, MANAGE, Hyderabad.
4. Kandeepan, G., Bhattacharya, D., Sharma, H. and Rajan, V.M. (2016). Development of chromogenic film as smart packaging indicator for monitoring quality of refrigerated chicken meat product. International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII), 10-12 November, 2016, College of Veterinary Science, Ludhiana, Punjab.
5. Kandeepan, G., Kumar, S., Rajan, V.M., Shukla, V. and Singh, B.P. (2016). Development and evaluation of smart packaging indicator for monitoring quality and shelf-life of meat subjected to temperature fluctuations during frozen storage. International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII), 10-12 November, 2016, College of Veterinary Science, Ludhiana, Punjab.
6. Kiran, M. and Naveena, B.M. (2017). Application of proteomic technologies in meat quality and safety studies. ICAR-Sponsored training on Techniques for assessment of quality and safety of meat products

through species identification and detection of chemical residues and microbial contaminants, January 3-12, 2017, NRC on Meat, Hyderabad.

7. Kulkarni, V.V. and Banerjee, R. (2016). Future road map for meat processing sector in India. ICAR sponsored Winter School on "Advances in value addition and quality evaluation of meat and poultry products, 20 September -10 October, 2016, IVRI, Izatnagar.
8. Kulkarni, V.V. and Banerjee, R. (2017). Opportunities, challenges and future prospects in small ruminant meat sector. National Seminar on Improvement of Small Ruminant Production System for Livelihood Security, 9-10 March, 2017, ICAR-CSWRI, Avikanagar.
9. Kulkarni, V.V. and Muthukumar,M. (2016). A perspective view on issues in safety of meat foods. ICAR-Sponsored training on Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants, January 3-12, 2017, NRC on Meat, Hyderabad.
10. Kulkarni, V.V. and Muthukumar, M. (2016). Indian meat industry: Current status, challenges and future prospects. International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII), 10-12 November, 2016, College of Veterinary Science, Ludhiana, Punjab.
11. Mallick, Smrutirekha and Banerjee, Rituparna (2017). Impact of pre-slaughter care on meat quality ad safety. ICAR-Sponsored training on Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants, January 3-12, 2017, NRC on Meat, Hyderabad.
12. Muthukumar, M. (2016). Chemical residues in pork and their detection. DoE, GoI sponsored model training programme on "Value addition and postharvest management of pork for ensuring hygienic pork production, 1-8 November, 2016, National Research Centre on Pig, Guwahati.
13. Muthukumar, M. (2016). Popularization of value addition of meat and meat products: NRCM experience and initiatives. International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII), 10-12 November, 2016, College of Veterinary Science, Ludhiana, Punjab.
14. Muthukumar, M. (2016). Scope of entrepreneurship in meat sector. Entrepreneurship development and business incubation, 24-28 October, 2016, NAARM, Hyderabad.
15. Muthukumar, M. (2016). Scope of meat processing. MEAT-BIZ INDIA 2016 Conference on "Emerging Trends and Business Opportunities for Meat and Poultry Processing Industries, 23 September 2016, Vijayawada.
16. Muthukumar, M. (2016). Statewise yield and value of carcass and byproducts of broiler chicken. IPSACON 2016, 3-5 November, 2016, College of Veterinary Science, Guwahati.

17. Muthukumar, M. (2016). Statewise yield and value of carcass and byproducts of buffalo. International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII), 10-12 November, 2016, College of Veterinary Science, Ludhiana.

18. Muthukumar, M. (2017). Methods for detection of pesticide residues with special emphasis on chromatography. ICAR-Sponsored training on Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants, January 3-12, 2017, NRC on Meat, Hyderabad.

19. Muthukumar, M. (2017). Opportunities in meat processing sector. First National Agripreneurs Convention-2017, 7 - 9 March, 2017, HMDA Ground, Hyderabad.

20. Muthukumar, M. (2017). Processing of animal foods for estimation of pesticide residues and Gas chromatographic analysis. ICAR-Sponsored training on Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants, January 3-12, 2017, NRC on Meat, Hyderabad.

21. Naveena, B.M. (2016). Entrepreneurship opportunities in livestock products processing. Entrepreneurship development through value addition in livestock products, August 22-25, 2016, Telangana State Management Institute of Livestock Development, Hyderabad.

22. Naveena, B.M. (2016). Success stories of development of entrepreneurship in livestock products processing. Entrepreneurship development through value addition in livestock products, June 13-17, 2016, MANAGE, Hyderabad.

23. Naveena, B.M. and Deepak, S.J. (2017). Proteomic tools for meat species identification. ICAR-Sponsored training on Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants, January 3-12, 2017, NRC on Meat, Hyderabad.

24. Reddy, P.B. (2016). Alteration of fatty acid profile of meat through nutritional manipulation in sheep. International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII), 10-12 November, 2016, College of Veterinary Science, Ludhiana.

25. Reddy, P.B. (2017). Organic Livestock production. ICAR-Sponsored training on Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants, January 3-12, 2017, NRC on Meat, Hyderabad.

26. Reddy, P.B. (2017). Organic Livestock production. Skill development programme organized by KVK-CRIDA, Hyderabad.

27. Reddy, P.B. and Kaje, V. (2017). Atomic absorption spectroscopy for analysis of trace metal contents in meat. ICAR-Sponsored training on Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants, January 3-12, 2017, NRC on Meat, Hyderabad.

28. Suresh, D. (2016). Food borne bacterial inactivation using ozone (O_3): Kinetics of bacterial death. Annual conference of IAVPH, 21-22 November, Udaipur.

29. Vishnuraj, M.R. (2016). The science of freezing meat. MEATBIZ INDIA 2016 Conference on emerging trends and business opportunities for meat and poultry processing industries, 23 September, 2016, Vijayawada.

30. Vishnuraj, M.R., Kandeepan G., Bindhu J., Panda S.K. and Kulkarni V.V. (2016). Effect of gas mixture composition on quality and shelf life of reduced oxygen packed chicken meat mince. International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII), 10-12 November, 2016, College of Veterinary Science, Ludhiana, Punjab.

b. Abstracts

1. Banerjee, R., Naveena, B.M., Muthukumar, M. and Kulkarni, V.V. (2016). Influence of cooking methods on quality characteristics, microstructure and storage stability of chicken sheek kebab under refrigeration (4+1^{0}C). In: Souvenir of International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII) held at College of Veterinary Science, Ludhiana during 10-12 November, 2016. Abstract No. APPLP 12. Page No. 135.

2. Muthukumar, M., Kandeepan, G., Pathak, V., Rathod K.S., Ambadkar, R.K. and Kulkarni, V.V. (2016). Statewise yield and value of carcass and byproducts of buffalo. In: Souvenir of International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII) held at College of Veterinary Science, Ludhiana, Punjab during 10-12 November, 2016. Page No.191.

3. Muthukumar, M., Baswa Reddy, P., Kanchana Komi and Kulkarni, V.V. (2016). Quality attributes and fatty acid profile of chicken nuggets incorporated with flax seed oil and natural antioxidants. In: Souvenir of International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII) held at College of Veterinary Science, Ludhiana, Punjab during 10-12 November, 2016. Abstract No. MPVA 7. Page No. 89.

4. Muthukumar, M., Kandeepan, G., Vikas Pathak, Rathod, K.S., Ambadkar, R.K. and Kulkarni V.V. (2016). Statewise yield and value of carcass and byproducts of buffalo. In: Souvenir of International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII) held at College of Veterinary Science, Ludhiana, Punjab during 10-12 November, 2016. Abstract No. IAPEP 2. Page No. 191.

5. Muthukumar, M., Kandeepan, G., Vikas Pathak, Rathod, K.S., Thomas R. and Kulkarni,V.V. (2016).Statewise yield and value of carcass and byproducts of broiler chicken. In: Souvenir of IPSACON 2016 held at College of Veterinary Science, Guwahati, Assam during 3-5 November, 2016. Page No. 267.

6. Naveena, B.M., Suresh, K.D., Rituparna, B., Muthukumar, M. and Kulkarni, V.V. (2016). Purification and characterization of antioxidant peptides from buffalo liver. In: Souvenir of International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII) held during 10-12 November at GADVASU, Ludhiana.

7. Nischella, S., Vaithiyanathan, S., Ashok, V. and Kalyani, P. (2016). Detection of mutton and chevon by PCR assay using Cyt B gene primers. In: Souvenir of International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII) held during 10-12 November at GADVASU, Ludhiana. pp 311.

8. Reddy, P.B., Muthukumar, M., Ramana, D.B.V., Naveena, B.M. and Venugopal, G. (2016). Alteration of fatty acid profile of meat through nutritional manipulation in sheep. In: Souvenir of International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII) held at College of Veterinary Science, Ludhiana, Punjab during 10-12 November, 2016.

9. Sen, A.R., Muthukumar, M. and Naveena, B.M. (2016). Quality characteristics and storage stability of restructured chicken slices added with plant juices. In: Proceedings National Conference on Innovative Food Processing Technologies for food and nutritional security held during 29-30 September, 2016 at CIPHET, Ludhiana.

10. Vishnuraj, M.R., Kandeepan, G., Bindu, J., Panda, S.K. and Kulkarni, V.V. (2016). Effect of gas mixture compositions on quality and shelf life of reduced oxygen packed chicken meat mince. In: Souvenir of International symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII) held at College of Veterinary Science, Ludhiana during 10-12 November, 2016.

7.4. Training manuals

1. Barbuddhe, S.B., Vinay Kumar, Lata Jain, Rawool, D.B., Kurkure, N.V., Satyajit Kale, Chatlod, L.R. (2016). Methods for detection of foodborne pathogens from food and clinical samples with special reference to *Listeria monocytogenes*.

2. Muthukumar, M., Vaithiyanathan, S., Naveena, B.M., Chatlod, L.R., Ramesh, M. and Kulkarni, V.V. (2017). Techniques of assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants. ICAR-NRC-Meat, Hyderabad.

3. Naveena, B.M., Muthukumar, M., Banerjee, R. and Suresh, K.D. (2016). Development of value added meat products. ICAR-NRC on Meat, Hyderabad.
4. Vishnuraj, M.R., Suresh Devatkal, Mallick, S. and Ramakrishna (2017). Hygienic slaughter practices and fabrication of sheep and goat carcasses. ICAR-NRC-Meat, Hyderabad.

7.5. Folders/Brochure

1. Banerjee, R., Muthukumar, M. and Mallick, S. (2017). Handling of meat for quality and safety
2. Mallick, S., Banerjee, R. and Muthukumar, M. (2017). Preslaughter welfare of meat animals.
3. Muthukumar. M. (2017). NRC on Meat- Agribusiness incubator.
4. Reddy, P.B. (2017). Adhunika Paddatulalo Jeevala Pempakam. National Livestock Mission (NLM) Project.
5. Reddy, P.B. (2017). Kothaga sandhra paddatilo gorrelu mekalu penche vaiki suchanalu'. National Livestock Mission (NLM) Project.
6. Suresh K. Devatkal (2017). Technology for shelf-stable pet foods using meat by-products and vegetables. NRC-Meat, Hyderabad.

7.6. Book Chapters

1. Kandeepan, G. (2016). Innovations in decontamination of carcasses. In: *Sheep and goat meat production and processing*. Shinde A.K., Gadekar, Y.P., Naqvi, S.M.K. and Sahoo A. (Eds.). Satish Serial Publishing House, Delhi, pp.322-338.
2. Malik, J.K., Kalpana, S. and Gupta, R.C. (2017). Chlorinated hydrocarbons and pyrethrins/pyrethroids. In: Reproductive and Developmental Toxicology. Academic Press/Elsevier, Amsterdam, pp.633-655.

8

PARTICIPATION IN TRAINING/ SEMINAR/CONFERENCE/ SYMPOSIA/WORKSHOP

8. PARTICIPATION IN TRAINING/SEMINAR/CONFERENCE/ SYMPOSIA/WORKSHOP

1. Dr.V.V.Kulkarni attended 23rd Managing Committee meeting at NMPPB on 29-04-2016 (FN) at Delhi.
2. Dr. M.R. Vishnuraj completed one month institute orientation training at ICAR-NRC on Meat as a part of FOCARS-103 from 11 April to 12th May, 2016.
3. Dr. P. Baswa Reddy participated in the expert committee meeting of APEDA on organic livestock production at the office of the Animal Husbandry Commissioner, Govt. of India, New Delhi on 05 May, 2016.
4. Dr. M.R. Vishnuraj completed 3 months Professional Attachment Training at ICAR-Central Institute of Fisheries Technology, Cochin from 12 May to 12 August, 2016.
5. Dr.V.V.Kulkarni attended the 1st meeting of the Technical Committee constituted for testing of tallow on 13-06-2016 at Directorate of Animal Husbandry, Punjab, Chandigarh.
6. Dr. Suresh K. Devatkal and Dr. G. Kandeepan attended training program on "Application of solar energy in food sector" at Society for Energy, Environment and Development (SEED), Hyderabad during 21-24, June, 2016.
7. Dr. G. Kandeepan attended contemporary academic meet-VICAM 2016 organized by CARD of Venus International Foundation on 9th July 2016 at Chennai.
8. Dr.V.V.Kulkarni attended a Round Table meeting on Public Private Partnership on Small Ruminant Value Chain Development at IFAD, New Delhi on 11-07-2016 and one day workshop on "Scientific Cooperation Framework for Food Safety" at FSSAI, New Delhi on 12-07-2016.
9. Dr. S. Vaithiyanathan and Dr. M. Muthukumar attend the certificate course on "Advances in food safety analytics" organized by CII, AOAC International (Indian section) at Vimta Labs, Hyderabad during 14-15 July, 2016.
10. Dr.V.V.Kulkarni attended the 68th Executive Committee meeting of MAFSU, Nagpur on 19-07-2016 at MAFSU, Nagpur.
11. Dr.V.V.Kulkarni attended the 23rd meeting of the Scientific Committee meeting of the Food Authority on 04-08-2016 at FSSAI, New Delhi.
12. Dr.V.V.Kulkarni and Dr. B.M. Naveena attended scientific panel committee meeting of FSSAI, Govt. India on 12th August and 23 December, 2016.
13. Dr. B.M. Naveena participated and made oral presentation at *"62nd International Congress of Meat Science and Technology (ICoMST)"* held at Bangkok, Thailand during 14-19 August, 2016.

14. Dr. L. R. Chatlod attended one day Hindi Workshop on 22nd August, 2016 at NIRD, Rajendranagar, Hyderabad.
15. Dr.V.V.Kulkarni attended the National Seminar on "Technology up-gradation and modernization of Food Processing Industries – Challenges & Opportunities" organized by All India Food Processors' Association on 16th September, 2016 at Chennai.
16. Dr.V.V.Kulkarni attended and delivered a key note address at the inaugural session in FOODBIZ India, 2016 at Vijayawada (AP) on 22-09-2016.
17. Dr. M. Muthukumar and Dr. M.R. Vishnuraj attended MEAT-BIZ INDIA 2016 Conference on "Emerging Trends & Business Opportunities for Meat and Poultry Processing Industries" organized by CII-APTDC on 23 September 2016 at Vijayawada.
18. Dr. G. Kandeepan and Dr. M.R. Vishnuraj participated in workshop on "Methods for detection of bacterial food borne pathogens with special reference to *Listeria monocytogenes*" organized during 5-6 October, 2016 by ICAR-NIBSM, Raipur in collaboration with ICAR-NRCM, Hyderabad.
19. Dr. M. Muthukumar attended XXXIII Annual Conference of Indian Poultry Science Association (IPSACON 2016) on "Rural poultry for Livelihood, economic and nutritional security" held at College of Veterinary Science, Guwahati, Assam during 3-5 November, 2016.
20. Dr. V.V. Kulkarni, Dr. B.M. Naveena, Dr. M. Muthukumar, Dr. P. Baswa Reddy, Dr. G. Kandeepan, Dr. Rituparna Banerjee and Dr. M. R. Vishnuraj participated 7th.Conference of Indian Meat Science Association (IMSACON-VII) during 10-12 November, 2016 at GADVASU, Ludhiana.
21. Dr. M.R. Vishnuraj participated in Regional Agricultural Fare: Krishi Kumbh, organized at Muzzzafirnagar, Uttar Pradesh during 28-30 November, 2016.
22. Dr. L. R. Chatlod attended FMD Free Zone workshop at Directorate of Animal Husbandry, Govt. of Telangana, Hyderabad on 28 November, 2016.
23. Dr.V.V.Kulkarni attended the `Pig Expo' at ICAR – NRC on Pig, Guwahati (Assam) on November 28-29, 2016.
24. Dr. Rituparna Banerjee and M.R. Vishnuraj attended brainstorming session on "Restructuring of FOCARS" organized by ICAR- NAARM on 3rd December 2016.
25. Dr.V.V.Kulkarni attended the 4th meeting of the Scientific Panel on "Meat and Meat Products including Poultry" on 23-12-2016 at FSSAI, New Delhi.

26. Dr. M. Muthukumar attended "Agri-Tech Commercialization platform" organized by Technology Development Board, Dept. of Science and Technology, GoI at NASC Complex, Pusa, New Delhi during 18-20 January, 2017.
27. Dr. Smrutirekha Mallick attended ICAR sponsored short course training entitled "Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants" from 03-12 January, 2017 at ICAR-NRC on meat.
28. Dr. B.M. Naveena attended meeting on "Development of content for the basic module of certified farm advisor" held at MANAGE on 9 February, 2017
29. Dr. L. R. Chatlod attended 3 days training program on "Competency Enhancement program for effective implementation of training functions by HRD Nodal Officers of ICAR" from 13-15th February, 2017 at NAARM, Hyderabad.
30. Dr. G. Kandeepan attended National conference on Innovation in packaging organized by Indian Institute of Packaging, Hyderabad during 23-24 March, 2017.
31. Dr. P. Baswa Reddy attended expert committee meeting of APEDA for looking into the anomaly and critical issues hampering the implementation of organic livestock standards and also suggesting the way forward for allowing livestock certification under grower groups at APEDA Bhawan, New Delhi on 24th March 2017.

Training Programmes Attended By Administrative Staff

Sl. No.	Name of the Officer/staff	Title of the Training	Period /place
1.	Sri. T. Devender, Assistant and Sri.B.P.R.Vittal, PS to Director	Training programme on e-procurement	NAARM, Hyderabad during 25/04/2016 to 26/04/2016.
2.	Sri.B.P.R.Vittal, PS to Director	45th MDP on Public procurement	NIFM, Faridabad during 02/05/2016 to 07/05/2016.
3.	Sri.M.N.V.Rao, AFAO	Public procurement	NIFM, Faridabad during 23/05/2016 to 28/05/2016
4.	Smt.V.Kalpana, UDC	Training on "Sexual harassment of women at work place"	ISTM, New Delhi during 18/08/2016 to 19/08/2016
5.	Sri.T.Devender, Assistant	Training on Government e-market place-Procurement made easy	Directorate of quality assurance on 22/02/2017.

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AWARDS AND RECOGNITIONS

9. AWARDS AND RECOGNITIONS

- Dr. V. V. Kulkarni, Director, and Dr. M. Muthukumar, Senior Scientist, ICAR-NRC on Meat have been awarded with IMSA Fellowship during International Symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII) held during 10-12th November, 2016 at Ludhiana.

Dr. V.V. Kulkarni and Dr. Muthukumar receiving IMSA Fellowship during IMSACON-VII

- Research paper presented by Dr. M. Muthukumar received First prize in oral presentation during XXXIII Annual Conference of Indian Poultry Science Association (IPSACON) held during 3-5th November, 2016 organized by AAU, Guwahati.
- Research paper presented by Dr. Kandeepan received First prize in oral presentation during International Symposium and 7th Conference of Indian Meat Science Association (IMSACON-VII) held on 10-12th November, 2016 organized by Dept. of LPT, GADVASU, Ludhiana.
- Research paper by Naveena et al. received Best Paper (Second Prize) award at International Symposium & 7th Conference of Indian Meat Science Association held at GADVASU, Ludhiana from November 10-12, 2017.
- Research paper by Muthukumar. M. et al. received Best Paper (Second Prize) award at International Symposium & 7th Conference of Indian Meat Science Association held at GADUVAS, Ludhiana from November 10-12, 2017.
- Research paper by Baswa Reddy et al. received Best Paper (Third Prize) award at International Symposium & 7th Conference of Indian Meat Science Association held at GADUVAS, Ludhiana from November 10-12, 2017.
- Dr. G. Kandeepan received outstanding faculty (Livestock Products Technology) award from Venus International Foundation, Chennai.
- Dr.V.V.Kulkarni, Dr. M. Muthukumar and Dr. Rituparna Banerjee were elected as President, Secretary and Treasurer, respectively for Indian Meat Science Association and Dr. B. M. Naveena was elected as Editor,

Journal of Meat Science at 7th Conference of Indian Meat Science Association (IMSACON VII) during 10-12 November, 2016.

- Dr. B. M. Naveena presented Oral Paper at *"62nd International Congress of Meat Science & Technology"* (ICoMST) held at Bangkok, Thailand from August 14-19, 2016.

Dr. Naveena, B.M., Senior Scientist at 62nd ICoMST, Bangkok, Thailand

- Dr. B. M. Naveena received Travel grant award from Centre for International Cooperation in Science, Chennai for attending 62nd ICoMST, Bangkok, Thailand.
- Dr. M. Muthukumar, Senior Scientist was nominated as one of the expert by Director General, MANAGE for preparing content on "Hygienic slaughter, clean meat production and waste management" for the Certified Farm Adviser programme of MANAGE.
- Dr. Baswa Reddy was nominated as expert member of the committee of APEDA for looking into the anomaly and critical issues hampering the implementation of organic livestock standards and also suggesting the way forward for allowing livestock certification under grower groups.
- Dr. G. Kandeepan received certificate of excellence: Special Mention-Young Scientist from South Asian Education Awards-17, Education Expo TV, Noida.

10

WORKSHOPS/ TRAININGS/AWARENESS PROGRAMMES ORGANIZED

10. WORKSHOPS/TRAININGS/AWARENESS PROGRAMMES ORGANIZED

ICAR sponsored 10 days short course

ICAR sponsored short course on "Techniques for assessment of quality and safety of meat products through species identification and detection of chemical residues and microbial contaminants" was organized at ICAR-National Research Centre on Meat, Hyderabad from 3-12th January, 2017. A total of 12 participants of various SAUs, ICAR Institute from 5 states of the

Participants with the Director and scientific staff of NRC on Meat

country participated in the training programme. During this 10 days program, 22 presentations, 9 practical demonstrations and visits to Directorate of Poultry Research, Rajendranagar, Hyderabad, National Institute of Plant Health and Management, Rajendranagar, Hyderabad and GHMC Modern Slaughterhouse, Chengicherla, Hyderabad were arranged. The program dealt with topics related to DNA and proteomic based methods for meat species and meat borne pathogens identification, protein purification, OFFGEL electrophoresis, liquid chromatography, gas chromatography, atomic absorption spectroscopy, etc. Dr.M.Muthukumar, Senior Scientist was the course director and Dr.S.Vaithiyanathan, Dr.B.M.Naveena and L.R.Chatlod coordinated the training.

Training on tallow species identification

Training on "Tallow species identification" (sponsored by Govt. of Punjab) was organized from 26-30th September, 2016. Dr. Gagandeep Bangar and Dr. Mukesh Mittal from Regional Disease Diagnostic Laboratory, Jalandhar, Punjab participated in this training programme.

Workshop on food-borne pathogens

Two days' workshop on "Methods for isolation of food borne bacterial pathogens from foods and clinical samples with special reference to Listeria monocytogenes" was organised during 5-6th October, 2016 at ICAR-NRCM Hyderabad in collaboration with ICAR-National Institute of Biotic Stress Management, Raipur. Total 17 participants attended the workshop. During these 2 days training program presentations on Food borne pathogens and Listeriosis, introduction to molecular techniques for detection of food borne pathogens, meat borne infections, hazard analysis and critical control points were arranged. Practical demonstrations on instrumentation, preparation of material and samples for isolation of bacterial pathogens, demonstration of methods for bacterial isolation and PCR, demonstration of electrophoresis and gel doc were organised. Dr.L.R.Chatlod, Scientist, NRCM Hyderabad and Dr.S.B.Barbuddhe, Principal Scientist, ICAR-NIBSM, Raipur coordinated the workshop.

Participants with the Director and scientific staff of NRC on Meat

Entrepreneurship training

Four entrepreneurship training program were conducted at ICAR-National Research Centre on Meat, Hyderabad during 7th-10th June, 6th-9th December, 2016, 28thJanuary to 1stFebruary, 27th to 31st March, 2017. Processing of different cured and smoked products, emulsion products, restructured products, enrobed products and ground meat products were demonstrated.

Participants of Entrepreneurship Training Programme

Different packaging and preservation methods, meat handling and cooking techniques were also demonstrated. Necessary information like availability of equipment, their costs, suppliers, ingredients, composition and products formulation was provided to participants to enable them to start their own business. During these training programmes, trainees were actively involved in products making and interacted well with coordinators.

Butchers training programme

Four trainings on 'Clean Meat Production' were conducted at NRC on Meat during 26-27th April, 22-23rd June, 7-8th September, 2016 and 23-27th January, 2017. Total of 58 butchers participated.

Participants during hands on training programme at experimental abattoir, NRC on Meat

Training and Capacity Building in Sheep and Goat Value Chain under National Livestock Mission (NLM)

The following training programmes have been conducted for different categories of participants:

1. A three days training programme for Sheep and goat farmers has been organized from 22nd to 24th February 2017. A total of 45 farmers from different districts of Telangana participated in the programme. One day visit to an organized sheep and goat farm was arranged for 'Field Level Demonstration' (FLD). Farmers were taken to RSK sheep and goat farm at Kotra village, Veldanda Mandal, Nagar Kurnool, Telangana. Practical demonstration of sheep rearing different breeds of Sheep and goats, dipping, silage making, preparation of complete feeds (Total Mixed Ration, TMR) etc., were carried out in the farm.

2. One awareness cum practical demonstration programme has been organized for meat handlers on 4th March 2017. A total of 53 participants from different municipal slaughter houses of Hyderabad, retail meat shops etc. attended the programme.

3. Training programme for field veterinarians was conducted for four days from 7th to 10th March 2017 to refresh their knowledge and introduce the recent concepts in sheep and goat value chain. The support of Animal Husbandry department of Telangana was taken in selection of the participants. A total of 21 participants from different districts of Telangana state participated in the training programme.

4. Second training programme of three days duration for sheep and goat farmers has been organized from 16th to 18th March 2017. A total of 31 farmers from different districts of Telangana participated in the programme.

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MEETINGS/EVENTS ORGANISED

11. MEETINGS/EVENTS ORGANISED

INSTITUTE RESEARCH COUNCIL (IRC) MEETING

The 11th Annual Institute Research Council (IRC) Meeting for the year 2015-16 was held at the committee room of NRC on Meat, Hyderabad on 5th April, 2016. Dr. Kondaiah, Former Director, NRC on Meat, Hyderabad, Dr. S. Barbuddhe, PS, NIBSM, Raipur and Dr. Rajan Gupta, PS, Animal Science Section, ICAR, New Delhi acted as the external expert members. During this meeting, on-going research projects were reviewed and new research projects were sanctioned.

WORLD VETERINARY DAY 2016

World Veterinary Day was celebrated on 30th April, 2016 with a theme of *"Continuing education with a one health focus"*. Dr. S. Krishnamachari, President, Andhra Pradesh Veterinary Council acted as a chief-guest and Dr. N. Kondaiah, Former Director, NRC on Meat, Dr. Suresh, Director Designate, Animal Resource Centre, NIN, Hyderabad, Mr. Manpreet Singh, Secretary, Blue Cross Society, Hyderabad acted as guests of honor. The greater need to address the issues relating to livestock transportation, animal stress, jurisprudence related matters, contribution of veterinarians in sustainable livestock health, vaccination, disease control programme, biomedical research, canine birth control programme, creation of animal disease free cities were discussed. On this occasion a senior veterinarian Dr. Gangakhedekar was felicitated. The event was also attended by Dr. Madan Kumar, Asst. Director, Dept. Animal Husbandry, Telangana, Dr. A.S.R. Anjaneyulu, Former Emeritus Scientist and many other Veterinarians from Centre for DNA Fingerprinting and Diagnostics, VV Med laboratory and other private labs.

Dr. V.V. Kulkarni, Director, NRC on Meat welcoming the guests

AGRI-BUSINESS INCUBATOR (ABI) MEETING

ABI meeting was held at ICAR-NRC on Meat on 3rd May, 2016. Scientific staff of ABI project and experts from ICRISAT and NAARM, Hyderabad attended the meeting.

Agri-business incubator meeting

RESEARCH ADVISORY COMMITTEE (RAC) MEETING

The 10th RAC meeting of NRC on Meat, Hyderabad was held on 3rd June, 2016. The meeting was chaired by Dr. Nagendra Sharma, Former VC, SKUAST, Jammu and other RAC members including, Dr. V.V. Kulkarni, Director, NRC on Meat, Dr. B. S. Prakash, ADG (ANP), Dr. J. K. Malik, Dr. U. K. Pal, Dr.Mineshwar Hazarika, Dr. George T. Oommen, Sri Kuppa Ranganayakulu, Shri Dirsala Rajagopal Reddy. Dr. B. M. Naveena acted as member secretary.

Research Advisory Committee meeting

INDEPENDENCE DAY CELEBRATION

Director, NRC on Meat unfurled the National Flag on 15th August, 2016 in the premises of ICAR-NRC on Meat, Chengicherla. Staff of NRC on Meat and their family members have participated in the celebration.

INAUGURATION OF AGRI-BUSINESS INCUBATOR

Dr. Habibur Rahman, Deputy Director General (Animal Science) and Dr. Joykrushna Jena, Deputy Director General (Fisheries) inaugurated the Agri-Business Incubator facility of ICAR-National Research Centre on Meat, Hyderabad on 31st August, 2016 in presence of all the faculty, entrepreneurs and other meat industry personnel.

Inauguration of ABI by DDG (AS) & DDG (Fisheries)

HINDI DIWAS

Hindi Diwas function was organized at ICAR-NRC on Meat, Hyderabad on 14th September, 2016. On the eve of this occasion, several competitions on Hindi recitation, Hindi song, antakshari, general knowledge, Hindi dictation were organized. Dr. Harvir Singh Nehwal, father of India's ace shuttler Saina Nehwal graced the valedictory session.

Dr. H.S. Nehwal addressing the gathering

VIGILANCE AWARENESS WEEK 2016

Vigilance Awareness Week with the focal theme on *"Public participation in promoting Integrity and eradicating corruption"* was observed during 31st October to 05th November 2016. Lectures and interaction of scientists, administrative staff and contractual staff on various aspects of vigilance were organised.

Observation of vigilance week

INSTITUTE MANAGEMENT COMMITTEE MEETING

Eleventhth Institute Management Committee meeting of NRC on Meat was held on 21st February, 2017. Dr. B.S. Prakash, ADG (AN&P), New Delhi, Dr. Ravishankar, Director, CIFT, Cochin, Dr. Kondal Reddy, Associate Dean & Registrar, TSVU, Rajendranagar, Dr. Ganesh Kumar, NAARM, representatives from A.P, A.H Dept., Farmer representatives participated in the meeting.

INSTITUTE FOUNDATION DAY

National Research Centre on Meat, Hyderabad celebrated its X Foundation day on 22nd February, 2017. The programme was inaugurated by unveiling Mahatma Gandhiji's new bust at the Institute followed by plantation. Dr. Ravindrababu, Director, Indian Institute of Rice Research, Hyderabad acted as a chief guest and Dr. C.K. Thota, Director-International Business, Allanasons Pvt. Ltd., Mumbai, Dr. Nadeem Fairoze, DI (PG), KVAFSU, Bidar, Dr. Sarathbabu, Officer I/c. NBPGR, Hyderabad were guests of honours. On this occasion different publications viz., NRC Meat Newsletter; Meat handling practices; Animal welfare and meat quality and newly developed shelf-stable pet food were released. National Livestock Mission (NLM) sponsored project was launched and a first training on "Sheep value chain" for 35 sheep farmers from different parts of Telangana was also inaugurated.

On the same day, the Centre observed "open day" and good number of students from local schools visited the Institute's facilities viz, experimental abattoir, meat processing plant and poultry farm and interacted with scientists. An interactive meeting was also held with entrepreneurs and Industry personnel wherein representatives from Kancor Ingredients Ltd., Kerala and PrARAS Biosciences Pvt. Ltd., Bangalore along with faculty from different Universities participated.

Release of NRCM newsletter (Meat News)

Students from local schools in Open Day programme

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DISTINGUISHED VISITORS

12. DISTINGUISHED VISITORS

- Sixteen member high level Ethiopian delegation including Mr. Mebrahtu Gebru, State Minister, Minister of Industry; Deputy Director General, Ethiopian Meat and Dairy Industry Development Institute; Vice President, Ethiopian Milk Producers Industry Association, and several other industries visited the Centre on 8th June, 2016.

Interactive meeting with Ethiopian delegates

- Prof. Prem Kumar Uppal, Adviser, Govt. of Punjab, Department of Animal Husbandry and Dairying and Fisheries visited the Centre on 8th July, 2016. He interacted with the Director and all the Scientists of the Centre and visited Meat Products Processing Plant.
- Dr. Habibur Rahman, Deputy Director General (Animal Science) and Dr. Joykrushna Jena, Deputy Director General (Fisheries) visited the Centre on 31st August, 2016.

DDG (AS) and DDG (Fisheries) with staff of NRC on Meat

- Dr. Rameshwar Singh, PD, DKMA visited NRC on Meat on 2nd September, 2016.
- Honourable MLA, Shri M. Sudheer Reddy of Medchal visited NRC on Meat on 29th Oct, 2016.

Students and trainees visit

Animal husbandry officials from AP

Vety. Officials with faculty of MANAGE, Hyderabad

Students from Karnataka Veterinary University

Students from Kerala Veterinary University

Students from Professor Jayashankar Telangana State Agricultural University

Students from CFDT, Chennai

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ITMU & ABI

13. ITMU & ABI

During the year 2016-17, the Institute Technology Management Unit/ ABI has facilitated singing of 2 agreements for providing consultancy for establishment of value added meat products processing unit and rendering plant for utilization of slaughterhouse by-products. Two MoUs were also signed with entrepreneurs for licensing of technologies for retailing of meat and manufacturing value added meat products. A contract research agreement was signed to evaluate carcass traits and meat quality characteristics of Aseel X Brown Layer. During the year 2016-17, 9 training programmes covering clean meat production and development of value added meat products were organized. The technologies developed at this centre were displayed at exhibitions conducted at various parts of the country.

I. Consultancy

S. No.	Name of Firm	Type of Agreement	Date	Revenue (Rs.)
1	M/s Kaavo Meat by Cool chef, Thadani house, Mumbai	Establishment of value added meat products processing unit	19-10-2016	40000
2	M/s Shri Ramalingeshwara Agro Foods Pvt Ltd., Hyderabad	Establishment of rendering plant for utilization of slaughterhouse by-products	19-10-2016	35000
Total				75,000

MoU with M/s Kaavo Meat

MoU with M/s Shri R. Agro Foods Pvt Ltd

II. Licensing of Technologies

S. No.	Name of Firm	Type of Agreement	Date	Revenue (Rs.)
1	M/S Pro Chicken, Hyderabad	Establishment of Retail meat shop	02-07-2016	20,000/-
2	M/S Farm Fresh Pork Products & Farms, Vijayawada, A.P.	Manufacturing of processed meat products	31-08-2016	30,000/-
Total				50,000

MoU with M/s Pro Chicken and M/s Farm Fresh Pork Products & Farms

III. Contract Research Projects

Sr. No.	Name of the Firm	Project title	Date	Revenue (Rs.)
1	Indbro Research & Breeding Farms Pvt. Ltd., Hyderabad	Evaluation of carcass traits and Meat Quality characteristics of Aseel X Brown Layer…	03-01-2017	77,000/-

MoU with Indbro Research & Breeding Farms Pvt. Ltd., Hyderabad

IV. Trainings Organized

Sr. No.	Name of the Training programme	Date	Number of participants	Revenue (Rs.)
1	Clean meat production	26th-27th April, 2016	12	Free
2	Hands on training programme on development of value added meat products	7th-10th June, 2016	06	9000
3	Clean meat production	22th-23th June, 2016	19	Free
4	Clean meat production	7th-8th September, 2016	21	Free
5	Tallow species identification	26th-30th September, 2016	02	20000
6	Hands on training programme on development of value added meat products	6th-9th December, 2016	18	36000
7	Clean meat production	23rd-27th January, 2017	6	12000
8	Hands on training programme on development of value added meat products	28th January to 1st February 2017	10	20000
9	Training on Meat Product Processing	27th to 31st March	11	22000
		Total	261	1,19,000

V. Exhibitions participated

Sr. No.	Name of Programme/ Event	Location	Date of Programme
1	Meat Tech Asia-2016	BIEC, Bangalore	26th to 28th, August, 2016
2	Farmer's Day-2016	Gungal Research Farm, CRIDA, Hyderabad	18th October, 2016
3	India Lab Expo-2016	Hitex City, Hyderabad	20th to 22nd October, 2016
4	Poultry Expo-2016	Hitex City, Hyderabad	23rd to 25th November, 2016
5	Krushi Kumbh-2016	Muzaffarnagar, U.P.	28th to 30th November, 2016
6	First national Agripreneurs Convention-2017	HMDA Ground, Hyderabad	7th to 9th March, 2017

Krishi Kumbh-2016

India Lab Expo-2016

Meat Tech Asia-2016

Poultry Expo-2016

VI. Intellectual Property Rights

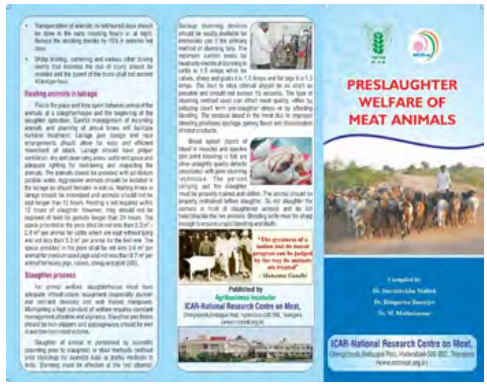
- Design application: Burger patty mould (Application No. 290498)
- Process patent: Process for preparation of succulent seekh-kebab with uniform size and smooth exterior employing sausage stuffer

Revenue Generation (2016-17)

Sr. No.	Type of service	Revenue (Rs.)
1.	Licensing Technical Knowhow	50,000
2.	Consultancy	75,000
3.	Contract Research	77,000
4.	Trainings	1,19,000
5.	Analytical services	2,92,400
6.	Sale of meat products	2,92,212
Total		9,05,612

ABI Promotional Brochure

Brochures published under ABI



14. NEW ENTRANTS/RETIREMENTS/ TRANSFER/PROMOTION

1. Dr. G. Venugopal retired from ICAR-NRC on Meat on 28th February, 2017.
2. Dr.Y.Babji, Principal Scientist was transferred to CSWRI, Avikanagar, Rajasthan on 2nd August, 2016.
3. Sh. Nitin Kant Suraj, Assistant was transferred to IARI, New Delhi on 26th April, 2016.
4. Sh.Pushpesh Khulbe, T-1 was transferred to IVRI, Mukhteswar, Nainithal on 25th August, 2016

15. PERSONNEL

Scientific, technical and administrative staff

1	DR. V.V. Kulkarni	Director
Scientific		
2	Dr.G.Venugopal	Principal Scientist (upto 28.02.2017)
3	Dr.S.Vaithiyanathan	Principal Scientist
4	Dr.Y.Babji	Principal Scientist (upto 02.08.2016)
5	Dr.C.Ramakrishna	Senior Scientist
6	Dr. Suresh Kumar Devatkal	Senior Scientist
7	Dr.B.M.Naveena	Senior Scientist
8	Dr.M.Muthukumar	Senior Scientist
9	Dr.P.Baswa Reddy	Senior Scientist
10	Dr.G.Kandeepan	Scientist
11	Dr.S.Kalpana	Scientist
12	Dr.L.R.Chatlod	Scientist
13	Smt. K.Varalakshmi	Scientist
14	Dr. Rituparna Banerjee	Scientist
15	Dr. Smrutirekha Mallick	Scientist
16	Dr. Vishnuraj M. R.	Scientst (from 11.04.2016)
Technical		
1	Smt. Kanchana Kommi	Technical Assistant
2	Shri. P.Phanikumar	Technical Assistant
3	Shri. B.V.D. Srinivasa Rao	Senior Technician
4	Er. Pushpesh Khulbe	Technician (upto 25.08.2016)
5	Shri. M.Srinivas	Technician
Administrative		
1	Shri Chandrashekhar	Asst. Administrative Officer
2	Shri. M.N.V. Rao	Asst. Finance & Accounts Officer
3	Shri. B.P.R.Vithal	Personal Secretary
4	Smt. C.Padmaja	Personal Assistant
5	Shri Nitin Kant Suraj	Assistant(upto 26.04.2016)
6	Shri T.Devender	Assistant
7	Shri S.Rukman	Junior Accounts Officer
8	Smt. V.Kalpana	UDC

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COMMITTEES

16. COMMITTEES

Quinquennial Review Team (QRT)

1. Dr.J. Abraham, Former Director, Centre of Excellence on Meat Science and Technology, C.V.Sc., Thirussur, Kerala - Chairman
2. Dr.V.Kesava Rao, Professor and Head (Retd), Department of Livestock Products Technology, RG College of Veterinary Science, Puducherry - Member
3. Dr.K.N. Selvakumar, Dean, Veterinary College and Research Institute, Orathanadu, Thanjavur, Tamil Nadu- Member
4. Dr.K.C.Varshney, Head, Department of Veterinary Pathology, RG College of Veterinary Science, Puducherry- Member
5. Dr.Chetan Kumar Thota, Director, International Business Allanasons Ltd, Secunderabad - Member
6. Dr. Manish Kumar Chatli, Head, Division of LPT, GADVASU, Ludhiana- Member
7. Dr. S. Vaithiyanathan, Principal Scientist, NRC on Meat, Hyderabad - Member Secretary.

Institute Management Committee (IMC)

1. Dr. V.V. Kulkarni, Director, National Research Centre on Meat, Hyderabad-Chairman
2. Dr. D.Venkateswarlu, Animal Husbandry Department, Govt. of Telengana State - Member
3. Dr.K.Kondal Reddy, Associate Dean, Sri P.V. Narsimha Rao Telengana State University for Veterinary Animal Fishery Sciences, Rajendranagar, Hyderabad – Member
4. Shri Kuppa Ranganayakulu (Ranga Sai), Aakaveedu Village, Racharla Mandal, Goddalur Constitutency, Prakasam District – Member
5. Dr. S.V.Rama Rao, Principal Scientist, ICAR – Directorate of Poultry Research, Rajendranagar, - Member
6. Dr.Subeer S. Majumdar, Director, National Institute of Animal Biotechnology (NIAB), Miyapur, Hyderabad - Member
7. Dr.Ganesh Kumar, Principal Scientist, ICAR – NAARM, Rajendra Nagar, Hyderabad – Member
8. Dr.Ravishankar C.N., Director, ICAR – CIFT, Cochin - Member
9. Dr. B.S. Prakash, Asst. Director General (AN & P), Indian Council of Agricultural Research, Krishi Bhavan, New Delhi - Member
10. Shri S.George, Chief Finance & Accounts Officer, ICAR – NAARM, Rajendra Nagar,Hyderabad
11. Sh.B.P.R.Vithal, I/c. Assistant Administrative Officer & Member Secretary, National Research Centre on Meat, Chengicherla, P.B.No.19, Boduppal Post, Hyderabad - Member

Research Advisory Committee

1. Dr.Nagendra Sharma, Former Vice Chancellor, SKAUST, Jammu - Chairman
2. Dr.J.K.Malik, Former Joint Director, IVRI,Izatnagar- Member
3. Dr.U.K.Pal, Professor & Head, Division of LPT, Rajiv Gandhi Institute of Veterinary Education & Research, Kurumbapet, Puducherry- Member
4. Dr.Mineswar Hazarika, Professor & Head, Division of LPT, Faculty of Veterinary Science, AAU, Khanapara Campus, Guwahati - Member
5. Dr. George T. Oommen, Former Professor & Head, Division of LPT, College of Veterinary & Animal Sciences, Pookot - Member
6. Dr.V.V.Kulkarni, Director, NRC on Meat, Hyderabad - Member
7. Dr. B.S. Prakash, Asst. Director General (AN&P), Indian Council of Agricultural Research, Krishi Bhavan, New Delhi - Member
8. Shri Kuppa Ranganayakulu (Ranga Sai) Aakaveedu Village, Racharla Mandal, Goddalur Constitutency, Prakasam District - Member
9. Shri Dirisala Rajgopala Reddy, Chandrapadu Village, Chimakurthy Mandal, Prakasam District, Andhra Pradesh - Member
10. Dr. B. M. Naveena, Senior Scientist, NRC on Meat, Hyderabad - Member Secretary

Institute Animal Ethics Committee

1. Dr. V.V.Kulkarni, Director, ICAR –NRC on Meat, Hyderabad – Chairman
2. Dr. B.Dinesh Kumar, Assistant Director, Food and Drug Toxicology Research Centre, National Institute of Nutrition, Hyderabad - Main Nominee
3. Dr. P.Uday Kumar, Deputy Director, National Institute of Nutrition, Hyderabad - Scientist from outside the Institute
4. Dr. Ramakrishna Sistla, Scientist, Pharmacology Division, Indian Institute of Chemical Technology, Hyderabad - Link Nominee
5. Shri G Manjunath, International Animal and Birds Welfare Society, Gudur, Ananthapur Dist. Andhra Pradesh- Socially aware Nominee
6. Dr. C.Ramakrishna, Senior Scientist, ICAR–NRC on Meat, Hyderabad - Veterinarian
7. Dr.L.R.Chatlod, Scientist, ICAR–NRC on Meat, Hyderabad - Scientist from different discipline
8. Dr. M.Muthukumar, Senior Scientist, ICAR–NRC on Meat, Hyderabad - Scientist from different discipline
9. Dr. P. Baswa Reddy - Scientist In-Charge cum Member Secretary, Senior Scientist, ICAR –NRC on Meat, Hyderabad.

17. STUDENTS' CORNER

Sr. No.	Name of the student	Research project topic	Member of advisory committee
1.	Dr.S. Nischala Department of Veterinary biochemistry, College of Veterinary Science, Rajendranagar, Hyderabad	Detection of mutton and chevon by PCR assay using CYT B gene primers	Dr. S. Vaithiyanathan, Principal Scientist
2.	Ms.L.Safiya Farheen B. Tech (Food Technology), College of Food and Dairy Technology, Koduvalli, Chennai	Quality evaluation of retort processed pet food and other meat products	Dr. Suresh K. Devatkal, Senior Scientist
3.	Ms. J.Jayalakshmi B. Tech (Food Technology), College of Food and Dairy Technology, Koduvalli, Chennai	Quality attributes of Kebab made with mechanically deboned meat	Dr. M. Muthukumar, Senior Scientist
4.	Dr. M. Shylaja Department of VPH, Veterinary College, Hyderabad	Studies on the incidence of *Staphylococcus aureus* and its toxins in livestock products	Dr. L.R.Chatlod Scientist
5.	Dr. Sriyapureddy Prasanti Department of VPH, Veterinary College, Hyderabad	Surveillance of quality and adulteration of milk sold in and around Hyderabad and its public health significance	Dr.L.R.Chatlod Scientist
6.	Dr. Mella Swapna Department of VPH, Veterinary College, Hyderabad	Isolation, identification and differentiation of common *Vibrio* species in sea food samples	Dr.L.R.Chatlod Scientist

18

RESEARCH FRAMEWORK DOCUMENT (RFD)

Performance Evaluation Report in respect of RFD 2015-16 of RSCs i.e. Institutes

Name of the Division: Animal Science

Name of the Institution: ICAR-National Research Centre on Meat, Chengicherla, Hyderabad

RFD Nodal Officer: Dr.L.R.Chatlod, Scientist

S. No	Object-ives	Weight	Actions	Success Indicators	Unit	Weight	Target / Criteria Value					Achieve-ments	Performance		Percent achievements against Tar-get values of 90% Col.*	Reasons for shortfalls or excessive achieve-ments, if ap-plicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw score	Weighted score		
1	Improve-ment of quality and safety of muscle foods and develop-ment of value added meat prod-ucts	55	Quality improvement of fresh and processed meat	Technologies for improving the meat and meat products quality and shelf life	Number	20	3	2	1	-	-	3	100	20	150	The targets were achieved as per the timeline of the research projects
			Development/ refinement/ modification of further processed and value added products of animal origin	Development/ refinement/ modification of processed and value added prod-ucts	Number	20	3	2	1	-	-	3	100	20	150	
			Ensuring safety of muscle foods	Establishment of baseline data for chemical residues, adulterants and microbial contaminants & developing technologies for detection of adultera-tion in meat/ fat	Number	15	3	2	1	-	-	4	100	15	200	

S. No	Objectives	Weight	Actions	Success Indicators	Unit	Weight	Target / Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.*	Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw score	Weighted score		
2	Capacity building and technology dissemination	23	Organizing training to entrepreneurs and other stakeholders and transfer & dissemination of technologies	Human resource development (conducting trainings and awareness programmes for stakeholders)	Number	15	10	9	8	6	5	27	100	15	300	Overwhelming demand from stakeholders' for conduct of training and technology transfer
				Transfer of technology (MoU and consultancy)	Number	5	5	4	3	2	1	8	100	5	200	
				Publications related to capacity building	Number	3	6	5	4	3	2	13	100	3	260	
3	Publication/ Documentation	5	Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Research articles published	Number	5	7	6	5	4	3	8	100	5	133	
			Timely publication of the Institute Annual Report (2014-2015)	Annual Report published	Date	2	30.06. 2015	02.07. 2015	04.07. 2015	07.07. 2015	09.07. 2015	30-5-2015	100	2	-	-

S. No	Objectives	Weight	Actions	Success Indicators	Unit	Weight	Target / Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.*	Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw score	Weighted score		
4	Fiscal resource management	2	Utilization of released plan fund	Plan fund utilized	%	2	98	96	94	92	90	98	100	2	-	
	Efficient Functioning of the RFD System	3	Timely submission of Draft RFD for 2015-2016 for Approval	On-time submission	Date	2	May 15, 2015	May 16, 2015	May 19, 2015	May 20, 2015	May 21, 2015	May 13, 2015	100	2	-	-
			Timely submission of Results for 2013-2014	On-time submission	Date	1	May 1 2015	May 2 2015	May 5 2015	May 6 2015	May 7 2015	April 23, 2015	100	1	-	-
5	Enhanced Transparency / Improved Service delivery of Ministry/ Department	3	Rating from Independent Audit of implementation of Citizens' / Clients' Charter (CCC)	Degree of implementation of commitments in CCC	%	2	100	95	90	85	80	100	100	2	-	-
			Independent Audit of implementation of Grievance Redress Management (GRM) system	Degree of success in implementing GRM	%	1	100	95	90	85	80	100	100	1	-	-

S. No	Objectives	Weight	Actions	Success Indicators	Unit	Weight	Target / Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.*	Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw score	Weighted score		
6	Administrative Reforms	7	Update organizational strategy to align with revised priorities	Date	Date	2	Nov.1 2014	Nov.2 2014	Nov.3 2014	Nov.4 2014	Nov.5 2014	Oct 31, 2014	100	2	-	-
			Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC).	% of Implementation	%	1	100	90	80	70	60	100	100	1	-	-
			Implementation of agreed milestones for ISO 9001	% of implementation	%	2	100	95	90	85	80	100	100	2	-	-
			Implementation of milestones of approved Innovation Action Plans (IAPs).	% of implementation	%	2	100	90	80	70	60	100	100	2	-	-

Rating: Excellent

Total Composite Score: 100

Weighted Score of a Success Indicator = Weight of the corresponding Success Indicator x Raw Score / 100

Total Composite Score = Sum of Weighted Scores of all the Success Indicators

19. SWATCHHTA PAKHWADA

(16th -31st October, 2016)

स्वच्छ भारत

एक कदम स्वच्छता की ओर

Swatchhta Pakhwada was celebrated at National Research Centre on Meat, Hyderabad from 16th to 31st October, 2016 with great enthusiasm and all the staff members actively participated in the Swatchhta mission. The Program began with Dr. V.V. Kulkarni, Director NRC on Meat, administering "Swatchhta Shapath" at 10.30 a.m. All the scientific, technical, administrative and contractual staff took pledge.

Several programmes were conducted during this period:

A lecture on 'Healthcare and common lifestyle diseases' was delivered by Invited speaker-Dr.Bhagwan, Senior Professor, Gandhi Medical College, Hyderabad on 18th October.

A session on YOGA has been arranged on 19th October by Dr. Suresh Devatkal, Sr. Scientist. All the staff- Scientific, technical, administrative and

contractual staff performed the Yogasanas as demonstrated and evinced lot of interest.

On 20th October, a renowned Nutritionist and Food safety expert, Dr. V.Sudarshan Rao, Deputy Director, National Institute of Nutrition, Hyderabad was invited to address the staff about the emerging food safety issues and the importance of food hygiene in protecting the health.

A 'Dental Camp' was arranged at NRCM on 22nd October by a team of doctors with nurses and support staff of RUKKU'S dental Hospital & Implant centre. SWATCHH BHARAT ABHIYAN was performed as part of Swatchhta Pakhwada on. Dr. Sudhaker Reddy, Retired Associate Dean of P.V.N.R. Veterinary University has attended as special guest. All the staff- Scientific, Administrative, Technical and contractual staff members ofNRC on Meat have actively participated. This time rear side of the campus was selected for performing Shramdaan. Bushes and plants adjoining the either sides of the road were also cleared up. Entire 200 meter long road was cleaned and swept by a batch of staff members and contractual.

On 24th October, Dr. R.V.S. Rao, Principal Scientist of NAARM was invited to deliver a talk on 'Positive Thinking'. In the afternoon NRCM team along with Director visited BMRS, Grammar High School, at Chengicherla village and conducted Elocution competition for High school students – VIII- X class. Thirty six students participated in the competition. Among the participants, two best students were selected based on their performance related to the subject, fluency, grammar and body language.

To commemorate the Swatchhta Pakhwada celebrations an awareness procession was taken out on 25th October, from NRC on Meat gate to Chengicherla village. In order to make the programme more effective some of the local leaders were invited to join the procession.

A drawing and painting completionon "Swatchh Bharat" was organised in Upper Primary Government School, Chengicherla. A total of 30 students of class 5th to 10th actively participated in the competition. In drawing, students depicted various cleanliness drives undertaken by government of India and state governments. Various issues like sanitation, personal hygiene, and environmental issues were also highlighted by the students.

A lecture on "Solar energy" was delivered by Dr. B.Ranganayakulu, the Founder & CMD of Thrive Solar at NRC on Meat, Chengicherla, Hyderabad on 27th October.

A guest lecture on "Traffic awareness-Road safety" was organized at NRC on Meat, Chengicherla, Hyderabad on dated 28th October. Mr. Harish Kumar, Traffic Inspector, Traffic Training Institute, Goshamahal, Hyderabad delivered the lecture on Traffic awareness-Road safety. He explained the precautions to be taken while driving on the road.

Honourable Member of Legislative Assembly, Shri M. Sudheer Reddy of Medchal constituency was invited to NRC on Meat on 29th October. Shri Sudheer Reddy, MLA, participated in Swatchh Bharat Abhiyan and planted saplings of Banyan tree in the campus. Subsequently, He addressed the NRCM staff and local people who also joined the programme.

Plantation by Hon'ble MLA Shri M. Sudheer Reddy

NOTES:

भाकृअनुप
ICAR

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

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ICAR-NATIONAL RESEARCH CENTRE ON MEAT

Chengicherla, Boduppal Post, Hyderabad - 500 092

ISO 9001:2008 Certified Organization

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