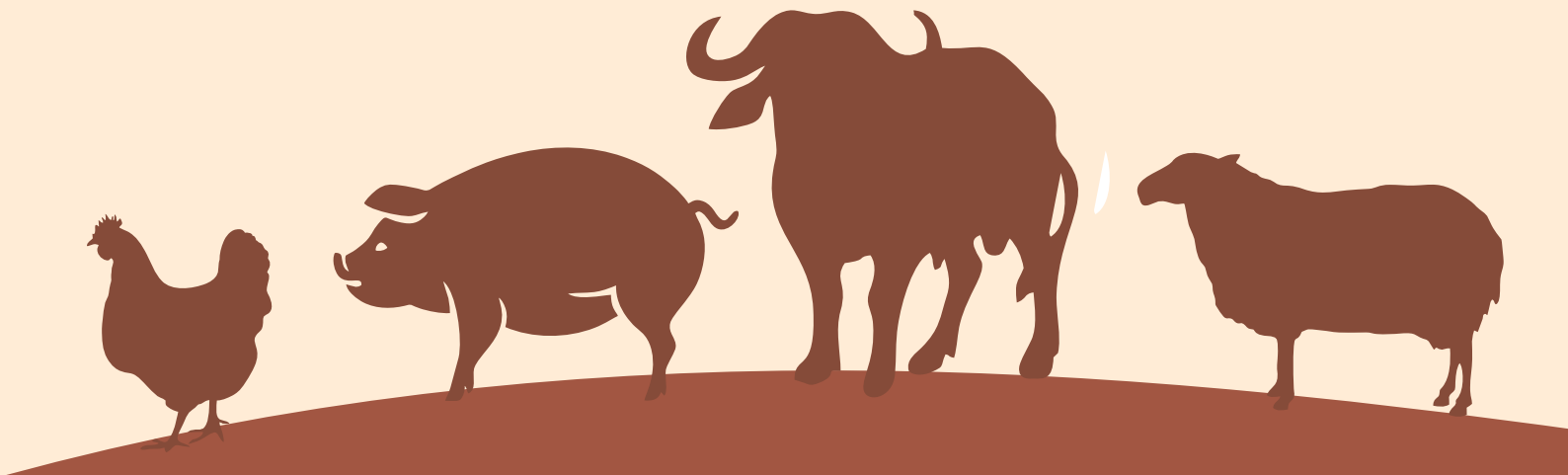
वार्षिक प्रतिवेदन
ANNUAL REPORT
2021



भा.कृ.अनु.प.-राष्ट्रीय माँस अनुसंधान केंद्र
ICAR - National Research Centre on Meat

Chengicherla, Boduppal Post, Hyderabad - 500092

ISO 9001:2015 Certified Organization

National Accreditation Board for
Testing and Calibration Laboratories

NABL

CERTIFICATE OF ACCREDITATION

MEAT SPECIES IDENTIFICATION LABORATORY (MSIL)

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

ICAR-NATIONAL RESEARCH CENTRE ON MEAT, CHENGICHERLA, HYDERABAD, MEDCHAL MALKAJGIRI, TELANGANA, INDIA

in the field of

TESTING

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Issue Date: 19/10/2020 **Valid Until:** 18/10/2022

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Identity : ICAR-NATIONAL RESEARCH CENTRE ON MEAT

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer

ANNUAL REPORT

2021

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PREFACE

ICAR-National Research Centre on Meat, Hyderabad is an unique institute with the distinction of having ISO 9001:2015, ISO/IEC 17025:2017 and FSSC/ISO 22000 certifications. In the year 2021, the Institute has made illustrious contributions through its state-of-the art research, training, extension, skill-development and outreach programmes. I feel honoured to present this Annual Report filled with wide range of activities targeted towards celebration of Azadi ka Amrut Mahotsav, fulfilling National goals and UN Sustainable Development Goals. The Institute works with a strong belief that meat, poultry and allied sectors have huge potential to augment the nutritional security, protein malnutrition, livelihood opportunities and income generation thereby contributing towards doubling farmers' income.

With increasing food fraud instances and constant demand from the regulatory agencies like FSSAI, I am elated to mention that during the year 2021, ICAR-NRC on Meat has released two lateral flow immunoassay-based rapid detection kits for authentication of pork and chicken. The pork detection kit was commercialised to M/s. MR Labs, Hyderabad and MoU was signed in presence of Dr. B.N. Tripathi, DDG (Animal Sciences) and Dr. Amrish Kumar Tyagi, ADG (AN & P). The Institute has also developed and commercialized Portable Meat Production and Retailing Facility (P-MART) for sheep and goats for achieving meat food safety. Two patents, one on P-MART and other on Haleem ball technology were filed. Two new theme-based multi-institutional research projects "DBT Network Programme on Anthrax Diagnosis and Control in India" and "Establishment of a Consortium for One Health to address Zoonotic and Transboundary Diseases in India, including the Northeast Region" were initiated. With these newly sanctioned grants, the Centre has a total of 11 extramural projects funded by different Govt. agencies like ICAR-National Agricultural Science Fund (NASF), FSSAI-Network on Scientific cooperation for Food Safety and Applied Nutrition (NetSCoFAN), DBT, MoFPI, FSSAI, and NLM. The Institute has also signed a contract research project with M/s. Indbro Poultry Farms, Hyderabad.

ICAR-NRC on Meat has been working on cutting-edge research areas of genomics, transcriptomics, proteomics, combating antimicrobial resistance in poultry, food-borne zoonotic diseases including anthrax diagnosis and control, cell-based meats, rapid detection kits to address meat quality, chemical and microbial safety, food frauds, authentication, packaging and establishment of one health consortium. Few other projects on animal by-products utilization, transcriptomic profiling of indigenous chicken, DNA barcodes, livestock traceability and the popularization of organic farming etc. are also being undertaken. The Institute has continued to upgrade its FSSC 22000 and ISO/IEC 17025:2017 certifications and started developing Certified Reference Material for qualitative determination of animal species.

In the year 2021, the Institute has organised a National workshop on "Buffalo meat sector" on 19th January, 2021; National Summit on "Building organized sheep and goat meat sector in India towards ensuring Atmanirbhar Bharat" on 3rd September, 2021 in collaboration with ICAR-NAARM

and NAAS, Hyderabad chapter. A National workshop on "Traceability issues in meat value chain" was also organised in collaboration with ICAR-DPR. A policy paper on traceability system for Indian meat sector has also been brought out. The NRC on Meat has been playing a pivotal role in capacity building activities and this year in spite of COVID scare, the Institute has successfully organized six entrepreneurship development programs training around 154 stakeholders through offline trainings besides one online training for Master Trainers on Meat and Poultry Processing under PM Formalisation of Micro Food Processing Enterprises (PM-FME) Scheme. Twenty four webinars were organized to celebrate the Azadi ka Amrut Mahotasav. For the benefit of farmers, the Institute has disseminated several technical know-how under MGMG and SCSP programs, NEH activities and organized numerous on site workshops and hands-on trainings. Moreover, during this year, Institute has celebrated numerous programmes viz. Institute foundation day, World Zoonoses Day, International Women's day, Hindi Pakhwada, Birth Anniversary of Mahatma Gandhi Ji, Parthenium Awareness Week, International Yoga Day, Vigilance awareness week, Constitution day and citizens' duties day, Swachhta pakhwada, etc.

I am extremely thankful to ICAR and other funding agencies for their overwhelming support in terms of resources, guidance and other constant hand-holding. I sincerely acknowledge the encouragement and support of Hon. Secretary, DARE and DG, ICAR, DDG (Animal Sciences), ADGs and Principal Scientists at the Animal Science Division of ICAR, RAC, IMC, and the QRT members and all the staff of the NRC on Meat. I congratulate all the staff of NRC on Meat and editorial team for their contributions and efforts in bringing out this Annual Report.

(S. B. Barbuddhe)

Director

प्रस्तावना

भा.कृ.अनु.प.-राष्ट्रीय माँस अनुसंधान केन्द्र, हैदराबाद आई.एस.ओ. 9001:2015, आईएसओ/आईईसी 17025:2017 और एफ.एस.एस.सी./आई.एस.ओ. 22000 प्रमाणन की विशेषज्ञता रखने वाला एक विशिष्ट संस्थान है। वर्ष 2021 में, संस्थान ने अपने अत्याधुनिक अनुसंधान, प्रशिक्षण, विस्तार-कार्यक्रम, कौशल-विकास और आउटरीच कार्यक्रमों के माध्यम से शानदार योगदान दिया है। मैं आजादी का अमृत महोत्सव के आयोजन, राष्ट्रीय लक्ष्यों को पूरा करने और संयुक्त राष्ट्र (यूएन) संधारणीय विकास लक्ष्यों को पूरा करने के लिए लक्षित भांति-भांति की गतिविधियों से भरी इस वार्षिक प्रतिवेदन को प्रस्तुत करते हुए गौरव का अनुभव कर रहा हूँ। संस्थान इस अटल इरादे के साथ काम करता है कि माँस, मुर्गी पालन और संबद्ध क्षेत्रों में पोषण सुरक्षा, आजीविका के अवसरों और आमदनी को बढ़ाने एवं प्रोटीन कुपोषण को कम करने और इस तरह, किसान की आय दोगुनी करने की अपार संभावनाएं हैं।

खाद्य पदार्थों में छल-कपट की बढ़ती घटनाओं और एफ.एस.एस.ए.आई. जैसी विनियामक अभिकरणों द्वारा निरंतर अनुरोध किए जाने के साथ, मुझे यह बताते हुए खुशी हो रही है कि वर्ष 2021 के दौरान भा.कृ.अनु.प.-राष्ट्रीय माँस अनुसंधान केन्द्र ने सूअर के माँस (पोर्क) और मुर्गी के माँस (चिकन) के प्रमाणीकरण के लिए दो पार्श्व प्रवाह प्रतिरक्षा आमापन-आधारित तत्काल पता लगाने वाला किट जारी किए हैं। मैसर्स एम.आर. लैब्स, हैदराबाद को पोर्क का तत्काल पता लगाने वाले किट के व्यावसायीकरण अनुमति दी गई तथा डॉ. बी. एन. त्रिपाठी, उपमहानिदेशक (पशु विज्ञान) और डॉ. अमरीश कुमार त्यागी, सहा. महानिदेशक (पशुपोषण एवं पशु शरीर क्रिया विज्ञान) की उपस्थिति में समझौता ज्ञापन (एम.ओ.यू.) पर हस्ताक्षर किए गए। संस्थान ने माँस खाद्य सुरक्षा के लिए भेड़ और बकरियों के लिए वहनीय माँस उत्पादन और खुदरा बिक्री सुविधा (पी-मार्ट) का भी विकास और व्यावसायीकरण किया है। पी-मार्ट पर और हलीम बॉल प्रौद्योगिकी पर दो पेटेंट दायर किए गए। दो नई थीम-आधारित बहु-सांस्थानिक अनुसंधान परियोजनाएं "भारत में एंथ्रेक्स निदान और नियंत्रण पर जैव प्रौद्योगिकी विभाग (डी.बी.टी.) नेटवर्क कार्यक्रम" तथा "पूर्वोत्तर क्षेत्र सहित भारत में जूनोटिक और ट्रांसबाउंड्री रोगों के निवारण के लिए वन हैल्थ के लिए एक कंसोर्टियम की स्थापना" की शुरुआत की गई। इन नव-संस्वीकृत अनुदानों के साथ, केंद्र के पास विभिन्न सरकारी एजेंसियों जैसे कि भा.कृ.अनु.प.-राष्ट्रीय कृषि विज्ञान कोष (एनएएसएफ), एफएसएसएआई-खाद्य सुरक्षा और अनुप्रयुक्त पोषण के लिए वैज्ञानिक सहयोग पर नेटवर्क (NetSCoFAN), डीबीटी, खाद्य प्रसंस्करण उद्योग मंत्रालय, एफ. एस. एस. ए. आई., और राष्ट्रीय पशु मिशन (एन. एल. एम.) द्वारा वित्त-पोषित कुल मिलाकर 11 बाह्य परियोजनाएं हैं। संस्थान ने मैसर्स इंडब्रो पोल्ट्री फार्म, हैदराबाद के साथ एक अनुबंध अनुसंधान परियोजना पर भी हस्ताक्षर किए हैं।

भा.कृ.अनु.प.-राष्ट्रीय माँस अनुसंधान केन्द्र जीनोमिक्स, ट्रांसक्रिप्टोमिक्स, प्रोटियोमिक्स, पोल्ट्री में रोगाणुरोधी प्रतिरोध का मुकाबला करने, एंथ्रेक्स निदान और नियंत्रण सहित खाद्य जनित जूनोटिक रोगों, कोशिका-आधारित माँस, माँस की गुणवत्ता का निराकरण करने के लिए रैपिड डिटेक्शन किट, रासायनिक और सूक्ष्मजीवी सुरक्षा, खाद्यगत धोखाधड़ी, प्रमाणन, पैकेजिंग और वन हैल्थ कंसोर्टियम की स्थापना जैसे अत्याधुनिक अनुसंधान क्षेत्रों पर काम कर रहा है। पशु उपोत्पादों के उपयोग, स्वदेशी चिकन की ट्रांसक्रिप्टोमिक प्रोफाइलिंग, डी.एन.ए. बारकोड, पशुधन अनुरेखणीयता (ट्रेसिबिलिटी) और जैविक खेती को लोकप्रिय बनाने आदि पर कुछ अन्य परियोजनाएं भी कार्य चल रहा हैं। संस्थान ने एफ.एस.एस.सी. 22000 और आई.एस.ओ./आई.ई.सी. 17025:2017 प्रमाणनों को स्तरोन्नत करना जारी रखा है और पशु प्रजातियों के गुणात्मक अवधारण के लिए प्रमाणित संदर्भ सामग्री का विकास करना शुरू कर दिया है।

वर्ष 2021 में, संस्थान ने 19 जनवरी, 2021 को " भैंस माँस क्षेत्र" पर एक राष्ट्रीय कार्यशाला का आयोजन किया; 3 सितंबर, 2021 को भा.कृ.अनु.प.- राष्ट्रीय कृषि अनुसंधान प्रबंधन अकादमी, हैदराबाद (एन.ए.ए.आर.एम.) और राष्ट्रीय कृषि विज्ञान अकादमी (एन.ए.ए.एस.), हैदराबाद चैप्टर के सहयोग से "आत्मनिर्भर भारत सुनिश्चित करने की दिशा में भारत में भेड़ और बकरी के माँस के संगठित सेक्टर के निर्माण" पर राष्ट्रीय शिखर सम्मेलन का आयोजन किया। भा.कृ.अनु.प.- कुक्कुट अनुसंधान निदेशालय (डी.

पी.आर.) के सहयोग से "माँस मूल्य श्रृंखला में अनुरेखणीयता मुद्दे" पर एक राष्ट्रीय कार्यशाला भी आयोजित की गई। भारतीय माँस सेक्टर के लिए अनुरेखणीयता प्रणाली पर एक नीति दस्तावेज भी प्रकाशित किया है।

राष्ट्रीय माँस अनुसंधान केन्द्र, क्षमता निर्माण गतिविधियों में महत्वपूर्ण भूमिका निभा रहा है और इस वर्ष कोविड-19 की आशंका के बावजूद संस्थान ने छह उद्यमिता विकास प्रशिक्षण कार्यक्रमों का सफलतापूर्वक आयोजन किया है, जिसमें ऑफ़लाइन प्रशिक्षणों के माध्यम से लगभग 154 हितधारकों को प्रशिक्षण दिया गया है। इसके अतिरिक्त, सूक्ष्म खाद्य प्रसंस्करण उद्यम (पी.एम.-एफ. एम.ई.) की पीएम निर्दिष्टीकरण योजना के तहत माँस और पोल्ट्री प्रसंस्करण पर मुख्य प्रशिक्षकों के लिए एक ऑनलाइन प्रशिक्षण भी आयोजित किया गया है। आजादी का अमृत महोत्सव के तहत चौबीस वेबिनार आयोजित किए गए। किसानों के फायदे के लिए, संस्थान ने एमजीएमजी और एससीएसपी कार्यक्रमों, एनईएच गतिविधियों के तहत कई प्रकार की तकनीकी जानकारी का प्रचार-प्रसार किया है और कई ऑनसाइट कार्यशालाओं और व्यावहारिक प्रशिक्षणों का आयोजन किया है। इसके अलावा, इस वर्ष के दौरान, संस्थान ने अनेक कार्यक्रमों का आयोजन किया है जैसे कि संस्थान स्थापना दिवस, विश्व जुनोसिस दिवस, अंतर्राष्ट्रीय महिला दिवस, हिंदी पखवाड़ा, महात्मा गांधी जी की जयंती, पार्थेनियम जागरूकता सप्ताह, अंतर्राष्ट्रीय योग दिवस, सतर्कता जागरूकता सप्ताह, संविधान दिवस और नागरिक कर्तव्य दिवस, स्वच्छता पखवाड़ा आदि।

मैं भा.कृ.अनु.प. और अन्य वित्त-पोषण एजेंसियों के प्रति संसाधनों, मार्गदर्शन और अन्य सभी प्रकार के सहयोग की दृष्टि से मिले अपार समर्थन के लिए उन सबके प्रति आभार व्यक्त करता हूँ। मैं माननीय सचिव, कृषि अनुसंधान और शिक्षा विभाग एवं महानिदेशक, भा.कृ.अनु.प., उप महानिदेशक (पशु विज्ञान), भा.कृ.अनु.प. पशुविज्ञान विभाग के सहा. महानिदेशकों, पंचवर्षीय समीक्षा दल (क्यू.आर.टी.), अनुसंधान सलाहकार समिति (आर.ए.सी.) और संस्थान प्रबंधन समिति (आई.एम.सी.) के सदस्यों और राष्ट्रीय माँस अनुसंधान केन्द्र के सभी स्टॉफ से मिले प्रोत्साहन एवं समर्थन के लिए उनके प्रति हृदय से आभार व्यक्त करता हूँ। मैं राष्ट्रीय माँस अनुसंधान केन्द्र के सभी स्टॉफ को और इस वार्षिक प्रतिवेदन को प्रकाशित करने में संपादक-मंडल द्वारा किए गए योगदान और प्रयासों के लिए उन्हें बधाई देता हूँ।

(एस. बी. बारबुद्धे)

निर्देशक

EXECUTIVE SUMMARY

ICAR-National Research Centre on Meat, Hyderabad has celebrated its 22nd Foundation day in the year 2021 after its establishment with its own building at Chengicherla in the year 2007. Since its establishment, the Institute is catering to the needs of livestock and poultry farmers, meat industry personnel, exporters, policy makers, regulatory bodies, Universities and industries. During the year 2021-22, an amount of Rs. 1062.17 lakhs was allocated and the Institute has incurred 100% expenditure. The summary of the Institute's activities during the period from January 2021 to December 2021 is presented below:

Research & Development

- Novel mutton haleem balls were developed and evaluated for proximate composition and consumer acceptance. The technology is ready for commercialization.
- Filter sterilized sheep serum (SS) was tried in place of fetal bovine serum (FBS) for culturing of myoblasts without affecting the growth. Development of processes for culturing and differentiation of muscle stem cells in animal derivative free media for cultured meat production was also initiated.
- Developed the gold-nanoparticle-based, sandwich-format lateral flow immunoassay (LFIA) test kit with excellent sensitivity allowing the detection of as low as 0.5 % (w/w) pork in raw and heat-processed meat mix and commercial meat samples within 15 min including sample preparation.
- Analysis of 166 market meat products samples from the North-Eastern (NE), Northern and southern region for the presence of polycyclic aromatic hydrocarbons (PAHs) revealed that the carcinogenic PAH compound - Benz(a)pyrene was detected in 27 out of the 166 (16.26%) samples. The work on quantitative determination of sulphonamide antimicrobial residues in buffalo meat samples and confirmatory analysis of colistin and nitrofuran antimicrobial residues in broiler chicken using different LC and MS based approaches is in progress.
- The sticker-type sensor made up of laccase-guaiacol-copper nanocomposite coated onto nitrocellulose membrane can be used for detecting thawing in frozen chicken. The protocol for the preparation of biodegradable packaging material and the sealability of the film with PVA has been standardized.
- Phytochemicals viz, thymol, carvacrol, eugenol and cinnamaldehyde were conjugated with green synthesized AgNPs and encapsulated using Chitosan-Alginate polymers and further studies are in progress to evaluate their efficacy against multi-drug resistant (MDR) pathogens (*E. coli* and non-typhoidal *Salmonella*) in poultry. Risk analysis of antimicrobial resistance among bacterial food-borne pathogens from broiler chicken farms of Telangana is also in progress.

- Work was initiated towards developing and evaluating a synthetic peptide derived polyclonal and/or monoclonal antibody based latex agglutination test (LAT) for rapid detection of *B. anthracis* spores from the animal feed supplements and soil samples
- Consortium of infectious disease and public health researchers was established to initiate a One Health programme with the ultimate objective of establishing inter-sectoral collaborations among veterinary, medical, agricultural, environmental, forestry, meteorological and other areas to detect, prevent and control zoonoses and transboundary diseases.
- Novel molecular quantification technique using Droplet Digital PCR to tackle buffalo meat adulteration and rapid assay for authentication of buffalo meat by employing alkaline lysis method of DNA extraction and LAMP using novel primers designed to target mitochondrial D loop region were developed. Development of DNA Mini-barcodes and High Resolution Melting (HRM) analysis assay for processed/cooked meat products authentication has also been initiated.
- Several monographs for meat and meat products as well as for egg and egg products, covering all the essential aspects of food safety and product content limits were prepared under the Development of Food products category monographs (Food- 'O' -Copoeia) for foods of animal origin.
- The carcass and meat quality, proteome changes of different native breeds (Aseel and Kadaknath) based on the slaughter age viz.14, 18, 21 and 24 weeks and compared with commercial broiler chicken and slow growing broiler meat were determined.
- Effect of microencapsulated essential oils namely, thymol and cinnamaldehyde was evaluated on the storage stability and sensory quality of emulsion based chicken nuggets.
- Efficacy of 0.3 ppm aqueous ozone was evaluated against pure culture of bacteria isolated from a meat source
- In continuation with our efforts in promotion and popularization of organic small ruminant production, organic meat production system for sustainable sheep husbandry and promotion of consumer health has been initiated. Performance study of sheep meat markets in India revealed that sheep prices and resulting mutton prices in India will increase by 3.64 times in next 10 years from 2020 to 2030.
- Portable Meat Production and Retailing Facility (P-MART) for sheep and goat comprising of animal holding, slaughtering and dressing, cutting and packaging, retailing and waste management facilities was developed and commercialized.
- Rapid screening assay(s) using standardized ELISA revealed seropositivity of 40.625% (39/96) for *Chlamydia* infection among slaughterhouse personal in Telangana.
- Impact of NRC on Meat research and other activities from 2001-2020 indicated that total no of effective projects per scientist per year was 1.19 with 0.26 of extramural and 0.92 of intramural projects. NRCM has published a total of 253 research paperswith an average of 0.99 paper per scientist per year for the overall period.

Training, consultancy, workshops, awareness programs and extension activities

- Induction training for 40 Food Safety Officers of Telangana and Himachal Pradesh on "Sampling & Laboratory Network" was organized on 15th January, 2021.
- National workshop on "Sustainability of Buffalo Sector in India" organized by ICAR-NRC on Meat and ICAR-NAARM, Hyderabad on 19th January, 2021.
- DST, Govt. India sponsored "Entrepreneurship in Livestock and Veterinary Sciences" Online Faculty Development Program was organized from 9th to 22nd February, 2021.
- Training programme on 'Meat Processing, Branding and Marketing' under ARYA Programme, Govt. of India organized for 15 participants from 24 to 25th February, 2021.
- Training programme on 'Recent analytical techniques for detection of meat adulteration, veterinary drug residues and microbes of public health importance' was organized for 10 veterinarians from Telangana from 15-19th March, 2021.
- Awareness programme conducted for 52 sheep and goat farmers and chairmen of different sheep breeding societies on 31st March, 2021.
- The MANAGE sponsored virtual training programme on 'Climate-smart technologies for food animal production and products' was organized from 19th to 23rd April, 2021 for more than 100 participants.
- Five awareness programmes on "Portable Meat Production and Retailing Unit for Sheep and Goats" were organized for around 75 participants.
- Indian Institute of Food Processing Technology (IIFPT), Thanjavur sponsored virtual training programmes for 30 Master Trainers on "Meat and Poultry Processing"were conducted during 4-7th and 10-13th August, 2021.
- Interface meeting with 30 Municipal Officials of Telangana State on hygienic meat production was conducted on 17th August, 2021.
- A National Summit on "Building organized sheep and goat meat sector in India towards ensuring Atmanirbhar Bharat"was jointly organized by ICAR-NRC on Meat, ICAR-NAARM, NAAS-Hyderabad Chapter and Indian Meat Science Association at ICAR-National Academy of Agricultural Research Management, Hyderabad in a hybrid mode on 3rd September, 2021.
- MEPMA Sponsored training program on 'Value addition to meat' was organized to 15 women SHG from different Municipalities of Telangana from14th to 16th September 2021.
- National Workshop on, 'Meat traceability and Recall: From concept to practice' was organized on 22nd October, 2021 and 150 delegates participated.
- Training-of-Trainer's program under FSSAI-FoSTaC on 29th November 2021 for16 participants.
- Four paid hands-on off-line "Entrepreneurship training programs" were conducted and imparted

skills to more than 69 participants.

MoU, Technology licensing, IPR and Publications

- Signed the MoU for licensing of "Immunochromatography-based pork detection kit" (IPDK) on 23rd October, 2021with MR Labs, Hyderabad
- Two patent applications were filed
- Three MoUs with Universities were signed for research and extension
- Four consultancy projects were signed for establishment poultry processing plant, slaughter-house and meat products plant
- During the year 2021, the Institute has published 19 research publications; 16 review papers; 10 brochures; one policy document and 10 training manuals

SCSP, MGMG and NEH activities

- Under SCSP program, two 3 days entrepreneurship development trainings, distribution of back-yard poultry birds (150 units) and meat processing equipment were undertaken on 5 different occasions.
- Under Mera Gaon Mera Gaurav (MGMG) program awareness on cleanliness was conducted among 150 school children and 10 teachers; appraised hygienic practices and encouraged about 20 butchers and meat shop owners; meeting on valueing water was organized and 20 butchers participated.
- Under NEH programme, a MoU has been signed with Central Agricultural University, Imphal; one interactive meeting, one training programme on "clean meat production and value added meat products", one awareness programme on "clean meat production and processing of value added meat products" were organized.

Institutional activities

- QRT, RAC, IMC and IRC meetings were conducted to review the progress of different activities and achievements of the Institute.
- 22nd Institute foundation day, International Women's day, World Zoonoses Day, World water day, World environment day, World soil day, Birth Anniversary of Mahatma Gandhi Ji, Vigilance awareness week, Constitution day and citizens' duties day, Swachhta pakhwada were celebrated.

कार्यकारी सारांश

भा.कृ.अनु.प.-राष्ट्रीय माँस अनुसंधान केंद्र, हैदराबाद ने वर्ष 2007 में चेंगिचेरला में अपने स्वयं के भवन के साथ अपनी स्थापना के बाद वर्ष 2021 में अपना 22वां स्थापना दिवस मनाया है। अपनी स्थापना के बाद से, संस्थान पशुधन और कुक्कुट किसानों, माँस उद्योग के कार्मिक, निर्यातकों, नीति निर्माताओं, विनियामक निकायों, विश्वविद्यालयों और उद्योग की जरूरतों को पूरा कर रहा है।

वर्ष 2021-22 के दौरान 1062.17 लाख रु0 आवंटित किए गए थे और संस्थान ने 100% व्यय उपगत किया है। जनवरी 2021 से दिसंबर 2021 की अवधि के दौरान संस्थान की गतिविधियों का सारांश नीचे प्रस्तुत किया गया है।

अनुसंधान एवं विकास

- सर्वथा नवीन मटन हलीम बॉल्स को विकसित किया गया और समीपस्थ संघटन और उपभोक्ता स्वीकृति के लिए उनका मूल्यांकन किया गया। प्रौद्योगिकी व्यावसायीकरण उपयोग के लिए तैयार है।
- भ्रूण गोजातीय सीरम (एफ.बी.एस.) के स्थान पर फिल्टर निर्जर्मीकृत भेड़ सीरम (एस.एस.) को मायोब्लास्ट के संवर्धन के लिए वृद्धि पर असर डाले बगैर आजमाया गया। संवर्धित माँस उत्पादन के लिए पशु व्युत्पन्न मुक्त माध्यम में माँसपेशियों की स्टेम कोशिकाओं के संवर्धन और विभेदन के लिए कार्यविधियों का विकास भी शुरू किया गया।
- उत्कृष्ट संवेदनशीलता के साथ गोल्ड-नैनोपार्टिकल-आधारित, सैंडविच-फॉर्मेट पार्श्व प्रवाह प्रतिरक्षा आमापन (एलएफआईए) परीक्षण किट विकसित की गई जिससे कच्चे और ऊष्मा-संसाधित माँस मिक्स और व्यावसायीक माँस नमूनों में 0.5% (डब्ल्यू/डब्ल्यू) पोर्क का 15 मिनट के भीतर पता लगाना संभव हुआ।
- पॉलीसाइक्लिक एरोमैटिक हाइड्रोकार्बन (पी0ए0एच0) की मौजूदगी के लिए उत्तर-पूर्वी (एन.ई.), उत्तरी और दक्षिणी क्षेत्र के 166 मार्केट माँस उत्पादों के नमूनों के विश्लेषण से पता चला कि कैंसरजनी पी.ए.एच. यौगिक - बेंज(ए)पाइरीन 166 में से 27 (16.26%) नमूनों में मौजूद है। भैंस के माँस के नमूनों में सल्फोनामाइड रोगाणुरोधी अवशेषों के मात्रात्मक अवधारण और विभिन्न एल.सी. और एम.एस. आधारित दृष्टिकोणों का उपयोग करके ब्रायलर चिकन में कोलिस्टिन और नाइट्रोफुरन रोगाणुरोधी अवशेषों के पुष्टिकरण विश्लेषण का कार्य प्रगति पर है।
- हिमीकृत चिकन में विगलन का पता लगाने के लिए नाइट्रोसेल्यूलोज झिल्ली पर लेपित लैकेस-गुआयाकोल-कॉपर नैनोकम्पोजिट से बने स्टिकर-टाइप सेंसर का उपयोग किया जा सकता है। जैव-अवक्रमणीय पैकेजिंग सामग्री की तैयारी और पीवीए के साथ फिल्म की सील करने की क्षमता के प्रोटोकॉल का मानकीकरण किया गया है।
- फाइटोकेमिकल्स जैसे थायमोल, कारवाक्रोल, यूजेनॉल और सिनामाल्डिहाइड को हरे संश्लेषित सिल्वर-नैनोपार्टिकल (Ag_NPs) के साथ संयुग्मित किया गया और चिटोसन-एल्गिनेट पॉलिमर का उपयोग करके इनकैप्सुलेट किया गया और पोल्ट्री में मल्टी-ड्रग-रोधी (एम.डी.आर.) रोगजनकों (ई. कोलाई और नॉन-टाइफाइडल साल्मोनेला) के प्रति उनकी प्रभावकारिता का मूल्यांकन करने के लिए आगे और अध्ययन किया जा रहा है। तेलंगाना के ब्रायलर चिकन फार्मों से जीवाणु खाद्य-जनित रोगजनकों के बीच रोगाणुरोधी प्रतिरोध का जोखिम विश्लेषण भी प्रगति पर है।
- पशु आहार संपूरकों और मृदा नमूनों से बेसिलस एन्थ्रेसीस बीजाणुओं का तेजी से पता लगाने के लिए सिंथेटिक पेप्टाइड व्युत्पन्न पॉलीक्लोनल और / या मोनोक्लोनल एंटीबॉडी आधारित लेटेक्स एग्लूटिनेशन टेस्ट (एल.ए.टी.) के विकास और मूल्यांकन की दिशा में काम शुरू किया गया।

- पशु चिकित्सा, चिकित्सा, कृषि, पर्यावरण, वानिकी, मौसम विज्ञान और अन्य क्षेत्रों के बीच अंतर-क्षेत्रीय सहयोग स्थापित करने के मुख्य उद्देश्य के साथ वन हैल्थ कार्यक्रम शुरू करने के लिए संक्रामक रोग और लोक स्वास्थ्य शोधकर्ताओं के कंसोर्टियम की स्थापना का कार्य शुरू किया गया ताकि जुनोसिस और सीमापार (ट्रांसबाउंड्री) रोगों का पता लगाया जा सके, उन्हें रोका जा सके और नियंत्रित किया जा सके।
- भैंस के माँस में मिलावट से निपटने के लिए ड्रॉपलेट डिजिटल पी.सी.आर. का उपयोग करते हुए सर्वथा नवीन आणविक मात्रा-निर्धारण प्रविधि और माइटोकॉन्ड्रियल डी लूप क्षेत्र को लक्षित करने के लिए अभिकल्पित सर्वथा नवीन प्राइमरों का उपयोग करके डी.एन.ए. निष्कर्षण और एल.ए.एम.पी. की क्षारीय लिसिस विधि का उपयोग करके भैंस के माँस के प्रमाणीकरण के लिए तेज आमापन विकसित किया गया। प्रसंस्कृत/पके हुए माँस उत्पादों के प्रमाणीकरण के लिए डी.एन.ए. मिनी-बारकोड और उच्च संकल्प गलनांक (एच.आर.एम.) विश्लेषण आमापन का विकास भी शुरू किया गया है।
- पशु मूल के खाद्य पदार्थ के लिए फूड प्रोडक्ट कैटेगरी मोनोग्रॉफ (फूड-'ओ'-कोपोइया) के विकास के अंतर्गत माँस और माँस उत्पादों के साथ-साथ अंडा और अंडा उत्पादों के लिए कई मोनोग्राफ, जिनमें खाद्य सुरक्षा और उत्पाद अंतर्वस्तु सीमा के सभी आवश्यक पहलुओं को शामिल किया ।
- वध आयु अर्थात 14, 18, 21 और 24 सप्ताह के आधार पर विभिन्न देशी नस्लों (असील और कड़कनाथ) के लोथ और माँस की गुणवत्ता, प्रोटिओम परिवर्तनों की व्यावसायीक ब्रॉयलर चिकन और धीमी गति से बढ़ने वाले ब्रॉयलर माँस की तुलना में निर्धारण किया गया।
- थायमोल और सिनामाल्डिहाइड नाम के माइक्रोएन्कैप्सुलेटेड आवश्यक तेलों के प्रभाव का मूल्यांकन इमल्शन आधारित चिकन नगेट्स की भंडारण स्थिरता और संवेदी गुणवत्ता पर किया गया।
- माँस स्रोत से पृथक्कृत बैक्टीरिया के विशुद्ध संवर्धन के प्रति 0.3 पी.पी.एम. जलीय ओजोन की प्रभावकारिता का मूल्यांकन किया गया।
- छोटे आकार के जुगाली करने वाले पशुओं के जैविक उत्पादन को बढ़ावा देने और लोकप्रिय बनाने के हमारे प्रयासों के क्रम में, संधारणीय भेड़ पालन के लिए जैविक माँस उत्पादन प्रणाली और उपभोक्ता स्वास्थ्य को बढ़ावा देने की पहल की गई है। भारत में भेड़ के माँस बाजारों के निष्पादन अध्ययन से पता चला है कि भारत में भेड़ की कीमतों और परिणामी मटन की कीमतों में 2020 से 2030 तक अगले 10 वर्षों में 3.64 गुना वृद्धि होगी।
- भेड़ और बकरी के लिए वहनीय माँस उत्पादन और खुदरा बिक्री सुविधा (पी-मार्ट), जिसमें पशु धारण, वध और ड्रेसिंग, कटिंग और पैकेजिंग, खुदरा बिक्री और अपशिष्ट प्रबंधन जैसी सुविधाओं का विकास और व्यावसायीकरण किया गया।
- तेलंगाना के वधशाला कार्मिकों में मानकीकृत एलिसा का उपयोग करते हुए तेज जाँच आमापन से पता चला कि 40.625% (39/96)क्लैमाइडिया संक्रमण की सीरोपॉजिटिविटी है।
- 2001-2020 तक माँस अनुसंधान और अन्य गतिविधियों पर राष्ट्रीय माँस अनुसंधान केन्द्र के प्रभाव से यह इंगित हुआ कि प्रति वैज्ञानिक प्रति वर्ष प्रभावी परियोजनाओं की कुल संख्या 1.19 है, जिसमें 0.26 बाह्य और 0.92 आंतरिक परियोजनाएं हैं जो 6.69% की दर से बढ़ रही हैं। रा0 माँ0 अनु. के. ने समग्र अवधि के लिए प्रति वैज्ञानिक प्रति वर्ष औसतन 0.99 पेपर के साथ कुल 253 शोध पत्र प्रकाशित किए ।

प्रशिक्षण, परामर्श, कार्यशालाएँ, जागरूकता कार्यक्रम और विस्तार गतिविधियाँ

- 15 जनवरी, 2021 को "प्रतिचयन और प्रयोगशाला नेटवर्क" पर तेलंगाना और हिमाचल प्रदेश के 40 खाद्य सुरक्षा अधिकारियों के लिए प्रवेशन प्रशिक्षण आयोजित किया गया।
- भा.कृ.अनु.प.-राष्ट्रीय माँस अनुसंधान केन्द्र, हैदराबाद और भा.कृ.अनु.प.- नार्म (एनएएआरएम), हैदराबाद द्वारा 19 जनवरी, 2021 को "भारत में भैंस क्षेत्र की संधारणीयता" पर राष्ट्रीय कार्यशाला का आयोजन किया गया।
- डीएसटी, भारत सरकार ने "पशुधन और पशु चिकित्सा विज्ञान में उद्यमिता" का प्रायोजन किया। 9 से 22 फरवरी, 2021 तक ऑनलाइन संकाय विकास कार्यक्रम आयोजित किया गया।
- भारत सरकार के आर्या (एआरवाईए) कार्यक्रम के तहत 'माँस प्रसंस्करण, ब्रांडिंग और विपणन' पर 24 से 25 फरवरी, 2021 तक प्रशिक्षण कार्यक्रम आयोजित किया गया। इसमें 15 प्रतिभागियों ने भाग लिया।
- तेलंगाना के 10 पशु चिकित्सकों के लिए 15-19 मार्च, 2021 तक 'माँस में मिलावट, पशु चिकित्सा दवाओं के अवशेषों और सार्वजनिक स्वास्थ्य महत्व के रोगाणुओं का पता लगाने के लिए विश्लेषणात्मक तकनीकों' पर प्रशिक्षण कार्यक्रम आयोजित किया गया था।
- 31 मार्च, 2021 को 52 भेड़-बकरी किसानों और विभिन्न भेड़ प्रजनन समितियों के अध्यक्षों के लिए जागरूकता कार्यक्रम आयोजित किया गया।
- 'खाद्य पशु उत्पादन और उत्पादों के लिए जलवायु-लघु प्रौद्योगिकियाँ' पर 100 से अधिक प्रतिभागियों के लिए 19 से 23 अप्रैल, 2021 तक राष्ट्रीय कृषि विस्तार प्रबंधन संस्थान (मैनेज) द्वारा प्रायोजित वर्चुअल प्रशिक्षण कार्यक्रम का आयोजन किया गया था।
- लगभग 75 प्रतिभागियों के लिए "भेड़ और बकरियों के लिए सुवाह्य माँस उत्पादन और रिटेलिंग यूनिट" पर पांच जागरूकता कार्यक्रम आयोजित किए गए।
- "माँस और कुक्कुट प्रसंस्करण" पर 30 मुख्य प्रशिक्षकों के लिए भारतीय खाद्य प्रसंस्करण प्रौद्योगिकी संस्थान (आई.आई.एफ.पी.टी.), तंजावुर के प्रायोजन में 4-7 और 10-13 अगस्त, 2021 के दौरान दो वर्चुअल प्रशिक्षण कार्यक्रम आयोजित किए गए।
- स्वच्छ माँस उत्पादन पर तेलंगाना राज्य के 30 नगरपालिका अधिकारियों के साथ 17 अगस्त, 2021 को इंटरफेस बैठक आयोजित की गई।
- "आत्मनिर्भर भारत सुनिश्चित करने की दिशा में भारत में भेड़ और बकरी के माँस के संगठित क्षेत्र का निर्माण" पर एक राष्ट्रीय शिखर सम्मेलन संयुक्त रूप से भा.कृ.अनु.प.-राष्ट्रीय माँस अनुसंधान केन्द्र, भा.कृ.अनु.प.- राष्ट्रीय कृषि अनुसंधान प्रबंधन अकादमी, हैदराबाद (एन.ए.ए.आर.एम.), राष्ट्रीय कृषि विज्ञान अकादमी (एन.ए.ए.एस.)-हैदराबाद चैप्टर और भारतीय माँस विज्ञान संगठन (ईमसा) द्वारा भा.कृ.अनु.प.-राष्ट्रीय कृषि अनुसंधान प्रबंधन अकादमी, हैदराबाद में 3 सितंबर, 2021 को हाइब्रिड तरीके से आयोजित किया गया।
- तेलंगाना के विभिन्न नगर पालिकाओं से 15 महिला स्वयं सहायता समूह (एस.एच.जी.) के लिए 14 से 16 सितंबर 2021 तक ' माँस के मूल्यवर्धन' पर एम.ई.पी.एम.ए. प्रायोजित प्रशिक्षण कार्यक्रम आयोजित किया गया।
- माँस अनुरेखणीयता एवं प्रत्याह्वान: अवधारणा से अभ्यास तक' पर 22 अक्टूबर, 2021 को राष्ट्रीय कार्यशाला का आयोजन किया गया और इसमें 150 प्रतिनिधियों ने भाग लिया।

- भा.कृ.अनु.प.-राष्ट्रीय माँस अनुसंधान केन्द्र ने 16 प्रतिभागियों के लिए 29 नवंबर 2021 को FSSAI-FoSTaC के तहत प्रशिक्षकों के प्रशिक्षण कार्यक्रम का आयोजन किया।
- चार सवेतन व्यावहारिक ऑफ-लाइन "उद्यमिता प्रशिक्षण कार्यक्रम" आयोजित किए गए और इनमें 69 से अधिक प्रतिभागियों को कौशल प्रदान किया गया।

समझौता ज्ञापन, प्रौद्योगिकी लाइसेंसिंग, आईपीआर और प्रकाशन

- 23 अक्टूबर, 2021 को एमआर लैब्स, हैदराबाद के साथ "इम्यूनोक्रोमैटोग्राफी-आधारित पोर्क डिटेक्शन किट" (आईपीडीके) के लाइसेंस के लिए समझौता ज्ञापन पर हस्ताक्षर किए गए।
- दो पेटेंट आवेदन दायर किए गए।
- विश्वविद्यालयों के साथ तीन समझौता ज्ञापनों पर हस्ताक्षर किए गए।
- कुक्कुट प्रसंस्करण संयंत्र, बूचड़खाने और माँस उत्पाद संयंत्र की स्थापना के लिए चार परामर्श परियोजनाओं पर हस्ताक्षर किए गए।
- वर्ष 2021 के दौरान संस्थान ने 27 शोध प्रकाशन; 13 समीक्षा पत्र; 10 ब्रोशर; एक नीति दस्तावेज़ और 10 प्रशिक्षण नियमावली प्रकाशित की हैं।

एससीएसपी, एमजीएमजी और एनईएच गतिविधियाँ

- अनुसूचित जाति उप-परियोजना (एस.सी.एस.पी.) कार्यक्रम के तहत, 5 अलग-अलग अवसरों पर दो 3 दिवसीय उद्यमिता विकास प्रशिक्षण दिए गए, बैकयार्ड पोल्ट्री बर्ड्स (150 नग) और माँस प्रसंस्करण उपकरणों का वितरण किया गया।
- मेरा गांव मेरा गौरव (एम.जी.एम.जी.) कार्यक्रम के तहत 150 स्कूली बच्चों और 10 शिक्षकों के लिए स्वच्छता पर जागरूकता का आयोजन किया गया; स्वच्छ प्रथाओं का मूल्यांकन किया और लगभग 20 कसाई और माँस की दुकान के मालिकों को प्रोत्साहित किया गया; पानी के महत्व पर बैठक आयोजित की गई जिसमें 20 कसाइयों ने भाग लिया।
- उत्तर पूर्वी हिमालय (एन.ई.एच.) कार्यक्रम के तहत, केंद्रीय कृषि विश्वविद्यालय, इंफाल के साथ एक समझौता ज्ञापन पर हस्ताक्षर किए गए हैं; एक परस्पर-संवाद बैठक, "स्वच्छ माँस उत्पादन और मूल्यवर्धित माँस उत्पाद" पर एक प्रशिक्षण कार्यक्रम, "स्वच्छ माँस उत्पादन और मूल्यवर्धित माँस उत्पादों के प्रसंस्करण" पर एक जागरूकता कार्यक्रम आयोजित किया गया।

सांस्थानिक गतिविधियाँ

- संस्थान की विभिन्न गतिविधियों और उपलब्धियों की प्रगति की समीक्षा करने के लिए पंचवर्षीय समीक्षा दल (क्यू.आर.टी.), अनुसंधान सलाहकार समिति (आर.ए.सी.), संस्थान प्रबंधन समिति (आई.एम.सी.) और संस्थान प्रबंधन समिति (आई.एम.सी.) बैठकें आयोजित की गईं।
- 22वां संस्थान स्थापना दिवस, अंतर्राष्ट्रीय महिला दिवस, विश्व जुनोसिस दिवस, विश्व जल दिवस, विश्व पर्यावरण दिवस, विश्व मृदा दिवस, महात्मा गांधी जी की जयंती, सतर्कता जागरूकता सप्ताह, संविधान दिवस और नागरिक कर्तव्य दिवस, स्वच्छता पखवाड़ा मनाया गया।

INTRODUCTION

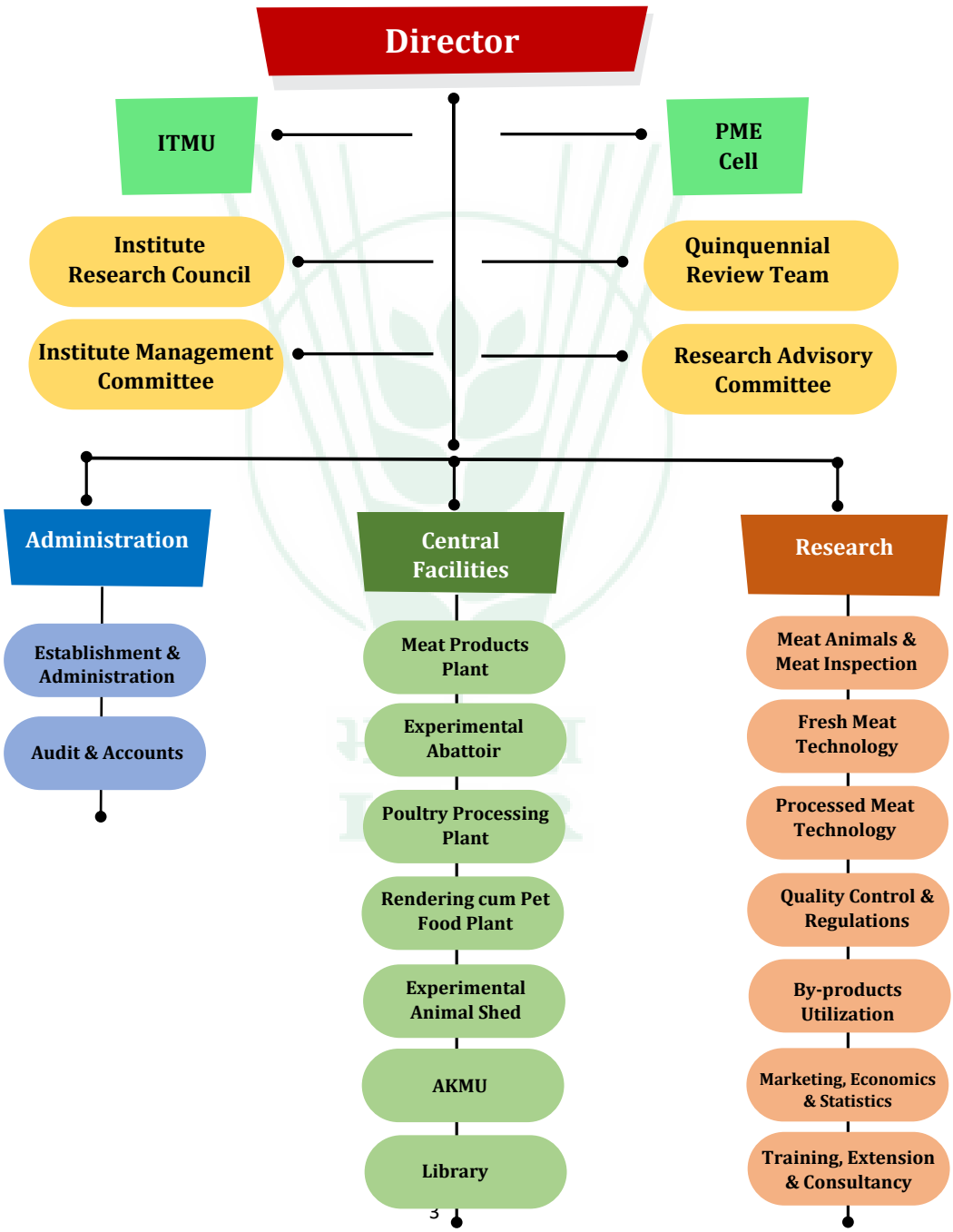
Livestock and poultry sector in India primarily contributes to national economy, nutritional security and provide livelihood opportunities. It provides employment to over 300 million rural people and contributes 12% of their household income. Increased demand for animal sourced proteins among middleclass and youngsters including milk, meat, poultry and eggs is augmenting farmers' income. Millions of landless and marginal farmers rearing sheep and goat, poultry, pigs and unproductive buffaloes are mainly depending on meat value chain for their regular income. Hence, strengthening of facilities for hygienic and clean meat and poultry production, processing and retailing must be supported. Meat sector in India is a USD 31 billion sector growing at more than 6% CAGR providing direct and indirect employment to millions of poor and marginal farmers. Besides domestic demand, India is also a net exporter of deboned, deglanded frozen buffalo meat worth more than USD 3 billion to around 50 countries.

The comparative advantage of India as a major meat producer and buffalo meat exporter will give lucrative business prospects to entrepreneurs in the meat processing industry. Meat and poultry sector activities support AtmaNirbhar Bharat Abhiyan and help to achieve new economic prospects as a result of India's changing demographics. Different schemes and programs supported by Ministry of Fisheries, Animal Husbandry and Dairying, Govt. India and Ministry of Food Processing Industries are targeted to augment the clean and safe meat production. ICAR-National Research Centre on Meat, Hyderabad, in its efforts to contribute towards organised meat sector development in the country is trying to address the need-based R&D, coordinate with multiple stakeholders including policy makers and regulators, training, extension and working with wider approach addressing all the issues right from meat animal production, meat quality, and safety to consumption.

The Institute is playing a pivotal role for conducting basic and applied research in various aspects of meat production, processing, quality assurance and marketing; developing rapid detection methods and kits for meat species and meat borne pathogens; improving quality and safety of meat and meat products through modern approaches; alternative meat proteins; establishment of incubation facilities for entrepreneurs; 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 and serving as a national repository of information in meat and allied sectors. The Institute is working towards achieving the national development goals like Swachha Bharat, Swastha Bharat, Skill India and also organized series of lectures to commemorate Azadi Ka Amrit Mahotsava. The Institute also supports Rajbhasha implementation and carried out different events. The Institute is supporting a good number of stakeholders including rural women entrepreneurs, beneficiaries from MGMG, SCSP and NEH components, entrepreneurs and others through hands-on training, field-level demonstrations, interaction meetings and technical consultancy etc. The Institute is focused to serve public needs and is expected to provide lead in developing the meat industry.

ORGANIZATIONAL SETUP

ICAR-NATIONAL RESEARCH CENTRE ON MEAT



VISION, MISSION and MANDATE

VISION

ICAR-NRC on Meat as a premier institution of meat research to solve the problems and face challenges of meat and allied sectors development

MISSION

Development of modern organized meat sector throughmeat production, processing and utilization technologiesto serve the cause of meat animal producers, processors and consumers

MANDATE

1. Basic and applied research in meat science and technology for meat production, processing, value addition and utilization.
2. Capacity development for different levels of personnel in meat sector.
3. National repository of information in meat and allied sectors.

STAFF STRENGTH

Staff	Sanctioned	In Position
Scientific	19	17
Technical	05	04
Administrative	14	10
Skilled supporting	01	0
Total	39	31

BUDGET

Budget details (In Lakhs)

		Sanctioned	Utilized
Head			
1	Grants in aid Salary	766.86	766.86
2	Grants in aid Pension	7.25	7.25
3	Grants in Capital	43	43.00
4	Grants in aid General	172	172.00
	Total	**989.11**	**989.11**
NEH			
5	Capital	6.94	6.94
6	General	22.5	22.50
	Total	**29.44**	**29.44**
SCSP			
7	Capital	6.12	6.12
8	General	37.5	37.50
	Total	**43.62**	**43.62**
	Grand Total	**1062.17**	**1062.17**

LIST OF ON-GOING RESEARCH PROJECTS

Extramural Projects

S NO	Project Details	PI
1.	Development of technological interventions and enhancement of quality, shelf-life and microbiological safety of traditional meat product- Hyderabadi Haleem	Dr. Suresh K. Devatkal
2.	Enabling technologies in mammalian cell culture towards cultured meat	Dr. Girish Patil, S
3.	Development of rapid immunochomatographic assay kit for field level detection of meat adulteration	Dr. B.M. Naveena
4.	National Agriculture Innovation fund – Agribusiness Incubation Centre (ABI) & Institute Technology Management Unit (ITMU)	Dr. M. Muthukumar
5.	Estimation of carcinogenic and mutagenic compounds in processed meat	Dr. M. Muthukumar
6.	Development of smart packaging nano-sensor for monitoring quality and safety of meat	Dr. Kandeepan G
7.	Exploiting encapsulated nanoparticle conjugated phytochemicals to combat antimicrobial resistance in poultry	Dr. Deepak B. Rawool
8.	DBT Network Programme on anthrax diagnosis and control in India (Multi-Institutional)	Dr. Deepak B. Rawool
9.	Establishment of a consortium for one health to address zoonotic and transboundary diseases in India, including the northeast region (Multi-Institutional)	Dr. S. B. Barbuddhe
10.	Setting – up food testing laboratories – Species and Sex Identification of Meat	Dr. Vishnuraj M. R
11.	Development of food products category monographs (Food-'o'-Copoeia) for foods of animal origin	Dr. Vishnuraj M. R

Institutional Projects

S NO	Project Details	PI
1.	Comparative studies on meat quality and muscle transcriptomic profile of indigenous and commercial chicken	Dr. A. R. Sen
2.	Effect of encapsulated essential oils for enhancing safety and quality of emulsion based chicken meat product.	Dr. Y. Babji
3.	Development of ozone (O3) based decontamination technology for poultry and sheep/goat carcasses	Dr. Suresh K. Devatkal
4.	Development of traceability based quality assurance methods for wholesome meat production	Dr. Girish Patil, S
5.	Development of processes for culturing and differentiation of muscle stem cells in animal derivative free media for cultured meat production	Dr. Girish Patil, S
6.	Implementation of food safety management system (FSMS) and mapping of water and energy consumption in meat processing facilities	Dr. B.M. Naveena
7.	Organic meat production system for sustainable sheep husbandry and promotion of consumer Health	Dr. P. Baswa Reddy
8.	Technological interventions for livelihood enhancement of socially backward people under SCSP	Dr. P. Baswa Reddy
9.	Design and development of portable meat production and retailing facility for sheep and goats, poultry and pigs	Dr. C. Ramakrishna
10.	Studies on Risk analysis of antimicrobial resistance among bacterial food-borne pathogens from broiler chicken farms of Telangana	Dr. L. R. Chatlod
11.	Emerging abattoir-associated occupational zoonoses: A pilot survey and development of rapid screening assay(s)	Dr. Deepak B. Rawool

12.	Development of nanocomposite biodegradable packaging material for meat and meat products	Dr. Kandeepan G
13.	Evaluation of modified atmosphere packaging and a colorimetric indicator for improving the shelf-life of meat and meat products	Dr. Kandeepan G
14.	Quantitative determination of sulphonamide antimicrobial residues in buffalo meat samples using RP-HPLC	Dr. S. Kalpana
15.	Confirmatory analysis of colistin and nitrofuran antimicrobial residues in broiler chicken samples by tandem mass spectrometry	Dr. S. Kalpana
16.	Development of DNA mini-barcodes and high resolution melting (HRM) analysis assay for processed/cooked meat products authentication	Dr. Gireesh Babu P
17.	Impact of meat research on livestock sector development-Role of Public Investment	K. Varalakshmi
18.	Performance study of sheep markets in India	K. Varalakshmi
19.	Impact evaluation of NRCM Technologies and Trainings/ capacity building programmes	K. Varalakshmi
20.	Integrated omics approaches for assessment of meat quality and authenticity	Dr. Rituparna Banerjee
21.	Development and storage stability of poultry slaughter co-products based pet snack/food	Dr. Yogesh P. Gadekar
22.	Amalgamation of information technology with meat technology for quality and safe meat production	Dr. Yogesh P. Gadekar
23.	Development of certified reference material (CRM, as per ISO 17034: 2016) for qualitative determination of animal species in regulatory food/forensic laboratories	Dr. Vishnuraj M. R

Research Highlights

Extramural Research projects

Development of technological interventions and enhancement of quality, shelf-life and microbiological safety of traditional meat product- Hyderabadi Haleem

Principal Investigator: Dr. Suresh Devatkal

Funding Agency: Ministry of Food Processing Industries

Mutton Haleem balls, novel product was developed for further effective utilization of mutton Haleem. These frozen mutton Haleem balls were evaluated for proximate composition and consumer acceptance. Nutritionally, this product contains 8.4 % and 6 % dietary fibre. Consumer ranked the product as highly acceptable.

Enabling technologies in mammalian cell culture towards cultured meat

Principal Investigator: Dr Girish Patil, S.

Co-Principal Investigator: Dr C. Ramakrishna

Funding agency: Department of Biotechnology, New Delhi (Collaborative research project with Centre for Cellular and Molecular Biology, Hyderabad)

Scaffolding is an important aspect of cultured meat production as it provides required shape and texture to the final cell mass. To develop the scaffolds, understanding the structure and composition of the Extracellular Matrix (ECM) is imperative. Reports on extraction and characterization of the sheep (*Ovis aries*) Skeletal Muscle Extracellular Matrix (SSMECM) are scarce. In this study, experiments were undertaken to decellularize sheep skeletal muscle by two methods: sodium dodecyl sulfate (SDS) and trypsin based methods. The decellularized skeletal muscle derived ECM showed white transparent appearance and the DNA content was less than 50 ng/mg. Absence of nuclear material in ECM confirmed using Hematoxylin and Eosin (H & E) analysis and the porous structure was confirmed using Scanning Electron Microscopy (SEM) analysis. The proteomic analysis was undertaken using Sodium Dodecyl Sulfate - Polyacrylamide Gel Electrophoresis (SDS-PAGE) which confirmed the presence of various ECM proteins. The ECM generated was biocompatible for cell culture when used as coating in place of collagen. Myoblasts were able to grow and differentiate muscle cells and finally, the cultured cells were positive for myogenic markers like Pax-7, Myo-D, Myo-G, and MEF2C. In addition, to bring down the cost of cell culture process, filter sterilized sheep serum (SS) was tried in place of Fetal Bovine Serum (FBS) for culturing of myoblasts. It was found that the SS can be used in place of FBS without affecting the growth of the myoblasts.

Cultured meat requires coculturing of myoblasts, fibroblasts and adipoblasts. Towards this target, sheep fat cells, adipoblasts were isolated from the sheep tissue. Adipose tissue was collected from epididymis and bilateral inguinal fat pads of slaughter sheep.

After the cells reach the confluence degree of 50–60%, adipogenicity is induced by incubating in DMEM/F12+ 10% FBS, 0.5mM isobutyl-methyl xanthine, 1μM dexamethasone, 200μM indomethacin and 10 μg/mL insulin. After 2-4 weeks of differentiation, oil red O staining was used for detection of accumulated oil droplets.

Development of rapid immunochromatographic assay kit for field level detection of meat adulteration

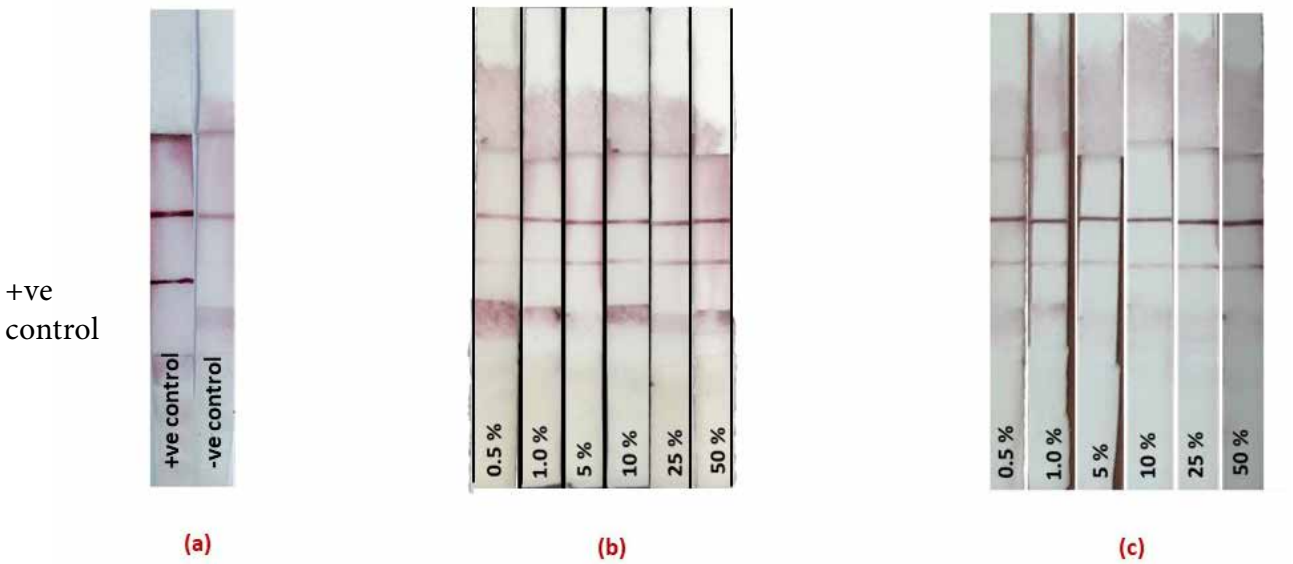
Principal Investigator: Dr. Naveena B. Maheswarappa

Co-Principal Investigators: Dr. S. B. Barbuddhe, , Dr. Rituparna Banerjee

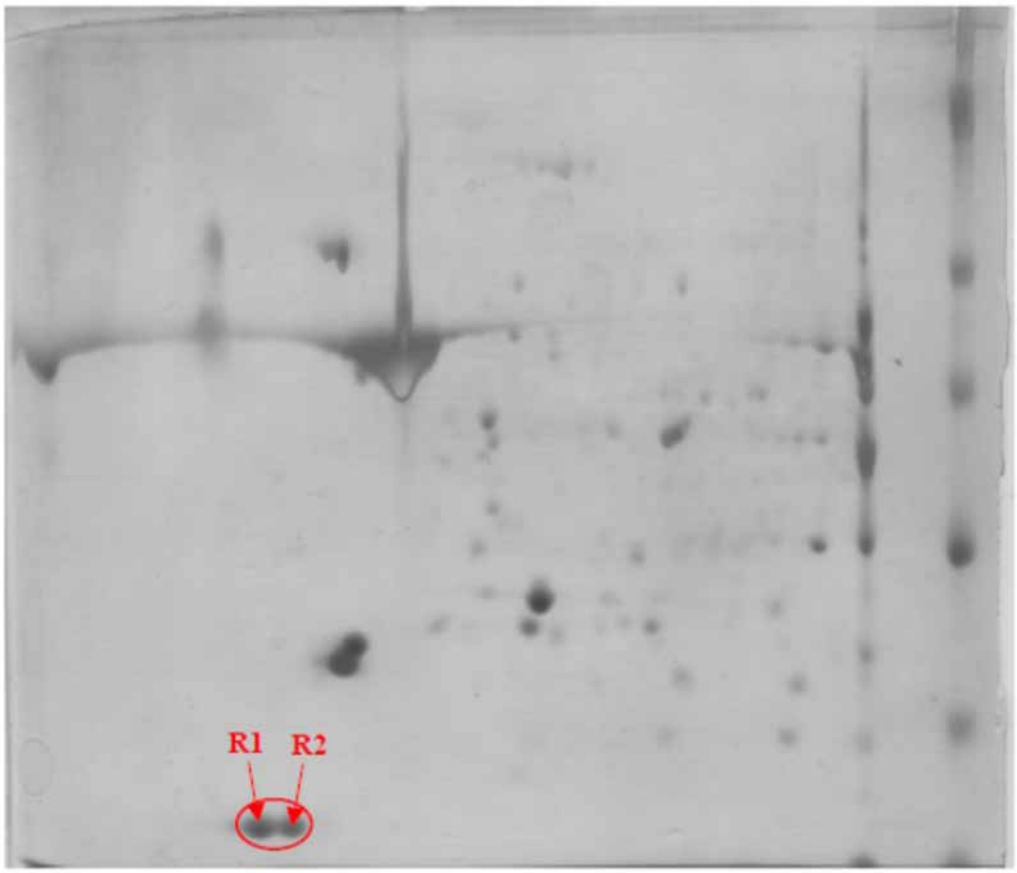
Funding agency: Department of Biotechnology

Developed the gold-nanoparticle-based, sandwich-format lateral flow immunoassay (LFIA) test kit with excellent sensitivity allowing the detection of as low as 0.5 % (w/w) pork in raw and heat-processed meat mix and commercial meat samples within 15 min including sample preparation.

Simple extraction and highly-specific, sensitive, reproducible, reliable and user-friendly LFIA-based rapid detection was performed without relying on any stationary laboratory set-up or well-trained personnel as compared to conventional laboratory-based techniques and was proposed as a complete point-of-care solution for pork authentication.



Representative results of LFIA strips for a) 100% raw pork extract as +ve control and 100% raw buffalo meat extract as -ve control, b) pork adulterated raw buffalo meat extract and c) pork adulterated cooked buffalo meat extract



Representative 2-DE gel of total muscle proteins extracted from raw cooked meat mix containing buffalo: pork (95.5:0.5)

National Agriculture Innovation fund – Agribusiness Incubation Centre (ABI) & Institute Technology Management Unit (ITMU)

Principal Investigator: Dr. M. Muthukumar

Co-Principal Investigators: Dr. Suresh Devatkal, Dr. B. M. Naveena, Dr. Girish Patil, S., Dr. G. Kandeepan, Dr. Rituparna Banerjee and Dr. Vishnuraj M.R.

Funding Agency: Indian Council of Agricultural Research, New Delhi

Under the component I (Institute of Technology Management Unit), the Intellectual properties generated in the institute are being protected through filing patents/copyright. Technologies developed at the Centre are disseminated through participation in various exhibitions/melas. During the year 2021, two patents viz., Portable meat production and retailing facility for sheep and goats and Frozen mutton haleem balls: Novel product and process for the preparation have been filed. Memoranda of Understanding were signed with various universities like Central Agricultural Uni-

versity, Imphal; Kerala Veterinary and Animal Sciences University, Pookode, Wayanad and Nanaji Deshmukh Veterinary science university, Jabalpur, M.P. to conduct collaborative research projects and extension activities.

Under the component II, the ABI Centre has been established with the objects to generate employment opportunities and promote viable enterprises in meat/ poultry processing. Several incubates were admitted to promote entrepreneurship in meat production and processing. Nine training programs were conducted to create awareness and enhance skill development.

i. Details of Intellectual Property Rights

S. No.	Patent Application No.	Year	Technology/ Innovation	Name of Inventor(s)	Date of Filing Complete/ Provisional Spec/ PCT	Status
1.	202111016135	2021	Portable meat production and retailing facility for sheep and goats	Dr. C. Ramakrishna	06.04.2021	Application Awaiting Examination
2.	202111029152	2021	Frozen mutton Haleem balls: Novel product and process for the preparation	Dr. Suresh K. Devatkal	29.06.2021	Application Awaiting Examination

ii. Trainings Conducted during the year 2021

S.No.	Name of the Training	Date	No. of Participants	Revenue Generated (Rs.)
1.	Online training for Master Trainers on Meat and Poultry Processing (PM Formalisation of Micro Food Processing Enterprises (PM-FME) Scheme	4-01-2021 to 07-01- 2021	25	3,19,114
2.	Training conducted for M/s. Meat Hub Incubatees of ABI-NRCM on clean meat production	13-01-2021	3	-
Total		**6,54,154**		

S.No.	Name of the Training	Date	No. of Participants	Revenue Generated (Rs.)
3.	Training on meat processing, branding and marketing	24-02-2021 to 25-02-2021	15	45,000
4.	Entrepreneurship development programme on value added meat products processing	02-03-2021 to 06-03- 2021	16	48,000
5.	Online Training for Master Trainers under PMFME	10-08-2021 to 13-08-2021	5	1,00,000
6.	Entrepreneurship development programme on value added meat products processing	24-08-2021 to 28-08-2021	14	49,560
7.	Entrepreneurship development programme on clean meat production, value addition and quality assurance	09-11-2021 to 13-11-2021	15	50,000
8.	Skill development programme on hygienic meat production	03-12-2021	91	-
9.	Entrepreneurial Skill development in hygienic meat production and small-scale meat products processing	14-12-2021 to 18-12-2021	15	42,480
Total		**6,54,154**		

iii. Contract Research

S. No.	Name of Technology	Name of contracting party	Mode of partnership	Date of Licensing	Revenue (Rs.)
1.	Identification and quality characterization of woody breast and white triping muscle myopathies in slow growing (indbro) and fast growing (white) broiler meat.	Indbro Research & Breeding Farms Pvt. Ltd. Snehapuri colony, Nagole, Hyderabad-500035	Contract	25-08-2021	1,28,266

iv. Consultancy Services Provided

S. No.	Name of Technology/ Know-How	Name of Contracting Party	Mode of Partnership	Date of Licensing	Revenue Generated (Rs.)
1.	Establishment of slaughterhouse for Goat/Sheep	M/s Sowmya Agro Farms, Survey No.166, Medinipur, Siddipet District, Telangana	Consultancy	02-03-2021	57,000
2.	Fabrication of portable meat production and retailing facility (P-MART) for Sheep and Goat	M/s K.S.N. Fabricators Road No.24, Manikchand X Road, Boduppal, IDA Mallapur, Hyderabad	Incubatee	11-05-2021	77,000
3.	Establishment of slaughterhouse for Goat/Sheep	M/s. One Straw Naturals Villa 29, Villa greens, Gandipet district, Telangana	Consultancy	15-06-2021	57,000
4.	Establishment of value-added meat products processing (Renewal)	M/s. Deccan Star Foods and Logistics, Dubbathanda, Miryalaguda, Nalgonda district, Telangana	Incubatee	15-09-2021	32,450
5.	Establishment of poultry processing unit	M/s. Meat Maestro Private Limited Legend 3 Apartments, Street No. 17, Himayathnagar, Hyderabad	Consultancy	05-10-2021	66,900
6.	Establishment of slaughterhouse for Goat/Sheep (Renewal)	M/S AKMACS Ltd 14-2-154, Chansanwadi, Goshamahal, Hyderabad	Consultancy	02-12-2021	32,450
Total		**3,22,800**			

v. MoUs with Universities

S. No.	Date	Name of the Firm	Type of Agreement
01.	18-2-2021	Central Agricultural University, Imphal	Collaborative research and Extension
02.	11-5-2021	Kerala Veterinary and Animal Sciences University, Pookode, Wayanad	Collaborative research and Extension
03.	9-8-2021	Nanaji Deshmukh Veterinary science university, Jabalpur, M.P	Collaborative research and Extension

ICAR-NRC on Meat released the pork detection kit and signed the MoU for technology licensing with MR Labs, Hyderabad

Dr. B.N. Tripathi, DDG (Animal Sciences) and Dr. Amrish Kumar Tyagi, ADG (AN & P) released the *"Immunochromatography-based pork detection kit"* (IPDK) on 23rd October, 2021. The kit is 100% field deployable starting from sample extraction till interpretation of results and the test can be completed within 15 min. The developed kit is highly sensitive (0.5 % w/w), species-specific and does not require any specialized laboratory set-up, refrigerated storage or skilled manpower.

Dr. S.B. Barbuddhe, Director NRC on Meat signed the MoU for licensing of technical know-how for pork detection kit with M/s. MR Labs, Hyderabad in the presence of Hon. DDG (AS). The kit was developed under the Department of Biotechnology funded project *"Development of rapid immunochromatographic assay kit for field level detection of meat adulteration"*. Dr. Naveena. B.M., Pr. Scientist & PI, Dr. Rituparna Banerjee, Scientist & Co-PI and Dr. S.B. Barbuddhe, Director & Co-PI acted as team members for developing the kit.

DDG (AS) released the pork detection kit

Director, NRC on Meat signed MoU with MR Labs, Hyderabad

Exchange of Memorandum of Agreement with M/S. One Straw Naturals for Establishment of Slaughterhouse for Goat and Sheep

Exchange of Memorandum of Agreement with M/S. K.S.N Fabricators for fabrication of portable meat production and retailing facility (P-MART) for Sheep and Goat

Entrepreneurship Development Program on Value added meat products processing conducted from 02-06th March, 2021

Estimation of carcinogenic and mutagenic compounds in processed meat

Principal Investigator : Dr. M. Muthukumar

Co-Principal Investigator : Dr. Rituparna Banerjee

Funding agency: FSSAI, New Delhi

A study was carried out to identify and quantify the levels of polycyclic aromatic hydrocarbons (PAHs) in smoked meat products (166 samples) viz., smoked beef (22), smoked chicken (28), smoked pork (24) from the North-Eastern (NE) region, smoked (tandoor) chicken (29) from the North region and smoked (tandoor) chicken (63) from the Southern region of India. The levels of polycyclic aromatic hydrocarbons (PAH)were analyzed on Acquity UPLC coupled with Mass spectrometer using APCI + ion mode MS detector.

Analysis of 166 market meat products samples for the levels of PAHs revealed that the carcinogenic PAH compound - Benz(a)pyrene was detected in 27 out of the 166 (16.27%) samples. The other compounds viz., Benzo (b) flouranthene, Benzo (k) flouranthene, Indeno (1, 2, 3-cd) pyrene, Dibenzo (a, h) anthracene, Benzo (g, h, i) perylenewere found in 9.04 to 69.8 % samples at varying levels (25.21 to 111.97 ppb). Among these, smoked chicken from North-eastern region showed highest concentration of all PAH compounds (39.45 to 383.98 ppb), whereas, chicken kebabs collected from Southern region showed lowest concentration of PAH compounds (0 to 47.28 ppb). Few PAH compounds viz., Benzo (b) flouranthene, Benzo (k) flouranthene, Indeno (1,2,3-cd) pyrene, Dibenzo (a, h) anthracene, Benzo (g, h, i) perylene were found to be absent in samples sourced from Southern region and were found below the quantification level in samples from Northern region. The benzo (a) pyrene was not detected in any of the tandoori chicken kebabs sourced from Southern region and was found in only 2 out of samples collected from Northern region at concentartion (27.09±6.89 ppb) higher than the prescribed level (for benzo (a) pyrene- 2 ppb) by EU Commission Regulation (EU, No. 835/2011).

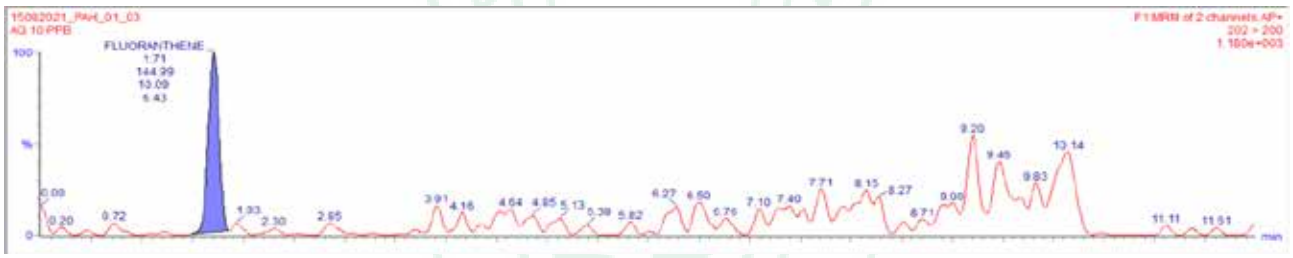
Out of 22 smoked beef samples, 24 smoked pork samples and 28 smoked chicken samples collected from north-eastern region, the percentage of samples found to be positive for benzo (a) pyrene compounds were 40.91, 33.33 and 28.57 % and the mean concentration was found to be 35.63± 2.81 ppb, 35.529.41± ppb and 114.8244.60± ppb, respectively. Among the products, the highest PAH concentration was found in following order: smoked chicken >smoked beef >smoked pork>Tandoori chicken kebab.

Table 1: Levels (ppb) of various PAHs compounds in processed meat products samples (Total 166 samples)

Compound Name	North Eastern Region			Northern Region	Southern Region	Overall Mean value
	Smoked Beef (22)	Smoked Chicken (28)	Smoked Pork (24)	Smoked (tandoori) chicken (29)	Smoked (tandoori) chicken (63)	
Fluoranthene	123.29 ± 24.01 (86.36)	209.28 ± 67.64 (100)	163.36 ± 40.58 (75)	48.09 ± 8.37 (68.97)	28.49 ± 4.01 (49.21)	111.97 ± 19.00 (69.87)
Chrysene	121.59 ± 23.21 (59.09)	123.63 ± 44.73 (96.43)	83.62 ± 23.42 (66.67)	92.69 ± 11.28 (79.31)	37.85 ± 6.64 (23.81)	95.36 ± 14.66 (54.82)
Benz[a] anthracene	92.88 ± 19.69 (77.27)	383.98 ± 119.78 (28.57)	138.84 ± 32.70 (37.50)	71.46 ± 10.46 (72.41)	47.28 ± 4.56 (39.68)	107.29 ± 16.81 (48.19)
Benzo[b] fluoranthene	29.71 ± 2.68 (40.91)	106.35 ± 43.73 (28.57)	38.48 ± 10.47 (29.16)	11.61 ± 1.55 (6.90)	0	54.27 ± 14.92 (15.66)
Benzo[a]pyrene	35.63 ± 2.81 (40.91)	114.82 ± 44.60 (28.57)	35.52 ± 9.41 (33.33)	27.09 ± 15.63 (6.89)	0	58.43± 14.80 (16.26)
Benzo[k] fluoranthene	63.99 ± 7.63 (40.91)	151.11 ± 55.01 (28.57)	46.63 ± 11.19 (37.50)	100.45 (3.44)	0	85.37 ± 18.30 (16.27)

Indeno [1,2,3-cd] pyrene	17.09±2.03 (36.36)	54.28±14.79 (14.29)	14.67±1.53 (12.50)	0	0	26.52 ± 5.81 (9.04)
Benzo[g,h,i] perylene	19.74 ± 2.48 (36.36)	43.69 ± 9.57 (14.29)	13.81 ± 1.46 (16.67)	42.77 (3.44)	0	25.33 ± 3.79 (10.24)
Dibenz [a,h] anthracene	18.75 ± 2.44 (36.36)	39.45 ± 9.32 (14.28)	13.02 ± 2.19 (8.33)	44.31 (3.44)	0	25.21 ± 3.90 (9.04)

* Value in parentheses indicate percentage of positive samples



Standard Chromatogram for Flouranthene at 10ppb by LC-MS

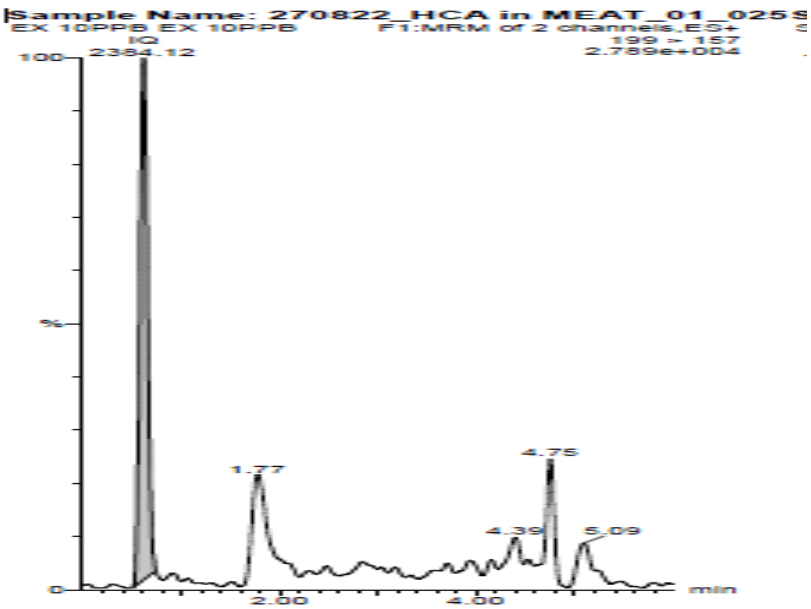
Identification and quantification of Heterocyclic Amines (HCA)

A total of 137 samples collected from the Northern (56 samples) and the Southern (81 samples) region of India were analysed to identify and quantify the levels of heterocyclic amines (HCA) in processed meat products. The levels of Heterocyclic Amines (HCA) were analyzed on Acquity UPLC coupled with Mass spectrometer using ESI + ion mode MS detector. Various HCA compounds viz., 2-amino-1-methyl-6-phenylimidazo[4,5-b] pyridine (PhIP),2-amino-3-methylimidazo quinolone (IQ),2-amino-3, 4-dimethylimidazo quinolone (MeIQ) and 2-amino-3, 8-dimethylimidazo quinoxaline (MeIQx), were identified by comparing retention times and mass spectra of unknown peaks with those of reference standards. Thus, the current study revealed that the level of HCA compounds PHIP and MEIQX were found to be below the level of quantification in both southern and northern region but imidazo quinolone (IQ) (21.17 % samples) and methylimidazo quinolone (MeIQx) (2.19% samples) were found at a level of 1.04 to 1.71 ppb.

Table 2: Concentration of individual components of HCAs among different varieties of processed meat samples (Total 137 samples)

Compound name	Northern Region (56 samples)	Southern region (81 samples)	Mean concentration (137 samples)
2-amino-1-methyl-6-phenylimidazo [4,5-b] pyridine (PhIP)	BQL	BQL	BQL
2-amino-3-methylimidazo quinolone (IQ)	1.44 ± 0.14 (41.07%)*	1.04± 0.19 (7.41%)*	1.36± 0.12 (21.17%)*
2-amino-3, 4-dimethylimidazo quinolone (MeIQ)	BQL	BQL	BQL
2-amino-3, 8-dimethylimidazo quinoxaline (MeIQx)	1.71 ± 0.56 (3.57%)*	1.49 (1.24%)*	1.64± 0.33 (2.19%)*

* Percentage of positive samples



Standard Chromatogram for IQ

Development of smart packaging Nano-sensor for monitoring quality and safety of meat

Principal Investigator: Dr. Kandeepan G

Co-Principal Investigator: Dr. Suresh Devatkal and Dr. Vishnuraj M. R.

Funding agency: Department of Biotechnology, Govt.of India

A research project was undertaken to develop a smart packaging sensor for detecting freshness and temperature abuse of meat during refrigerated and frozen storage conditions in supply chain. A ready to use strip made of anthocyanin-gold-curcumin nanocomposite was used as on-package sticker type freshness sensor in chicken meat packaged in polypropylene trays with polypropylene over wrap. The samples were stored in the refrigerator (4±1°C) and the response of the strip-type indicator with the volatile amines released from chicken meat was studied. Different meat quality and safety parameters were analyzed at suitable intervals to correlate the colour change in indicator sensor at refrigeration (4±1°C) storage. The results indicated that the color of the strip-type indicator changed from dark pink to whitish pale pink to bluish during the storage period with ΔE declining significantly from 39.79 to 18.53. The rate of discoloration increased as the concentration of volatile amines released from chicken meat increased from 6.46mg% to 26.16mg% during the progressive storage period. Simultaneous determination of quality parameters like total volatile basic nitrogen, free amino acid, tyrosine value, ammonia and pH in chiller stored chicken meat showed a significantly elevated levels of 22.59mg%, 43.08mg%, 4.36mg%, 18.84mg% and 5.94, respectively causing onset of deterioration of meat quality from day7.

A sticker type temperature abuse sensor (TAS) was developed by optimizing the levels of enzyme-substrate (Laccase-Guaiacol) and Copper nanoparticle. The ready to use indicator was attached to packaged frozen (-18±1°C) chicken meat and subjected to different temperature abuse conditions i.e. 0±1°C, 5±1°C, 10±1°C and refrozen to -18±1°C. The TAS based on Laccase-Guaiacol-Copper nanoparticle complex changed from colorless to light brown, then light brown to brown and finally brown to dark brown color. The color changes were irreversible. These color changes indicated the deterioration in meat quality and safety as a result of temperature abuse. The simultaneous analysis of pH, drip loss, extract release volume, total volatile basic nitrogen, instrumental color, total plate count, psychrophilic count, yeast and mold count and various sensory attributes indicated that the changes in quality parameters were well comparable with the color change in the TAS. The brown TAS color indicated moderate thawing of the frozen chicken meat while final dark brown TAS color indicated high temperature exposure and frozen chicken meat was extremely thawed.

Thus, anthocyanin-gold-curcumin nanocomposite based strip-type sensor can be successfully used for real-time monitoring of quality and safety of refrigerated chicken meat. The sticker-type sensor made up of laccase-guaiacol-copper nanocomposite coated onto nitrocellulose membrane can be used for detecting thawing in frozen meat.

Color change in sticker-type meat freshness sensor (anthocyanin-curcumin-gold nanocomposite) during refrigerator storage (0,3,5,7 & 9 days) of chicken meat

Chicken meat and Temperature Abuse Sensor (TAS) subjected to different temperature fluctuations during frozen storage. (-18±1°C to 0±1°C, 5±1°C, 10±1°C & refrozen to -18±1°C)

Exploiting encapsulated nanoparticle conjugated phytochemicals to combat antimicrobial resistance in poultry

Principal Investigator: Dr. Deepak B. Rawool

Co-Principal Investigator: Dr. Girish Patil and Dr. B. M. Naveena

Funding agency: ICAR (National Agricultural Science Fund – NASF)

The project aims to identify specific phytochemicals conjugated and/or encapsulated using appropriate nanoparticles and polymer for their targeted delivery against multi-drug resistant (MDR) pathogens (*E. coli* and non-typhoidal *Salmonella*) in poultry.

The green synthesis of silver nanoparticles (Ag NPs) was performed using culture- free supernatant of decline phase culture of the probiotic strains, *Lactobacillus acidophilus* MTCC 10307 and *L. plantarum* MTCC 1407. The synthesized AgNPs with least MIC values *i.e.*, 0.10 M $AgNO_3$ with *L. acidophilus* (9:1) was optimally selected for further characterization and antimicrobial assays. In order to assess the changes in weight in relation to changes in temperature and thermal stability, differential thermal analysis (DTA)/ thermogravimetric analysis (TGA) was performed. A weight loss of 15 % up to 200°C with an intense exothermic peak between 150°C and 200°C was observed in TGA-DTA. The results indicated that a complete thermal decomposition and crystallization of the sample occurred simultaneously which is suggestive of thermal stability.

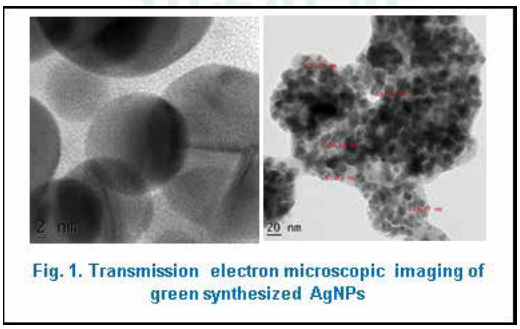


Fig. 1. Transmission electron microscopic imaging of green synthesized AgNPs

Aggregated nanoclusters were observed in SEM; however, the TEM imaging of AgNPs revealed a spherical morphology and crystalline nature with an optimum size of 15.152 nm (Fig. 1). The MIC values of green synthesized AgNPs against MDR- EAEC and non-typhoidal *Salmonella* strains ranged from 7.80 µM to 31.25 µM, respectively, while the MBC values were found to be twice the MIC levels. Further, the green synthesized AgNPs exhibited potential antioxidant activity by ABTS

(2,2′-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) and ferric reducing antioxidant power (FRAP) assays.

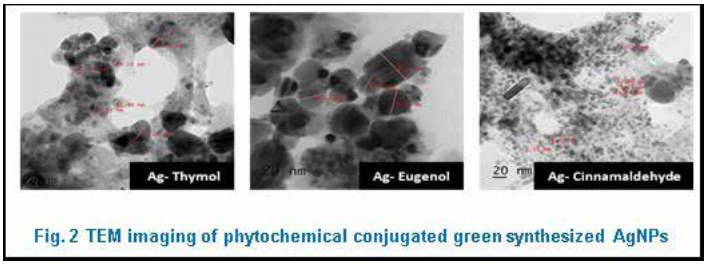


Fig. 2 TEM imaging of phytochemical conjugated green synthesized AgNPs

The identified and shortlisted phytochemicals (thymol, carvacrol, eugenol and cinnamaldehyde) were then conjugated with the green synthesized AgNPs and confirmed by Fourier- transform infrared spectroscopy (FTIR) analysis by surface functional group analysis. The FTIR spectra inferred that the conjugation of phytochemicals *viz*., thymol, eugenol and cinnamaldehyde has changed the surface functional group of green synthesized AgNPs indicating conjugation with AgNPs. The sizes of conjugated AgNPs determined by TEM imaging ranged between 10-40 nm (Fig 2).

Moreover, the conjugated Ag NPs were found to be safe as determined by haemolytic assay and variably stable when subjected to high- end temperatures (70°C; 90°C), cationic salts (150 mM NaCl and 2 mM $MgCl_2$), enzymes (lysozyme, proteinase- K and trypsin) and pH (4.0, 6.0, and 8.0). The loading efficiency of the phytochemical- conjugated AgNPs ranged from 16 to 30%; further, to achieve targeted delivery the phytochemical conjugated AgNPs were encapsulated using Chitosan-Alginate polymers and its further *in vitro* release kinetics studies are in progress.

Network Programme on Anthrax Diagnosis and Control in India (Multi-Institutional)

NRCM Component: Development of Latex agglutination test for detection of *Bacillus anthracis* spores in animal feed supplements and soil samples

Principal Investigator: Dr. Deepak B. Rawool

Co-Principal Investigator: Dr. S. B. Barbuddhe and Dr. P. Baswa Reddy

Funding agency: Department of Biotechnology (DBT)

The detection of *Bacillus anthracis* in limited laboratory resource settings is quite difficult. In this research project, we aim to develop and evaluate a synthetic peptide derived polyclonal and/or monoclonal antibody based latex agglutination test (LAT) for rapid detection of *B. anthracis* spores from the animal feed supplements and soil samples. We believe that the developed assay will serve as an important screening tool for rapid detection of *B. anthracis* spores under limited resource settings. Secondly, we intend to employ this assay for detection of *B. anthracis* spores in soil samples as soil serves as an important reservoir for this pathogen. Further, the developed assay can also be used for screening of animal feed supplements.The existing BIS protocols (modified version) for detection of *B. anthracis* spores requiring BSL-3 facilities are quite laborious, time consuming, and need sophisticated equipments for feed analysis.

The project has been implemented in the month of September, 2021 and the manpower (JRF) rcruitement, purchase of equipments and research consumables is under progress. Also, four virtual mode review meetings with PMU Anthrax, Hisar has been organized to discuss the progress of the project.

Establishment of a Consortium for One Health to address Zoonotic and Transboundary Diseases in India, including the Northeast Region (Multi-Institutional)

NRCM Component: Pan India surveillance of foodborne (*Listeria* and *Salmonella*) pathogens

Principal Investigator: Dr. S. B. Barbuddhe

Co-Principal Investigator: Dr. Deepak B. Rawool, Dr. Laxman Chatlod, Dr. Yogesh Gadekar and Dr. Vishnuraj M. R

Funding agency: Department of Biotechnology (DBT)

Zoonotic and transboundary animal diseases impose a huge pecuniary burden on any nation, but particularly on lower- and middle-income countries, including India. The project envisages carrying out surveillance of important bacterial, viral and parasitic infections of zoonotic as well as transboundary pathogens in India, including the Northeast, through the use of existing diagnostic tests, and the development of additional methodologies when required, for the surveillance and for understanding the spread of emerging diseases. In this project, a consortium of infectious disease and public health researchers will be set up to initiate a One Health programme with the ultimate objective of establishing inter-sectoral collaborations among veterinary, medical, agricultural, environmental, forestry, meteorological and other areas to detect, prevent and control zoonoses and TADs. For this, a number of partnering institutions/organizations, including seven institutions/organizations and eight disease investigation laboratories from the North-eastern region and ten institutions/organizations from outside the northeast, will work coherently to initiate and/or improve surveillance of select diseases, and initiate mechanisms to establish border posts to detect and control the entry of pathogens and their reservoirs, especially those of ruminants and swine. It is also proposed to address disease forecasting as well as mitigation strategies while preparing standard operating procedures (SOPs) for preparedness to tackle specific diseases.

The project has been implemented. As per the action plan prepared, uniform SOPs were prepared for detection of targeted pathogens and preparation of sampling plan for collection of samples is in progress. At NRCM, JRF and SRF have been recruited, and purchase of equipments and research consumables is in underway. NRC on Meat has been given the responsibility to perform Pan India surveillance of foodborne (*Listeria* and *Salmonella*) pathogens.

Setting – up Food Testing Laboratories – Species and Sex Identification of Meat

Principal Investigator: Dr. Vishnuraj M. R

Funding agency: MoFPI through ICAR

Under the FTL project, ICAR-National Research Centre on Meat, Hyderabad has completed three years of NABL Accreditation status with ISO/IEC 17025: 2017 and now completed Desktop Sur-

veillance, 2021. The grant of accreditation (TC-7992) of MSIL is for a period of two years from 19/10/2020 to 18/10/2022. Currently the institute is accredited for three scopes including a) Molecular Biomarker Analysis (DNA) for Animal species identification (comprising of cattle, buffalo, sheep, goat, pig, horse, yak, mithun, camel, rabbit, chicken & turkey), b) Molecular Biomarker Analysis (DNA) for Wildlife meat species identification, c) Halal compliance through detection of porcine DNA in meat and meat products. Satisfactorily completed proficiency testing in 'Lamb Authenticity' from Fera science Ltd, UK during September 2021.

One of the notable research achievements include the development of novel molecular quantification technique using Droplet Digital PCR to tackle buffalo adulteration in traditional meat products. This was achieved using in-house designed primers targeting the single copy nuclear gene Melanocortin 1 receptor of buffalo. At first, regression models were generated connecting buffalo meat weight to the DNA extracted and secondly between the DNA weight and copy number of target gene. The applicability of this regression was evaluated with real-world comminuted meat products like Haleem. Qualitatively, real-time PCR assays were standardized using the same primers evaluated for highly processed and cooked meat product samples. This assay was investigated and found suitable to detect and quantify substitution of buffalo ghee in cow ghee and buffalo milk in cow milk. The proposed assay can support the regulatory frame work of FSSAI in tackling the vulnerability in animal derived products associated with economically derived food frauds.

Another assay for species-specific simultaneous detection of sheep and goat mislabeling using duplex touchdown PCR has been developed. This is achieved using a set of common forward primer and species-specific reverse primers targeting the mitochondrial cytochrome B *(cytb)* gene of both sheep and goat. The applicability of the assay was evaluated on samples procured from local retailers, which revealed a 50% mislabelling among the two species.

Development of Food products category monographs (Food-'o'-Copoeia) for foods of animal origin

Principal Investigator: Dr. Vishnuraj M. R

Funding agency: FSSAI

Under this project, we have prepared several monographs for meat and meat products as well as for egg and egg products, covering all the essential aspects of food safety and product content limits. The monographs contain the appropriate definition of the product along with general parameters like moisture content, fat content, carbohydrate content, ash content etc. The monographs also provide detailed information on the limits of antibiotics, pesticides/insecticides, heavy metals and NOTs, up to how much they are allowed to be in a food product (in case of meat & meat products; egg & egg products). The limits are also classified according to different organs (offal) and have been provided separately. Further, the process hygiene criteria and food safety criteria limits for microbial organisms have been appropriately classified and provided. In order to make the monographs clearer for the end users (i.e., the food business operators) the monographs have been created in a well-structured manner along with test-methods, Indian standard details and HS codes for import and export purposes. Under the project, we have identified the requirement of 42 monographs, out

of which 18 are for various fresh, chilled and frozen meat; 8 for meat products; 16 for egg and egg products.

Institutional Research Projects

Comparative studies on meat quality and muscle transcriptomic profile of indigenous and commercial chicken

Principal Investigator: Dr. A. R. Sen

Co-Principal Investigator: Dr. Suresh Devatkal, Dr. B.M. Naveena, Dr. M. Muthukumar

Dr. T. K. Bhattacharya, Dr. S. Jayakumar, Dr. S. Mishra, Dr. G. Patra

The study aimed to determine the carcass and meat quality of different native breeds (Aseel and Kadaknath) based on the slaughter age viz.14, 18, 21 and 24 weeks. The meat quality was also compared with commercial broiler chicken and slow growing broiler meat. In Aseel, slaughter weight significantly increased upto 21st week and then reduced the growth rate. The giblet % reduced with increased age of birds. The carcass yield % varied from 66.35 to 72.39% and was noted to be higher in 21st week of age. The leg yield % was more at 24th week of age and breast yield % also showed the similar trend. The total meat % was also observed to be more in 24th week of age. The carcass yield % in Kadaknath birds varied from 65.25 to 69.96% and no much difference was found in higher age group birds.

The initial and ultimate pH values measured in the breast muscle of both the native breeds increased with the increasing age. The mean values of cook loss was highest in young groups and it reduced with increasing age. The water holding capacity % was significantly higher upto 21st week of age and reduced at 24th week of age of Aseel birds. The redness (a*) value of Aseel breast meat increased significantly ($P<0.05$) with increasing age. However, the redness value of Kadaknath breed reduced upto 21st week and significant ($P<0.05$) increase was observed at 24th weeks of age. A significant higher shear force value was noticed in older age group than the young ones in both the breed. The sensory tenderness and overall acceptability was rated higher at 21st week of age. Though the tenderness was acceptable at 24th weeks of age, it was best rated at 21st week of age both in Aseel and Kadaknath breed. It is concluded that variation exists among different native breeds of chicken and their ages. This study recommend the slaughter age at 21st weeks of age for the native breeds studied optimizing retail cuts and considering several meat quality characteristics.

Effect of age on colour change of breast meat of Kadaknath native birds

Colour traits	14th week	18th week	21st Week	24th Week
L*	33.91 ±3.87c	41.33 ±4.14b	45.91 ±2.90a	44.05 ±3.74a
a*	1.18 ±0.25d	0.81 ±0.06c	1.01 ±0.10b	2.60 ±0.04a
b*	3.05 ±0.81c	4.71 ±1.22b	6.21 ±0.80a	4.11 ±0.53b
Hue	75.38 ±6.50a	78.37±3.21a	78.9 6±8.47a	55.25 ±4.72b

Colour traits	14th week	18th week	21st Week	24th Week
Chroma	3.49 ±0.06 c	4.82 ±0.49 b	6.34 ±0.61 a	6.34 ±0.69 a

Means with different superscript (Row wise) differ significantly (P<0.05) Hue-tan^{-1}b*/a*, Chroma-Root a*^{2}+b*^{2}

Carcasses of Aseel and Kadaknath slaughtered at different age

Effect of encapsulated essential oils for enhancing safety and quality of emulsion based chicken meat product

Principal Investigator: Dr. Y. Babji

Co-Principal Investigators: Dr. G. Kandeepan G, Dr. S. Kalpana, Dr. P. Baswa Reddy

Emulsion based chicken nuggets were prepared using a formula consisting of (a) lean chicken meat: 70%=700g, (b) ice/chilledwater:10%=70g, (c)vegetableoil;10%=70g, (d) condiments:3.5%=25g, (e) refined wheat flour/maida:3.3%=23, (g) spice mix:1%=7, sodium pyrophosphate 0.4% (2.8 g, and salt 1.5%)= 10.5 g. From the point of view of sensory evaluation, both control and 0.1% cinnamon treated (0.1% microencapsulated cinnamaldehyde EO) chicken nuggets were highly acceptable. Though, the cinnamon treated chicken nuggets exhibited cinnamon odour, these nuggets were acceptable to the panellists. The yield of the control was 95 % whereas the yield of the treatment was 97.5 %.

The control nuggets showed a little over 2.0 log per gram aerobic plate counts of meat product, whereas, the 0.1 % cinnmaldehyde essential oil treated nuggets showed a decrease in aerobic plate counts by 0.5 to 0.75 logs / gram. Treatment of chicken nuggets with microencapsulated cinnamldehyde essential oil reducedthe aerobic plate counts by acting as a bacteriostatic and bactericidal agent in the meat products preservation. Pathogenic bacteria such as *E. coli, Salmonella, Listeria*

and *Staphylococcus aureus* counts neither in treated and control nugget samples during refrigerated storage.

Development of Ozone (O_3) based decontamination technology for poultry and sheep/goat carcasses

Principal Investigator: Dr. Suresh Devatkal

An environmentally friendly disinfectant, ozone was studied as a natural decontaminating agent for poultry and sheep/goat carcass.

The efficacy of 0.3 ppm aqueous ozone was evaluated against pure culture of bacteria isolated from a meat source. The ozone was generated in a pilot scale unit customized for meat decontamination studies. A known quantity of bacterial stock solution (approx., log 8 cfu/ml) was suspended in sterile distilled water (1:10 ratio) and aqueous ozone was introduced into this solution. Samples were removed at 0, 0.5, 1, 2, 4, 8 min intervals and plating was carried immediately after the end of each interval. Survival bacterial counts were calculated for estimating the log reduction. To measure the ozone level dissolved in water a colorimetric (indigo method) method was used.

Ozone Unit

Development of traceability based quality assurance methods for wholesome meat production

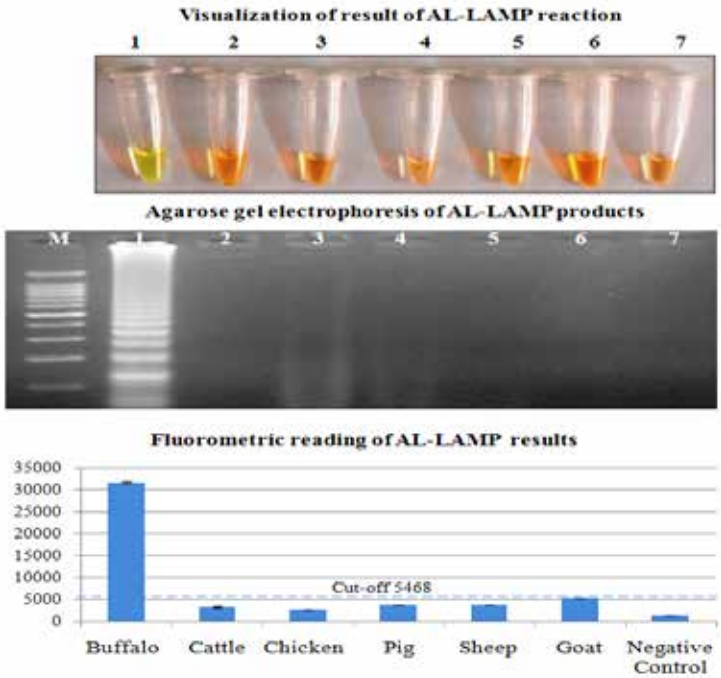
Principal Investigator: Dr. Girish Patil, S.

Co-Principal Investigators: Dr. C. Ramakrishna, Dr. Gireesh Babu P. and Dr. S. B. Barbuddhe

The project aimed to develop a national level policy for establishment of system for implementation of traceability in meat value chain. In this direction, interactions were held with various stakeholders and policy makers on requirements for establishing buffalo meat traceability. Two meetings were held with officials of Department of Animal Husbandry and Dairying, GoI. A National workshop on "Meat Traceability Recall: From Concept to Practice" was organized by ICAR-National Research Centre on Meat, Hyderabad in collaboration with Department of Animal Husbandry and Dairying, Govt of India on 22nd October, 2021. The officials of DAHD, APEDA, ICAR and stakeholders from meat sector participated in the programme. A policy paper on "Traceability system for Indian Meat Sector: Concept and way forward" was released on the occasion. The deliberations of the workshop paved the way for developing road map for development of meat traceability in India.

AL-LAMP assay for rapid and on-site authentication of buffalo (*Bubalus bubalis*) meat

In the present study, a rapid assay for authentication of buffalo meat was developed by employing Alkaline Lysis (AL) method of DNA extraction and Loop-mediated Isothermal Amplification (LAMP) using novel primers designed to target mitochondrial D loop region. The results of the AL-LAMP assay were visualized by SYBR Green I dye. Further, the LAMP amplification was confirmed by agarose gel electrophoresis and fluorometry. The developed AL-LAMP assay was validated using raw, heat treated and admixed/ adulterated buffalo meat samples. The AL-LAMP assay required just 120 min and could be carried out with minimum instrumentation. Hence, the technique holds potential for use as on-site assay for species authentication of buffalo meat.



Buffalo specific AL-LAMP assay based on visualization of colour, agarose gel electrophoresis and fluorometric detection of reaction products in different meat animal species. 1) Buffalo; 2) Cattle; 3) Chicken; 4) Goat; 5) Sheep; 6) Pig; 7) Negative control; M)100 bp ladder

Development of processes for culturing and differentiation of muscle stem cells in animal derivative free media for cultured meat production

Principal Investigator: Dr. Girish Patil, S.

Co-Principal Investigators: Dr. C. Ramakrishna and Dr. Gireesh Babu P.

Standardization of isolation and culturing of chicken myoblasts

Chicken embryo of 10 to 14-day old were used for isolation of the myoblasts. The myoblasts were extracted by following standards protocol. After isolation, myoblasts were incubated at 37 °C under 5% CO_2 and 25% humidity for multiplication.After reaching 80% confluence culture medium

was replaced with fusion medium (DMEM/FI2 + 2% Horse serum + 1X Penstrep) and cultured for 7 days at 37 °C (5% CO_2 and 25% humidity) for formation of myotubes.

(a) 0 day **(b) 1st day** **(c) 3rd day**

Myoblasts extracted from chicken embryo visualized under microscope

Implementation of Food Safety Management System (FSMS) and mapping of water and energy consumption in meat processing facilities

Principal Investigator: Dr. B. M. Naveena

Co-Principal Investigators: Dr. M. Muthukumar; Dr. Suresh Devatkal

Portable water flow meters were installed on the plant's plumbing system to collect water flow data from September 2020 to October 2021. Under standard primary poultry processing conditions including steps like scalding, defeathering and screw-chilling carried out at semi-automatic poultry processing plant of NRC on Meat, our findings indicated an average water consumption of 11.83 litres/bird or 8.45 litres/kg dressed carcass. However, slaughter without scalding, defeathering and screw-chilling steps wherein skin and feathers are manually removed and no screw-chilling was practiced, a significantly ($P<0.05$) lower water consumption of 4.71 litres/bird or 3.36 litres/kg dressed carcass was observed. Secondary processing of chicken and mutton into different value added meat products revealed an average consumption of 30.7 and 51.2 litres/kg finished product, respectively. Current study has identified the scalding, defeathering and screw-chilling steps in primary poultry processing as hot-spots and suggest to develop automation of skin along with feather removal steps as a water efficient poultry processing step.

Organic meat production system for sustainable sheep husbandry and promotion of consumer health

Principal Investigator: Dr. P. Baswa Reddy

Co-Principal Investigators: Dr. D.B.V. Ramana, Dr. Pankaj, Dr. C. Ramakrishna, Dr. M. Muthukumar

A project on "organic meat production system for sustainable sheep husbandry and promotion of consumer health" is being carried out in collaboration with ICAR-CRIDA at Hayatnagar Research Farm CRIDA. Under this project, certified organic fodder is being produced in an area of 0.8 hec-

tares for feeding to the sheep under organic system. Organic fodder of CO-4, hedge lucerne, stylo, subabul are produced under organic production guidelines as per NPOP requirements. Organic certification of fodder has been carried out through APEDA accredited certifying agency 'Aditi organic certification Pvt Ltd, Bengaluru. After due inspection and auditing, organic scope certificate for the year 2021-22 has been awarded for the fodder as per the NPOP standards of India.

Utilizing the certified fodder, Deccani sheep are reared as per NPOP organic standards and the animals were certified for organic compliance by accredited certifying agency.

After attaining the slaughter weight, representative animals from organic certified unit and also from non-certified regular flock were slaughtered at experimental abattoir of ICAR-NRC on Meat to study the carcass characteristics and meat quality parameters. Value added meat products were prepared from oranic and non-organic meat and they were evaluated for their organoleptic characters by expert panellists as well as regular meat consumers.

In the next stage, the Deccani sheep flock was replaced with Nellore brown sheep procured from the farmers to study their performance under organic production system. The Organic certification process for Nellore brown sheep is in progress.

Carcass characteristics of Organic and non-organic sheep

Carcass traits	Non Organic	Organic
Animal Wt Before slaughter	22.73	30.1
Hot Carcass	10.42	14.55
Chilled Carcass Weight	9.9	13.72
Dressing Percentage on Live wt.	45.84	48.34
Dressing Percentage on Empty Body wt.	55.54	56.18
Chilling loss (%)	4.99	5.7

Sensory Evaluation of Organic and Non-organic value added meat products

Product	Organic/Non Organic	App/ Color	Flavor	Saltiness	Juiciness	Text/ Crisp	Over-all accept-ability
Mutton Meat Balls	Non Organic	6.97	7	6.63	6.88	6.84	6.91
Mutton Meat Balls	Organic	7.13	7.13	6.78	7	7.03	7
Mutton Nuggets	Non Organic	7.31	7.06	6.78	6.89	6.89	7
Mutton Nuggets	Organic	7.25	7.33	7.19	7.25	7.25	7.44
Mutton Kebabs	Non Organic	6.79	6.83	6.46	6.25	6.42	6.83

Product	Organic/Non Organic	App/ Color	Flavor	Saltiness	Juiciness	Text/ Crisp	Over-all accept-ability
Mutton Kebabs	Organic	7.13	6.96	6.46	6.46	6.92	7.04
Mutton Curry	Non Organic	6.42	6.96	6.33	6.46	6.54	6.67
Mutton Curry	Organic	7.13	6.75	6.54	7	6.58	7.08

Design and development of Portable Meat Production and Retailing Facility for sheep and goats, poultry and pigs

Principal Investigator: Dr. C. Ramakrishna

Co-Principal Investigators: Dr. Girish Patil, S. and Dr. S. B. Barbuddhe

Infrastructure for hygienic meat production and retailing is a prerequisite for achieving meat food safety. This work was undertaken to develop a simple, economical and hygienic facility for production of meat from small ruminants under small scale production system. Portable Meat Production and Retailing Facility (P-MART) comprises five facilities: i) animal resting facility; ii) slaughtering and dressing facility; iii) cutting & packaging facility; iv) retailing facility; and (v) waste management facility. First four units are wheeled and separable and can be moved independently. All four units have been provided with facilities like pest killers, wall mounted fans, exhaust fans, water storage facility, electrical stunner, refrigeration, bone cutting and mincing. Facility can be operated either on ground or on a vehicle. Food grade stainless steel (SS 304) was used for fabricating the P-MART. Anaerobic biogas plant based system was utilized for disposal of the slaughterhouse waste. Prototype of the facility was fabricated and its operation was validated for functionality and quality of the final product. P-MART was found to be a user friendly, low cost, portable, mobile, environment friendly and animal welfare compliant. The capacity of P-MART is to slaughter less than 10 animals per day by two operators. P-MART has been primarily made up of SS 304 grade stainless steel. The technology was transferred to one stakeholder for upscaling the P-MARTs. An application was submitted for grant of patent (Patent Application No. 202111016135).

Technology on preparation of manure from solid waste generated from slaughter of about 10 sheep and goats by aerobic composting using perforated stainless steel bins was developed, tested and validated. The solid waste (mainly gastro intestinal contents) was collected in perforated stainless steel bins, dewatered and allowed for aerobic composting in open area at ambient temperature. The contents were mixed once in a week for aeration. The solid waste was converted to manure in about 4 to 8 weeks of time. Technology on low cost electric stunner for Sheep and Goats using transformer (converting 230V to 110V) was developed, tested and validated.


Portable Meat Production and Retailing Facility (P-MART) for Sheep and Goats

Studies on risk analysis of antimicrobial resistance among bacterial food-borne pathogens from broiler chicken farms of Telangana

Principal Investigator: Dr. L. R. Chatlod

Co-Principal Investigators: Dr. Deepak B. Rawool, Dr. P. Baswa Reddy

Amidst the foodborne pathogens, antimicrobial resistance (AMR) is an emerging global public health threat. Although various researches have isolated NTS and *E. coli* from poultry farms in India, there exists a dearth in the systemic studies particularly, the genotypic diversity of these pathogens within and between poultry farms. Furthermore, reports regarding the occurrence of multi-drug resistant (MDR) pathogens among broiler meat production settings are scanty in the country.Hence, this project is being undertaken to isolate bacterial food-borne pathogens (*Escherichia coli*, Non-typhoidal *Salmonella* (NTS) from broiler chicken farms and characterizing them for antimicrobial susceptibility pattern and genotypic diversity and to assess the risk(s) of antimicrobial resistance among the food-borne pathogens isolated from broiler chicken farms.

To study the occurrence of *E. coli*, and *Salmonella* spp., a total of 60 samples comprising of poultry droppings (10), water from waterers (10) and tank (10), feed sample from stock (10), and feeders (10), and soil (10) from various broiler farms of Telangana have been collected and screening using cultural as well as molecular approach is under progress.

Emerging abattoir-associated occupational zoonoses: A pilot survey and development of rapid screening assay(s)

Principal Investigator: Dr. Deepak B. Rawool

Co-Principal Investigators: Dr. S. B. Barbuddhe, Dr. Ashwin Raut, Dr. Laxman Chatlod, Dr. Vishnuraj M. R.

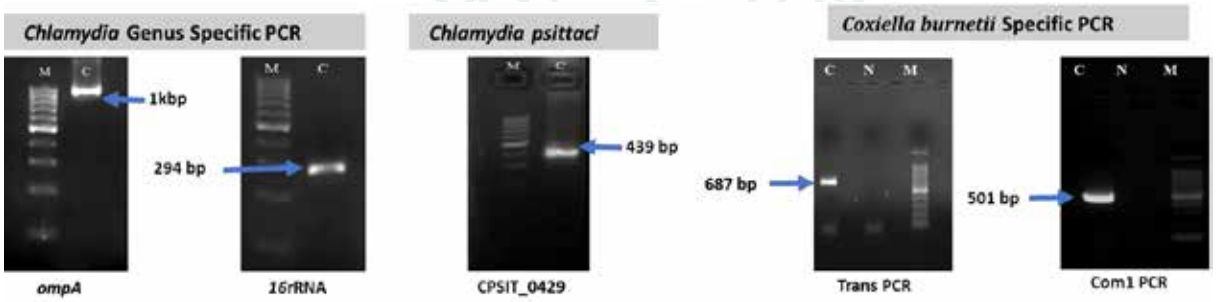
The project aims to screen for the emerging occupational zoonoses (Chlamydiosis, Coxiellosis, CCHF, Hepatitis-E) among personnel involved in abattoir value chain using appropriate molecular

and/or serological detection assays and and to develop in-house rapid diagnostic/screening assay(s) for the detection of predominant emerging occupational zoonotic infection(s).

Synthetic peptide based indirect ELISA for detection of *Chlamydia* antibodies in humans has been standardized. The standardized parameters for indirect ELISA include an antigen coating of 100 ng/well, primary antibody dilution of 1: 200, and secondary anti-human antibody at a concentration of 1: 5000, respectively. To differentiate positive and negative sample, an avg. negative control OD value x 2 + Standard Deviation was set as a cut off OD value.

Employing the standardized ELISA, earlier collected serum samples (n=96) from slaughterhouse personnel from Jiyaguda (n=30), Bhoiguda (n=33), and Amberpet (n=33) were screened. On analysis an overall seropositivity of 40.62% (39/96) was obtained for *Chlamydia* infection among abattoir associated personnel.

In addition, we optimized PCR protocols for detection of *Coxiella burnetii* and *Chlamydia psittaci* for molecular detection of these pathogens among persons involved in abattoirs. The optimized gel images for the same are presented in figures below.



Optimized PCR gel images revealing detection of *C. burnetii* and *C. psittaci*

Droplet Digital PCR (ddPCR) and Quantitative PCR (qPCR) methods were developed for precise and sensitive detection of *C. psittaci*. The limit of detection (LOD) of ddPCR was up to 2.4 copies, whereas, qPCR could detect up to 38 copies of the DNA template. These developed ddPCR and qPCR assays were tested for its detection efficacy by screening the field samples (n = 124), comprising lung tissues from dead poultry and feral birds. Of 124 samples, seven samples were tested positive by ddPCR, while three were tested positive by qPCR. The developed ddPCR could serve as a reliable screening tool, particularly in those clinical samples where in the shedding of *C. psittaci* is substantially very low.

Development of nanocomposite biodegradable packaging material for meat and meat products

Principal Investigator: Dr. Kandeepan G.

The biopolymers provide scaffold for the development of packaging materials through cross-linking with the stabilizers, plasticizers and bioplastics. There is a need for development of sealable, biodegradable, shelf stable, bio based packaging material with better packaging characteristics. This project aims to develop and characterize nanocomposite biodegradable packaging material and to

determine the effect of this packaging material on the quality and shelf-life of meat and meat products. The biopolymers were mixed with plasticizer, stabilizer and bioplastics to make a base material for film formation with better sealability and film characteristics. Nanoparticle sized antioxidants and antimicrobials were incorporated into this solution to improve shelf-stability. The cross-linking polymers were subjected to heating and stirring. Then stretchable films with thickness 0.11mm, transparency 91.83% and good sealing property has been formed through casting technique. The protocol for the preparation of biodegradable packaging material (comprised of corn starch, carboxy methyl cellulose, glycerol and polyethylene glycol) and the sealability of the film with PVA is standardized. The optimization of ingredients and protocol for the preparation of nanocomposite film with nanoclay (MMT), PVA & clove oil and the analysis of properties of the film is under progress.

Biodegradable nanocomposite packaging film with sealing property

Evaluation of modified atmosphere packaging and a colorimetric indicator for improving the shelf-life of meat and meat products

Principal Investigator: Dr. Kandeepan G

Co-Principal Investigator: Dr. Y. Babji & Dr. Y. P. Gadekar

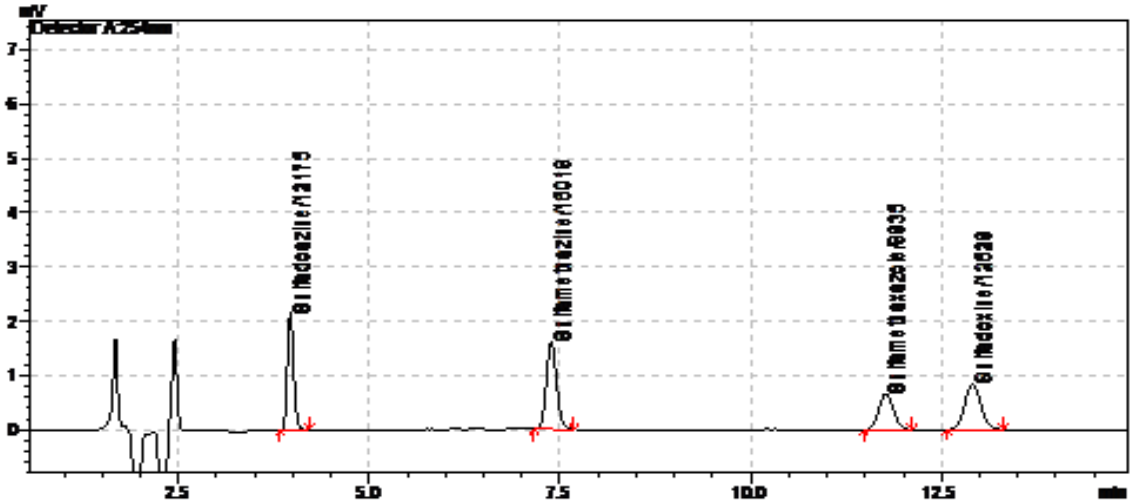
The gaseous composition of packaged meat/meat product plays a pivotal role in determining the shelf-life. The objective of the project is to standardize gaseous composition for modified atmospheric packaging, to compare the shelf-life attributes of modified atmospheric packaging and aerobic packaging and to develop colorimetric sensor for modified atmospheric packaged meat and meat product. The chicken leg meat (CLM) was stored under refrigerated storage (4±1°C) with aerobic and modified atmospheric packaging (MAP20 = 20% O_2 + 30% CO_2 + 50% N_2, MAP10 = 10% O_2 + 40% CO_2 + 50% N_2, MAP0 = 0% O_2 + 20%CO_2 + 80% N_2) conditions and evaluated for quality attributes. The results indicated that MAP has significantly increased the color of the chicken leg meat compared to AP. The changes in myoglobin forms, meat pigment, haeme iron, hunter lab color units (L*, a*, b*) were insignificant under aerobic as well as modified atmospheric packaging. MAP extends the desirable color of chicken leg meat upto 15 days compared to only 6 days for aerobic packaging.

Modified atmosphere packaging machine with gas mixture

Quantitative determination of Sulphonamide antimicrobial residues in buffalo meat samples using RP-HPLC

Principal investigator: Dr. S. Kalpana

Co-Principal Investigator: Dr. M. Muthukumar



Representative optimized chromatogram of 4 Sulphonamides at 100ppb

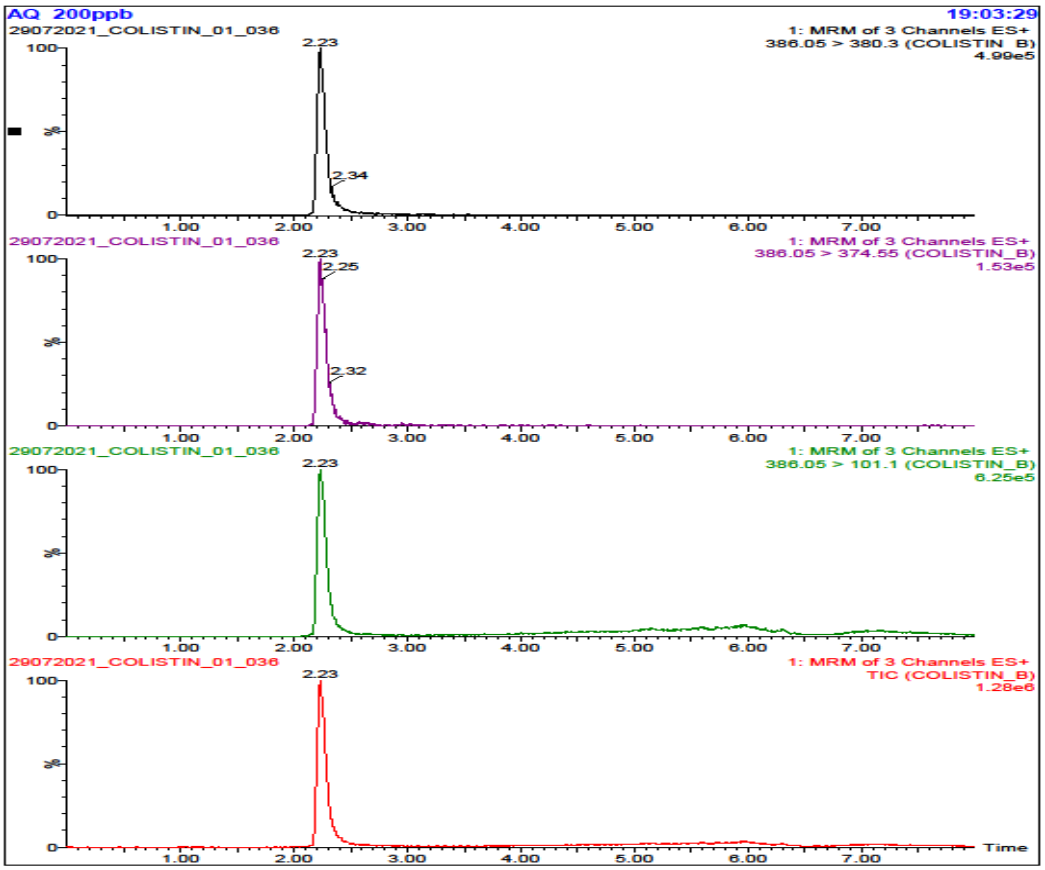
A liquid chromatographic method for the simultaneous quantitative determination of sulfadiazine, sulfadoxine, sulfamethazine and sulfamethoxazole in buffalo meat was optimized. The chromatographic separation was accomplished in isocratic elution mode with mobile phase consisting of glacial acetic acid in Acetonitrile: Methanol:Water (85:10:05, v/v). Mean extraction recoveries of sulfadiazine, sulfadoxine, sulfamethazine and sulfamethoxazole were in the range of 85-89 %. The limit of detection (LOD) were 6.06,7.63,6.79 and10.68 µg/Kg and the limits of quantification (LOQ) for sulfadiazine, sulfadoxine, sulfamethazine and sulfamethoxazole were 18.37, 23.12, 20.57 and 32.37 µg/kg, respectively. For monitoring purpose, about three hundred buffalo meat samples were collected from in and around Hyderabad city for monitoring viz Narapally, Amberpet, Charminar,

Cherlapally, Uppal etc and extracted for analysis of 4 Sulphonamide residues. About 200 extracted samples were injected and analyzed in triplicate using RP-HPLC and none of the samples had the said residues at or above MRL (100 µg/Kg) and further analysis is in progress.

Confirmatory analysis of Colistin and Nitrofuran antimicrobial residues in broiler chicken samples by tandem mass spectrometry

Principal investigator: Dr. S. Kalpana

Co-Principal Investigator: Dr. M. Muthukumar



Representative TIC of Colistin B

A selective and sensitive liquid chromatography tandem mass spectrometric (LC–MS/MS) method has been established for simultaneous determination of two residual polypeptide antibiotics polymixin E1 (colistin A), polymixin E2 (colistin B) in chicken meat samples. The extraction is based on acidified methanolic solvent followed by a reversed phase solid phase extraction step to clean-up and concentrate. This single-step clean-up produces sufficiently clean extract in order to control matrix-related signal suppression in the electrospray interface with acceptable recoveries. Colistin in the extracts were separated on a reversed phase acquity BEH C18 column (100mm×2.1 mm, 1.7µm) in gradient elution mode. Using electrospray LC–MS/MS with multiple reaction monitoring

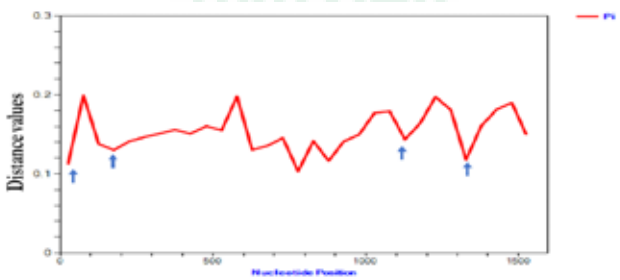
(MRM), identification and quantification of the major components of the two polypeptides were performed based upon the intensities of mass fragments from the respective precursor ions: colistin A at 390.83→385 and 390.83→379.2; colistin B at 386.05→380.3 and 386.05→374.55, respectively, the matching of the specific tolerance of the relative abundance of the monitored ions. The method presented good fit (regression coefficient ≥ 0.99) over the quantitation range of 5-200 ppb with the lower limit of quantitation (LLOQ) being 5 µg/kg for colistin A and colistin B, respectively. LOQ is lower than the Maximum Residue Limit (MRL) set by the Codex Alimentarius for colistin (150 µg/kg).

Development of DNA mini-barcodes and High Resolution Melting (HRM) analysis assay for processed/cooked meat products authentication

Prncipal Investigator: Dr. Gireesh Babu P.

Co-Principal Investigators: Dr. Girish Patil S., Dr. C. Ramakrishna, Dr. Vishnuraj M. R.

The project is aimed at developing universal mini-barcode based high resolution melting (HRM) assay for the identification of meat adulteration. The average interspecific genetic distance values were 0.253±0.02, 0.210±0.02 and 0.204±0.015 for CoI, 16s rRNA and cytochrome b genes, respectively. Whereas the average intraspecific genetic distance values were found to be 0.012±0.001, 0.022±0.002 and 0.019±0.001 for CoI, 16s rRNA and cytochrome b genes, respectively. The phylogenetic tree analysis revealed that all the three mitochondrial genes have sufficient phylogenetic signal. The nucleotide polymorphism analysis conducted for the three mitochondrial genes showed a greater number of transitions than transversions. The transition vs transversion ratio of 2.24, 1.78 and 1.91 was observed for CoI, 16s rRNA and cytochrome b genes, respectively. In CoI, 16s rRNA and cytochrome b genes, the region between nucleotide positions 250 to 750 bp, 350 to 675 bp and 200 to 700 bp, respectively were found to be the most variable region with high concentration of transversions. These regions in respective genes were selected for designing universal primers to identify the species.



Sliding window analysis of COI gene of different meat species

Impact of meat research on livestock sector development-role of public investment

Principal Investigator: K. Varalakshmi

Based on the data from internal reports and Wos software this study generated knowledge on research productivity, visibility and impact of NRCM on scientific community since its inception i.e.

2001-2020 through bibliometric analysis in terms of papers, citations, trend, research prioritization, H index, institutional collaboration, author collaboration, citation analysis, journal analysis, depicted through bibliometric networks and google maps.

General Trend in NRCM activities & Impact

Budget of NRCM has increased from 2.2 crores in 2003 to 10.67 crores in 2020 registering a growth rate of 10.26% CAGR (95 crores for 2003-20) for the 18-year period. NRCM has taken up 112 projects (CAGR @ 13.2%) since its inception for the 20-year period i.e. from 2001 to 2020. Out of which 73 were completed and 39 are still continuing up to 2020. Project productivity showed that total numberof effective projects per scientist per year was 1.19 with 0.26 of external and 0.92 of internal projects growing @ 6.69% with slight variation between external and internal projects. NRCM has published a total of 253 research papers with average of 0.99 paper per scientist per year for the overall period.

Bibliometric Analysis of NRCM research

Results of Bibliometric analysis done for peer reviewed papers (#124) recovered from WoS software are given under different headings with Bibliometric networks prepared by using bibexcel, pajeck and vos viewer softwares. Google maps for co-author institutes were prepared.

Summary of Bibliometric characteristics of NRCM articles recovered in WOS (#124 articles)

Particulars	#			% to total		
	FA	RA	Total	FA	RA	Total
TP	59	65	124	47.58	52.42	100.00
ATP	3.28	3.61	6.89			
TC	975	454	1429	68.23	31.77	100.00
Avg citation /paper	16.53	6.98	11.52			
Avg citation /yr	54.17	25.22	79.39			
Avg citation /paper /yr	0.92	0.39	0.64			
Citation count of top 10 publications	632 (64.82% of FA)	199 (43.83% of RA)	699 (48.92%)			(48.92%)
Avg Citation count of top 10 publications	63.2	19.9	69.9			
Sum of citing articles						
H index			19			

Top 10 papers account for 48.92% of total citations i.e only 8.06% of top papers account for nearly half of the total citations received.

Trend in NRCM publications

Year wise trend shows that the highest number of articles and citations were produced in 2019 (14.52%), 2020 (18.47%) and highest number of citations were taken by the papers produced in 2008 (249) followed by 2010 (192%).

Research prioritization of NRCM indicated by Keyword analysis

Overall LPT discipline has contributed for 50% of total articles of NRCM out of which 37% is from LPT of NRCM. Overall Meat science has topped in the preferred journals for increasing visibility of NRCM research due to its international appearance. NRCM has collaborated with about 21 institutes from India and abroad out of which 4 are international institutes and 17 are within India.

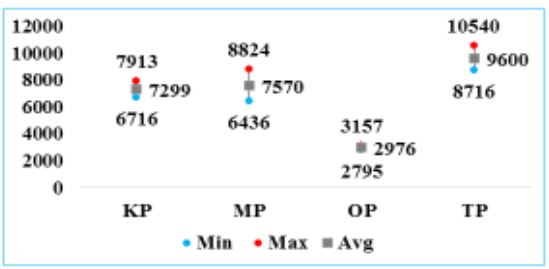
It can be inferred that only 26.61% of papers account for 80.83% of citations while 72.58% of papers account for only 18.47% of citations. H index regarded as the measure of research output visibility is estimated as 19 for 2001-2020.

Performance study of sheep markets in India

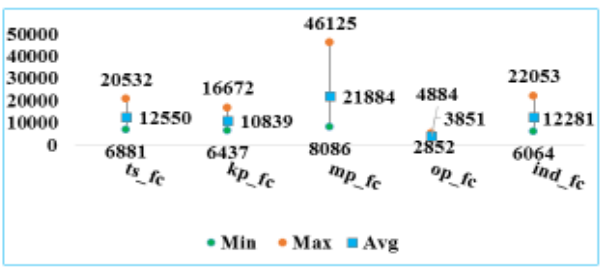
Principal Investigator: K. Varalakshmi

Co-Principal Investigators: Dr. P. Baswa Reddy

Using time series from AGMARKNET, the study generated information on performance of sheep markets indifferent states Telangana (1), Karnataka(14), Maharashtra(4) and Odisha (3) and state as a whole market (4) and India as a whole and forecasted the arrivals and prices for sheep and mutton. Karnataka sheep markets are performing well compared to other states which may be attributed to absence of unregulated markets / marketing system but it has to be verified with the primary data on market structure, performance by survey and movement of sheep. Based on ARIMA models forecasting was done initially for 2 years up to December 2022 and it was extended to next 30 years up to 2050. Based on forecasted prices of sheep, meat prices were also forecasted up to 2050. ARIMA models forecasted that the prices from Jan 2020 to Dec 2021 will range between 6716-7913 with average of 7299 per medium animal for Karnataka. These values are 6436-8824 and 7570, 2795-3157 and 2976,8716-10540 and 9600 for Maharashtra, Odisha and Telangana, respectively.



Jan 2020 to Dec 2021



Jan 2020 to Dec 2030

Forecasted Prices of Sheep in different states

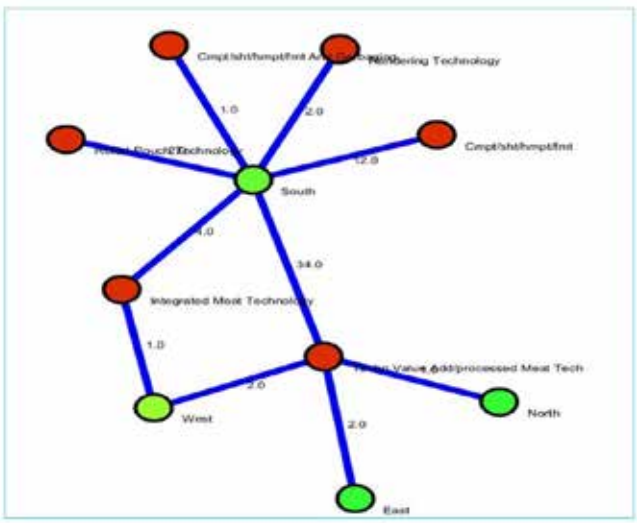
Sheep prices and resulting mutton prices in India will increase by 3.64 times in next 10 years from 2020 to 2030. This increase maybe 2.98, 2.59, 5.7, 1.71 times for Telangana, Karnataka, Maharashtra and Odisha, respectively. Full Data base (Baseline/secondary data) on all parameters of the study (Arrivals and prices) collected from AGMARKENET for 2005-2019 (time series data from 2005-2019) and the of trend, ARIMA analysis for forecasted prices and arrivals of sheep and mutton up to 2050 for all the markets in different states and India are available in the form of soft copy.

Impact evaluation of NRCM Technologies and Trainings/capacity building programmes

Principal Investigator: K. Varalakshmi

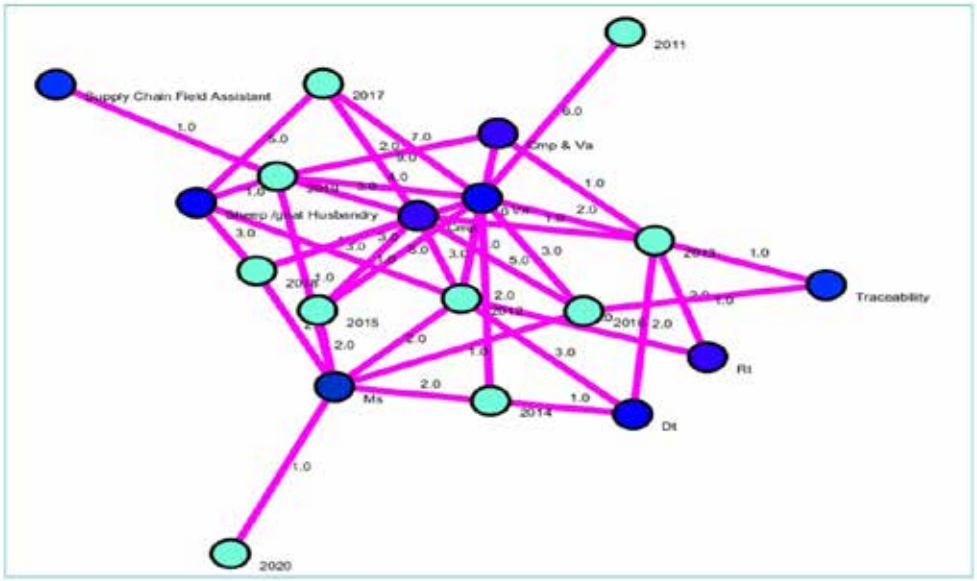
Trend in technology transfer: The results of year wise beneficiaries shows that in 2012 more number of beneficiaries were benefited by NRCM technology transfer as indicated by more no of TOT (8) followed by 2018 and 2019 (7 each). Most of the entrepreneurs have shown interest in processed meat technology. Technology acquisition is low with 79.41% of the entrepreneurs have taken only one technology and only 20.59% of beneficiaries have taken 2 technologies.

More than ¾ (89.71%) of technologies adopted by industries belong to Southern states of India showing technology concentration in nearby areas due to close proximity. Category wise technology analysis showed that processed meat technology contributed more than 57.35% TOT and 63.06% for revenue with technology spread index of 4.59.



Preliminary structure of trainings/capacity building programmes

NRCM has conducted about 96 training programmes during 2011-2020 to 1639 trainees out of which 15.38% were female participants. Training programmes are growing by year on year basis with CGAR of 9.94% from 2011-2019 excluding 2020. Category wise analysis shows that more number of training programmes were given in value addition (35.42%) followed by clean meat production (18.75%). Female participation was less than 1/3rd in training programmes.



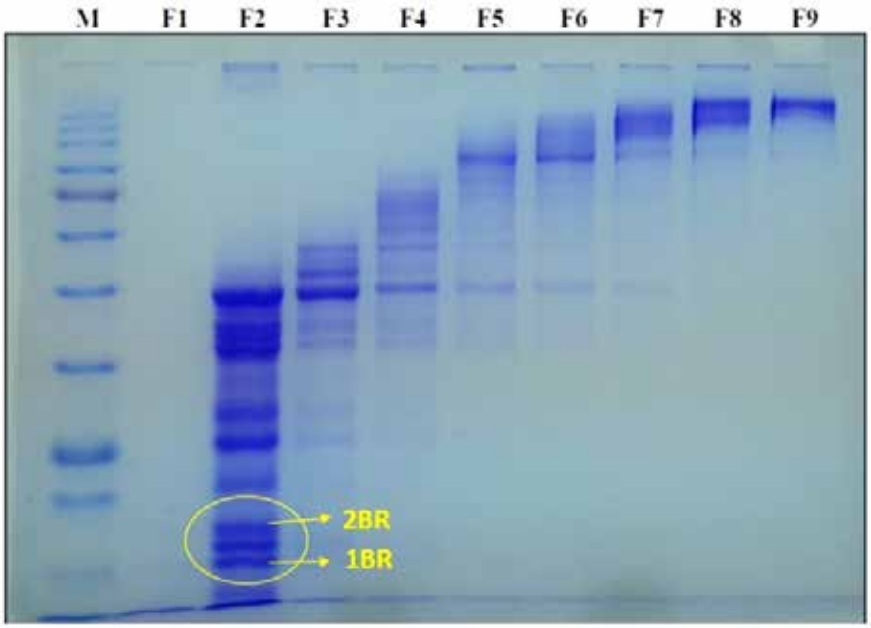
Trend in Training programmes of NRCM

Integrated omics approaches for assessment of meat quality and authenticity

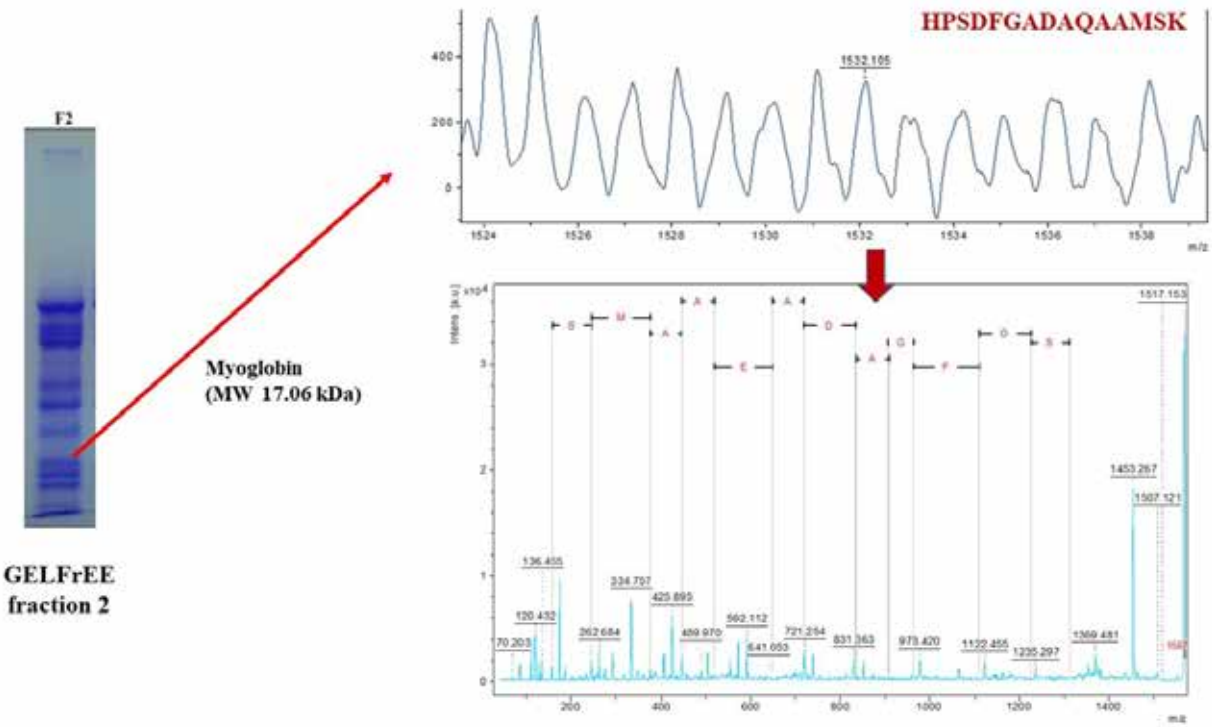
Principal Investigator: Dr. Rituparna Banerjee

Co-Principal Investigators: Dr. B. M. Naveena, Dr. M. Muthukumar, Dr. Y. P. Gadekar

A project was initiated to optimize protein fractionation protocols coupled with mass spectrometry for meat quality and authenticity. An extraction buffer containing PBS and SDS was standardized and protein extraction was accomplished by simple trituration in a pestle and mortar followed by filtration with a grade 1 filter paper. A novel GELFrEE fractionation technique was used, which fractionates the complex protein mix into smaller fractions in liquid form within 2-3 hours. Sample extract from raw, cooked meat and their mixes were loaded on the sample loading chamber of GEL-FrEE 8100 5% cartridge with a fractionation range of 3.5 to 500 kDa. The proteins were partitioned according to their size or molecular weight, resulting in 12 distinct fractions. SDS-PAGE profile of selected GELFrEE fractions from raw and cooked buffalo meat and pork sample exhibited that low molecular weight proteins were more resistant to heat induced denaturation showing similar protein band intensity even after cooking, whereas, the band intensity of high molecular weight proteins was reduced significantly. In-gel digestion and MALDI-TOF MS of selected protein bands revealed the presence of species-specific myoglobin and carbonic anhydrase-3. These proteins exhibit differences in sequence between buffalo meat and pork peptides. Peptides derived from carbonic anhydrase-3 were species specific and used for validation and determination of pork content as low as 0.5% in raw as well as heat-processed meat mixes. Species-specific peptide sequences were further validated using MALDI-TOF/TOF MS and sequence alignment tools. The suitability of GELFrEE fractionator for simple, rapid, reproducible and reliable fractionation of low-molecular weight proteins was established and can be coupled with shotgun or top-down proteomic studies for meat authentication



SDS-PAGE visualization of selected GELFREE fractions of raw buffalo meat separated using 5% (3.5-500 kDa) cartridge



GELFrEE fraction of buffalo meat extract, selection of species-specific peptide (m/z 1532.10) from myoglobin and characterization using MALDI-TOF/TOF MS

Development and storage stability of poultry slaughter coproducts based pet snack/ food

Principal Investigator: Dr. Yogesh P. Gadekar

Collaborating institute: ICAR-Central Sheep and Wool Research Institute, Avikanagar**,** Rajasthan.

Co-Principal Investigators: Dr. Girish Patil S., Dr. A. R. Sen, Dr. M. Muthukumar, Dr. Deepak B. Rawool, Dr. P. Baswa Reddy, and Dr. Vinod Kadam

The slaughtering of poultry and food animals generates a considerable quantity of coproducts that are unsuitable for human consumption. During the slaughter of poultry, inedible products yield was assessed as head (3.85%), shank (4.4%), intestines (6.17%) while blood and feathers accounted for 11.08%. The microbial quality of the raw poultry slaughter coproducts had a total viable count: Log_{10} 6.18; *Staphylococcus aureus*: Log_{10} 5.04, *E. coli*: Log_{10} 5.041, and yeast and molds: Log_{10} 5.13. The slaughter coproducts were subjected to dry rendering to obtain the poultry slaughter coproduct meal. The poultry slaughter coproduct meal was used for making pet snacks. The rendered poultry coproduct meal has microbial quality within acceptable limits. The texture profile of the pet snack indicated hardness values of 48.76 (N), while other texture parameters were fracturability (28.29 N), springiness (1.57 cm).

Texture Profile of Extruded Pet Snack

Parameter	Observation (Mean±SE)
Hardness (N)	48.76±1.18
Gumminess (N/cm^2)	18.19±1.15
Springiness (cm)	1.57±0.12
Cohesiveness (ratio)	1.46±0.09
Fracturability (N)	28.29±0.91
Chewiness (N/cm)	17.34±1
Stickiness	0.123±0.01
Resilience	0.081±0.02

In another study, the chicken feathers obtained from the slaughter of poultry and sheep wool were used for developing reinforced biocomposites using the hand lay-up technique. Their quality was assessed for different parameters. Biocomposite is a composite material formed by a matrix (resin) and a reinforcement of natural fibers. The composite density (g/cm^3) ranged from 0.933 to 1.24. The composite weight (g) ranged from 176-140. The value addition to slaughter coproducts could be effectively done.

Biocomposite from chicken feathers

Amalgamation of information technology with meat technology for quality and safe meat production

Principal Investigator: Dr. Yogesh P. Gadekar

Collaborating institute: ICAR-Central Sheep and Wool Research Institute, Avikanagar**,** Rajasthan.

Co-Principal Investigators: Dr. Girish Patil S., Dr. Rituparna Banerjee, and Dr. Arvind Soni

A project has been initiated to develop an application for the prediction of meat yield in sheep and a decision support system for antemortem and post mortem examination.

Development of Certified Reference Material (CRM, as per ISO 17034: 2016) for qualitative determination of animal species in regulatory food/forensic laboratories

Principal Investigator: Dr. Vishnuraj M. R

Necessary training has been completed for general requirements for the Competence of Reference Material Producers' as per ISO/IEC 17034. Work has been initiated for development of certified reference materials (CRM) for genetic identification of economically important meat and fish species to combat food fraud.

Technological interventions for livelihood enhancement of socially backward people under SCSP

Principal Investigator: Dr. P. Baswa Reddy

Co-Pricipal Investigators: Dr. Girish Patil S., Dr. C. Ramakrishna, Dr. M. Muthukumar, Dr. S. Kalpana, K. Varalaxmi

Training programme for the SC women SHG group from Khammam and Korutla

Three days practical hand-on training programme on 'Entrepreneurial skill development for women SHGs on hygienic meat production and value addition' was organized for seven women Self Help Group members from Khammam and Korutla (Jagityal district) of Telangana at ICAR-NRC on Meat from 10th to 12th Feb 2021 under SCSP/ DAPSC component.


Distribution of Meat processing equipments to women SHG members of Korutla

Meat processing equipments for establishment of small scale meat processing unit were provided to the SC members of SHG group from Korutla on 12th Feb 2021.


Distribution of backyard poultry birds to SC women of Dorakunta village, Kodada, Suryapet district

One hundred units of backyard poultry (with 20 birds, 20 kg feed, 1 feeder and 1 waterer per unit) were provided to SC women of Dorakunta village, Kodada, Suryapet dist on 12 March, 2021.

Distribution of backyard poultry birds to SC women of Tadkole village, Kama Reddy district

Fifty units of backyard poultry (with 20 birds, 20 kg feed, 1 feeder and 1 waterer per unit) were provided to SC women of Tadkole, Kama Reddy dist on 17 April, 2021.

Distribution of small scale meat processing equipments to SC women of Aushapur

A three days training programme on 'Entrepreneurial skill development in hygienic meat production and small scale meat products processing' was organized for the participants from Aushapur and Kukatpally of Medchal Malkajgiri dist, Telangana and meat processing equipments were distributed for establishment of small scale meat products processing unit to the SC women who are part of 'Aushapur foods' through District Rural Development Officer (DRDO), Medchal Malkajgiri district on 27 July 2021 in the presence of Shri Yenugu Sudarshan Reddy, MPP, Ghatkesar and Smt Kaveri Maschender Reddy, Sarpanch Aushapur.

Workshops/Training/Meetings/ Awareness Programmes Organised

Induction Training for Food Safety Officers of Telangana and Himachal Pradesh

Induction Training for Food Safety Officers of Telangana and Himachal Pradesh Sampling & Laboratory Network was organized through virtual mode on 15th January, 2021 at ICAR- NRC on Meat, Hyderabad. A total of 40 Food safety officers from Telangana and Himachal Pradesh participated in the training programme.

National workshop on *"Sustainability of Buffalo Sector in India"*

A National workshop on ***""Scientific Interventions and Policies for Strengthening of Buffalo Meat Sector: Catalyst for Boosting India's Agro-Economy"*** was organized at ICAR-National Academy of Agricultural Research & Management (NAARM), Hyderabad in both offline and online mode on 19th January 2021. The event was jointly organized by ICAR-NRC on Meat, ICAR-NAARM, NAAS-Hyderabad Chapter and Indian Meat Science Association. Over 40 experts from various research institutes, universities, APEDA, animal husbandry departments, meat industry and export agency participated in the workshop and extensively deliberated on the technological, institutional, regulatory and policy impediments which need to be addressed to unleash the potential of the sector.

Entrepreneurship in Livestock and Veterinary Sciences: Online Faculty Development Program

ICAR- National Research Centre on Meat, Hyderabad organized a free online certificate training course on "Entrepreneurship in Livestock and Veterinary Sciences" from 9th to 22nd February 2021. This course was sponsored by Department of Science and Technology, Ministry of Science and Technology, New Delhi. The major objective of the training course was capacity building of teaching and extension faculties and veterinarians working under agriculture, veterinary, fisheries and allied departments.

Training programme on 'Meat Processing, Branding and Marketing' under ARYA Programme

A two days training programme on 'Meat Processing, Branding and Marketing' was organized at ICAR-NRCM, Hyderabad on 24-25th February, 2021 under ARYA Programme. A total of 15 members participated in the programme.

Entrepreneurship Development Program conducted on Value added meat products processing

A five days entrepreneurship Development Programme on "Value added meat products processing" was organized at ICAR-NRCM, Hyderabad from 2nd to 6th March 2021. A total of 15 participants attended the training programme.

Training programme on "Entrepreneurial skill development in small ruminant production and value addition"

A three days training programme was conducted on 'Entrepreneurial skill development in small ruminant production and value addition'for the sheep farmers cum entrepreneurs of Peddapally Dist. Telangana from 8th to 10th March 2021 following all the Covid-19 protocols. A total of 15 participants attended the training programme at ICAR-NRCM campus. Hands on training was provided for the hygienic slaughter of animals, clean meat production, and preparation of value-added meat

products. The participants were sensitized on different entrepreneurial opportunities in sheep and goat value chain right from animal production to meat production and marketing.

Training programme on 'Recent analytical techniques for detection of meat adulteration, veterinary drug residues and microbes of public health importance'

A five days training programme was conducted for the veterinarians of Veterinary Biologicals Research Institute (VBRI) and QA lab of Animal Husbandry department, Govt. of Telangana from 15th to 19th March, 2021 on 'Recent analytical techniques for detection of meat adulteration, veterinary drug residues and microbes of public health importance' following all the Covid-19 protocols. A total of 10 veterinarians attended the training programme. As part of the training programme, the trainees were imparted hands-on training on molecular techniques for Meat species identification, microbial identification techniques, and detection of residues of pesticides, veterinary drugs & heavy metals in meat samples. They were also sensitized on the different statutory regulations regarding meat adulteration and residue levels in meat.

Awareness programme for the sheep and goat farmers and chairmen of different sheep breeding societies

A one-day awareness programme was conducted for the sheep and goat farmers and chairman of different sheep breeding societies of Mahabubabad district of Telangana on 31st March 2021 following all the Covid-19 protocols. A total of 52 participants attended the programme. The participants were sensitized on different advanced systems of small ruminant rearing including scientific feeding, breeding, health care and management of small ruminants for improving productivity and

profitability in sheep and goat farming. They were exposed to hygienic slaughter and clean meat production from sheep and goat. Different entrepreneurial opportunities in sheep and goat value chain were explained to the participants.

Virtual training programme on 'Climate-smart technologies for food animal production and products'

The MANAGE sponsored 5 days virtual training programme on 'Climate-smart technologies for food animal production and products' was organized by ICAR-NRC on Meat from 19th to 23rd April 2021. More than 100 members participated in this 5-day virtual training programme.

Awareness program on Portable Meat Production and Retailing (P-MART) Unit for Sheep and Goats

Awareness program on features and utility of portable meat production unit developed by the Centre was organized on 28th and 29th June 2021. About 30 participants from different departments and entrepreneurs including Director, Animal Husbandry Department, Govt of Telangana, Director, Society for Elimination of Rural Poverty (SERP). Govt of Telangana, Veterinarians working in different sector and meat traders participated in this awareness programme. The technical details pertaining to Portable Meat Production and Retailing Unit for sheep and goats was provided to the participants.

Awareness programs on P-MART Unit for sheep and goats

Five training programs on P-MART facility for sheep and goats were organized at the Institute on 5th, 19th and 28th July 2021, 9th, 11th, 24th and 26th August, 2021. A total of about 65 participants participated in the program. Participants in the training program included Veterinarians, representatives of Municipal Corporations, meat industry stakeholders and entrepreneurs.

Besides, four Awareness programs on, 'Portable Meat Production and Retailing Facility (P-MART) for Sheep and Goats' on 07th, 08th, 09th and 22nd December 2021 was organized for representatives of Godavri Cuts Pvt Ltd., Hyderabad, Licious Pvt Ltd., Hyderabad, Adviser to Uttarakhand Govt and entrepreneurs from Maharashtra.

Training programme on 'Entrepreneurial skill development in hygienic meat production and small-scale meat products processing'

A three days training programme on 'Entrepreneurial skill development in hygienic meat production and small-scale meat products processing' was organized for the participants from Kukatpally and Aushapur of Medchal Malkajgiri district of Telangana from 22nd to 24th July 2021. A total of 24 participants were provided hands on training on clean meat production, value added meat products preparation, packaging and marketing of meat and meat products.

Interface meeting with Municipal Officials of Telangana State on hygienic meat production

Interface meeting between officials of Municipal officials of Telangana and Scientists of ICAR – NRC on Meat, Hyderabad was organized at the Institute on 17th August 2021. In the meeting, Dr. M. Satyanarayana, Commissioner and Director of Municipal Administration (CDMA); Commissioners, Mayors and Municipal Chairpersons of Nizampet, Peerzadiguda, Badanpet, Bandlaguda-Jagir, Boduppal, Medchal, Pochampally, Kompally, Narsing, Shamshabad and Manikonda participated. The discussion was focused on Portable Meat Production and Retailing Facility (P-MART) for Sheep and Goats developed by the Centre. Thirty members participated in the interface meeting programme.

National Summit on "Building organized meat sector in India towards ensuring Atmanirbhar Bharat"

A National Summit and consultation on ***"Building organized sheep and goat meat sector in India towards ensuring Atmanirbhar Bharat"*** was jointly organized by ICAR-NRC on Meat, ICAR-NAARM, NAAS-Hyderabad Chapter and Indian Meat Science Association at ICAR-National Academy of Agricultural Research Management, Hyderabad in a hybrid mode on 3rd September, 2021 as a part of celebration of Azadi ka Amrit Mahotsav. This unique hybrid event saw the participation of around 95 members online and 25 participants attended in-person.

MEPMA Sponsored training program on, 'Value addition to meat'

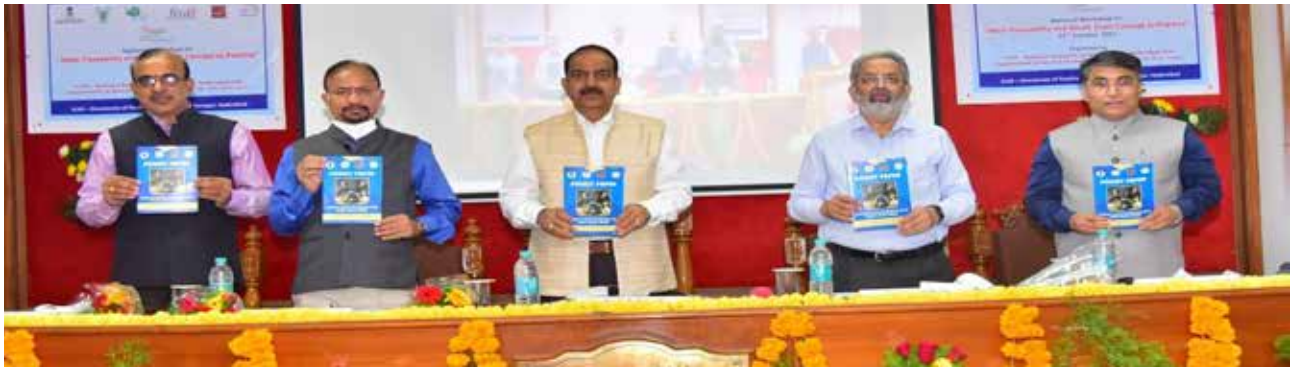
Under Mission for Elimination of Poverty in Municipal Areas (MEPMA) a training program on, 'Value addition to meat' from14th to 16th September 2021 was organized at the Institute. A total of 15 women SHG Members from different Municipalities of Telangana participated in these three days training programme

Awareness programme organized for the school children on 'Nutri cereals and their role on human health'

The awareness programme was organized for the school children on 'Nutri cereals and their role on human health' at ICAR-NRC on Meat on 17th September, 2021.

National Workshop on 'Meat traceability and Recall: From Concept to Practice'

A National workshop on "Meat Traceability Recall: From Concept to Practice" was organized by ICAR-National Research Centre on Meat, Hyderabad in collaboration with Department of Animal Husbandry and Dairying, Govt of India on 22nd October,2021 as a part of Azadi Ka Amrit Mahotsav. Dr. M. Angamuthu, Chairman, APEDA graced the occasion as Chief Guest. Dr. B.N.Tripathi, Deputy Director General (Animal Sciences), ICAR, New Delhi presided over the function. Besides, Dr. Pravin Malik, Animal Husbandry Commissioner, Dr. Amrish Tyagi, ADG (AN and P), ICAR, Dr. R.N. Chatterjee, Director, ICAR-DPR, Hyderabad and Dr. S. B. Barbuddhe, Director, ICAR-NRC on Meat, Hyderabad were present on the ocasion. The workshop highlighted the potential of livestock traceability and its future implications. Over 150 delegates attended the workshop offline and online mode. A policy paper on "Traceability system for Indian Meat Sector: Concept and way forward" was also released.



Training programme on "Entrepreneurship development program (EDP) on clean meat production, value addition and quality assurance"

A five days training programme entitled "Entrepreneurship development program (EDP) on clean meat production, value addition and quality assurance" was organized at ICAR-NRC on Meat, Hyderabad from on 9-13th November, 2021. A total of 15 participants had hands on training towards hygienic slaughter of animals, clean meat production, and preparation of value-added meat products.

Training-of-Trainer's program under FSSAI-FoSTaC

ICAR-National Research Centre on Meat, Hyderabad conducted Training-of Trainers (ToT) program sponsored by Food Safety and Standards Authority of India (FSSAI) under Food Safety Training and Certification (FoSTaC) on 29th November, 2021. A total of 16 participants comprising of faculty members, industry personnel, food safety auditors and supervisors from 5 states have participated. The training mainly focused on "Hygienic and Sanitary Practices to be followed by Food Business Operators engaged in meat sector" as per SCHEDULE-4, Part-4, Section A of FSSAI.

Training on 'Skill Development Programme on Hygienic Meat Production'

One day 'Skill Development Programme on Hygienic Meat Production' was conducted for meat handlers of Jiaguda on 3rd December 2021 at ICAR- NRC on Meat, Hyderabad. Almost 91 meat handlers participated in the programme. As a part of the programme lectures on personal hygiene and hygienic meat production were delivered. A practical session was conducted on hygienic slaughter of sheep and goat.

Online training programme for Master Trainers on "Meat and Poultry Processing"

A virtual training programme for Master Trainers on "Meat and Poultry Processing" was organized at ICAR-NRCM, Hyderabad in collaboration with Indian Institute of Food Processing Technology (IIFPT), Thanjavur during 10-13th August, 2021. The Training of Master Trainer's Program in the domain of Meat & Poultry Processing under PM FME scheme was inaugurated by Dr. C. Anandharamakrishnan, Director, IIFPT, Thanjavur, Tamil Nadu. Dr. Amrish Kumar Tyagi, Assistant Director General (AN&P), Indian Council of Agricultural Research and S. B. Barbuddhe, Director, ICAR –National Research Centre on Meat, Hyderabad were also present at the inaugural programme. A total of 5 members participated in the training programme.

Programmes under Mera Gaon Mera Gaurav (MGMG)

ICAR-National Research Centre on Meat, Hyderabad successfully organized a cleanliness awareness programme at HOPE foundation school, Chengicherla village, Hyderabad on 29th October, 2021 under Mera Gaon Mera Gaurav programme. Dr. Y. Babji, Principal Scientist narrated 150 school students and 10 teachers about significance of cleanliness and health issues especially with reference to COVID-19 pandemic.

Swachh Bharat Abhiyan under Swachhta Pakhwada Campaign Organized at Keesara Village

Swachh Bharat Abhiyan under Swachhta Pakhwada Campaign on 20 December, 2021 was organised at Keesara village by Dr. Y. Babji, Principal Scientist informed the currently implemented hygienic practices and encouraged about 20 butchers and meat shop owners of Keesara village to endure the adoption of hygienic slaughter practices and to follow strict COVID-19 protocols at all times especially during business transaction hours on daily basis.

Awareness programme on occasion of World Water Day 2021

ICAR-National Research Centre on Meat, Hyderabad organized an awareness programme at Keesara village on 19 March, 2021 on the occasion of "**World Water Day 2021"** and the theme of which was "Valuing water ". Dr. Y. Babji, Coordinator interacted with the butchers and meat processors during the meeting. He explained the importance of freshwater and advocated for the sustainable management of freshwater resources for their meat business and other purposes including drinking fresh and wholesome water; created awareness of the global water crisis and its impact on water resources of India and Sustainable Development Goal (SDG) 6: Water and sanitation for all by 2030.

Programmes under North Eastern Hill Region (NEH)

Under NEH programme, a MoU has been signed with Central Agricultural University, Imphal and the collaborative project is continuing for distribution of piglets, vaccines, feeds and other necessary inputs for livelihood improvement. Two tribal villages and 10 beneficiaries from each village were identified for livelihood improvement programme (27th to 30th January, 2021).

Survey in the tribal area of Manipur

One interactive meeting was organized at ICAR-NRC on Pig on 6th March 2021 and planned for road map development for animal sector in North eastern states and further stakeholders meeting.

One training programme on "Clean meat production and value added meat products" was organized at ICAR-NEH Complex, Barapani from 7th to 8th March, 2021 and 30 meat handlers attended the programme. Hygienic slaughter of pig was demonstrated and different retail cuts were shown to the participants. A variety of value added products from chicken and pigs were processed and hands-on training was done.

One training and awareness programme on "Clean meat production and processing of value added meat products" was organized for meat handlers and entrepreneurs at the College of Veterinary Science, Aizawl, Mizoram under Central Agriculture University, Imphal, Manipur during 24th to 26th March, 2021. A total of 17 participants (M-11, F-6) attended the programme. A good number of equipment and other teaching and training aids were also procured for the development of infra-structure at the College under NEH Fund of ICAR-NRC on Meat, Hyderabad.

Other Events

Foundation Day celebration

The ICAR-National Research Centre on Meat, Hyderabad celebrated its 22nd Foundation Day on 22nd February, 2021. Prof. (Dr) V. Ravinder Reddy, Hon'ble Vice-Chancellor, PVNR Telangana Veterinary University, Hyderabad graced the occasion as the Chief Guest, while, Dr. Suresh S. Honnappagol, Chairman, QRT and Dr. Subeer S. Majumdar, Director, National Institute of Animal Biotechnology, Hyderabad were invited as Guests of Honour. Dr. Subeer S. Majumdar delivered the 'Foundation Day' Lecture on the topic "Gene-based manipulation for value addition to livestock". Further, entrepreneurs who have successfully established their start-ups with the help of the center were felicitated. Also, best-performing employees of the Institute were felicitated at the hands of the Chief Guest. Several publications and videos developed by the NRCM scientists were released by the Chief Guest.

The program was attended by NRCM staff, ex-employees of NRCM, various senior officials of ICAR Institutes in Hyderabad, stakeholders, officials from private companies, and research scholars of the centre.

International Women's Day

International Women's Day was celebrated at the Insitute on 8th March 2021. On this occasion, several activities were conducted to create awareness on the proposed theme i.e., "Women Leadership in Agriculture: Entrepreneurship, Equity, and Empowerment". Dr. (Mrs) K. Manorama, Former Professor and Head, Quality Control Lab, PJTSAU, Rajendranagar, Hyderabad was invited as the Chief Guest. She delivered a lecture on 'Women Leadership in Agriculture: Achieving an Equal Future in COVID-19 World'.

On this occasion, successful women entrepreneurs of NRCM-Agribusiness Incubation Centre, Mrs. K. Saraswathi, Founder of M/s. Indian Foods and Spices, Mrs. K. Sulochana, recipient of Model Farmer award by Telangana State Adarsha Raithu Seva Sangam for establishing pig slaughterhouse at Mahabubnagar, and Mrs. Sarika, owner of M/s. Satyanarayana Spicy Foods shared their experiences and success stories. Also, essay writing and rangoli competition were conducted on 'Gender mainstreaming' and 'Women empowerment'.

World Water Day celebration

ICAR-NRC on Meat successfully organized World Water Day on 22nd March 2021. Dr. S. B. Barbuddhe, Director, ICAR-NRC on Meat, Hyderabad delivered a lecture on "Valuing water: United Nations Summary Progress Update 2021: SDG6-Water and Sanitation for all" and deliberated on 6 indicators namely drinking water, sanitation, hygiene, wastewater, water quality, water use efficiency, water stress,integrated water management, and transboundary and international cooperation and ecosystems.

World Environment Day

World Environment Day was celebrated at the Institute on 5th June, 2021. On this occasion, saplings were planted by the Scientists and Administrative Staff in the Institute campus.

International Yoga Day

International Yoga day was celebrated at the campus on 21 June 2021. The program was attended by scientists and staff of the Institute. Dr. S. B. Barbuddhe, Director introduced the theme for the year i.e., "Yoga for Wellness". He highlighted the importance and significance of daily yoga practice in our life. He also stressed the role of yoga practice in minimizing the stress and psychological issues arising due to the COVID-19 pandemic in the country. The practical demonstrations on Yoga were given by Dr. Suresh Devatkal, Principal Scientist. The Yoga protocol prescribed by Government of India was followed during the program.

World Zoonoses Day

ICAR-National Research Centre on Meat, Hyderabad, in collaboration with the Indian Meat Science Association (IMSA), National Association for Welfare of Animals and Research (NAWAR), and Society for Research on *Listeria* (SRL) jointly organized a National Webinar on 6th July 2021 to celebrate World Zoonoses Day. Dr. M. D. Gupte, Former Director, National Institute of Epidemiology (ICMR) graced the national webinar as an invited speaker. The topic of his lecture was "Anticipating Zoonoses Control through One Health Approach". The Webinar was hosted through virtual mode. Over 134 participants comprised of Academician, Researchers, Retired Professors, and students from Veterinary, Medical, Wildlife, and Environment Institutes were enriched with his lecture. Also, personnel from Food Industry and Animal Farm Owners actively participated in this event.

XVI Institute Research Council Meeting

XVI Institute Research Council meeting of ICAR – National Research Centre on Meat, Hyderabad was held on 04th and 05th October 2021. Dr (Prof) Sudhakar Reddy, Retd. Professor and Head, Department of LPT, Veterinary College, Hyderabad was invited as the expert. Dr. Rajan Gupta, Principal Scientist, Animal Science Division, ICAR also attended the meeting. Dr. S. B. Barbuddhe, Director, ICAR – National Research Centre on Meat, Hyderabad chaired the meeting. All the Scientists presented the progress report of their respective research projects.

Vigilance Awareness Week-2021

Vigilance Awareness Week (VAW) was observed at Institute from 26th October 2021. Dr. S.B. Barbuddhe, Director, ICAR-NRCM administered an integrity pledge to all the staff of the institute. Dr. Pandith M., Director, Ground Water Department, Telangana State delivered a lecture on "*Status of Groundwater Development and Management, Telangana State*" on 28th October 2021. Besides, an essay writing competition was conducted on the topic 'स्वतंत्रभारत**@75:** सत्यनिष्ठा के साथ आत्मनिर्भरता **Independent India@75: Self Reliance with Integrity**', following appropriate Covid-19 protocols. The staff members of the centre actively participated in the competition. The closing ceremony of Vigilance Awareness Week was held on 1st Nov, 2021, Dr. V.V. Kulkarni, Former Director, ICAR-NRCM, Hyderabad was invited as the Chief guest. The winners of the essay writing competition were awarded by the dignitaries.

Swachhta Campaign

In pursuance of the Council's instructions, Dr. S. B. Barbuddhe, Director, NRC on Meat, launched a special Swachhta campaign at ICAR-NRC on Meat, Hyderabad from 2nd to 31st October 2021. Different activities were undertaken during the period and all the staff participated actively with great enthusiasm. To commemorate the "Special Swachhta Campaign" an awareness procession was also taken out at Chengicherla village on 26th Oct, 2021. Many placards-slogans/quotes and banners about Swachh Bharat were carried by the staff.

World Soil Day

World soil day was celebrated at Institute on 5th December 2021. Director, Dr. S. B. Barbuddhe narrated the importance of soil in agriculture and briefed about the theme of World soil day for the year 2021. All the staff of the Institute actively participated in the programme.

Constitution and Citizens' Duties Day

The constitution and citizens' duties day was celebrated on 26th November 2021 at ICAR-National Research Centre on Meat, Hyderabad to commemorate the adoption of the Indian Constitution by the Parliament. The program started with the reading of the Preamble of Indian Constitution live by all the ICAR-NRCM staff along with Hon'ble President of India, Shri. Ram Nath Kovind Ji. The Director, felicitated 15 winner students of Hope foundation school, Chengicherla, Hyderabad with certificates who participated in debate on theme "Agriculture and Environment in the citizen face". The students were also given exposure visit to different demonstration plots of ICAR-NRCM and orientation towards opportunities in agricultural sector for entrepreneurship and employment.

Participation in Training/ Seminar/ Conferenc-es/ Symposia/ Workshop

Dr. S.B. Barbuddhe attended the 44th Annual Conference of Indian Association of Medical Microbiologists and chaired a session on "Role of One Health" at IAMM, Guwahati on 23 December, 2021.

Dr. S.B. Barbuddhe attended the Agriculture Science Congress held at BHU, Varanasi on 14-16 November, 2021.

Dr. S.B. Barbuddhe attended the XXV meeting of ICAR Regional Committee meeting – III on 11 December 2021 organized by ICAR Research Complex for NEH Region, Umiam through webcasting.

Dr. Y. Babji, Dr. Yogesh Gadekar, Dr. Deepak B Rawool and Dr. Rituparna Banerjee attended the training program on Regulations & Molecular application in meat and poultry industry, Assurance of Claims for Vegan, Vegetarian and Halal foods and Setting by a lab with NGS capability for food industry organized by the Food Safety and Standards Authority of India in collaboration with Thermo-Fisher Scientific on 27 - 29th April 2021.

Dr. Y. Babji attended an online Training on "Application of Intellectual Property Rights (IPR) for Different Aspects of Animal Genetic Resources in India" organized by the Department of Animal Genetics & Breeding, College of Veterinary Science & A.H., Mhow (M.P.) during 10th - 20th September 2021.

Dr. Y. Babji, Dr. Yogesh Gadekar and Dr. Rituparna Banerjee attended the training program "MDP on Market Research & Value Chain Management of Agricultural Commodities" at ICAR-NAARM, Hyderabad during 21-25 September 2021.

Dr. Y. Babji, Dr. Yogesh Gadekar and K. Varalakshmi attended National Webinar Series, Expertopedia at ICAR-CIPHET, Ludhiana on 18th October, 2021.

Dr. Y. Babji, Dr. S. Girish Patil, Dr. M. Muthukumar, Dr. Rituparna Banerjee, Dr. Gireesh Babu P attended the training of the trainer's program under FSSAI-FoSTaC on Hygienic and Sanitary Practices at ICAR-National Research Centre on Meat, Hyderabad on 27th November 2021.

Dr. Y. Babji and Dr. Yogesh Gadeker attended an international workshop on "Scientific Writing", organized by ICAR-National Dairy Research Institute, Karnal, Haryana on 23-24 June 2021.

Dr. Y. Babji and Dr. Yogesh P Gadekar attended International Webinar on "Eco-Health Paradigm: Towards Sustainability & Global Health", organized by Kerala Veterinary and Animal Sciences University, Kerala on 3-4th August 2021.

Dr. Y. Babji attended a Preconference workshop on Scope and Career Opportunities in Meat Science & Technology, organized by Meat Technology Unit, Thrissur, Kerala on 25th October 2021.

Dr. Y. Babji, Dr. Yogesh P Gadekar, Dr. S. Kalpana, Dr. Kandeepan and Dr. Gireesh Babu P attended the 5th Annual Convention of Association of Meat Scientists and Technologists & International Conference on Convergence of Technology and Policy for Sustainable Meat Production, organized by Kerala Veterinary and Animal Sciences University, Kerala during 25-28th October 2021.

Dr. S. B. Barbuddhe, Dr A. R. Sen, Dr. Y. Babji, Dr M. Muthukumar, Dr. G. Kandeepan, Dr. Yogesh Gadekar, Dr. S. Kalpana, Dr. P. Baswa Reddy, Dr. Girish Patil, S, Dr. L. R. Chatlod, Dr. B. M. Naveena, Dr. Gireesh Babu P and Dr. Rituparna Banerjee attended the "Tenth Conference of Indian Meat Science Association (IMSACON-X) and International Symposium" on "Holistic approach to the meat food quality & safety in a continuum from farm to fork", organized by Sardar Vallabhbhai Patel University of Agriculture Meerut, Uttar Pradesh during 25-27th November 2021.

Dr. Girish Patil, S. attended a training program on "Climate-resilient animal husbandry" from 18th to 21st August 2021.

Dr. Girish Patil, S. attended the training program of National Level Resource Persons of PMFME at FSSAI, New Delhi on 17th November 2021.

Dr. Girish Patil, S. attended the XV XVI and XVII meeting of Scientific Panel on, 'Meat and meat products' of FSSAI, New Delhi on 18th January, 29th July, and 02nd December 2021.

Dr. Girish Patil, S. attended the sensitization workshop of Agricultural Research Management System Nodal officers organized by ICAR on 08th June 2021.

Dr. B.M. Naveena attended a training program on "Pre-RMP Management Development Program on "Leadership Development" at ICAR-NAARM, Hyderabad during 13-24 Dec 2021.

Dr. Deepak B. Rawool attended a virtual training of INFOLNET (2.0) version for Referral Laboratories of FSSAI on 30th April 2021 and 6th August 2021

Dr. Deepak B. Rawool attended a virtual training on "Food Fraud and Authenticity" Organized by FOSF on 26th April 2021

Dr. Deepak B. Rawool attended an international symposium & workshop on "One Health in India: Research informing biosafety, preparedness and response" organized by ICMR on 12th April 2021.

Dr. Deepak B. Rawool attended the WHO webinar on "Burden of foodborne diseases: how can we estimate it and why do we need it" organized by WHO SEARO, New Delhi on 29th June 2021.

Dr. M. Muthukumar attended (Online) seminar the National Dialogue on Innovative food for hospital industry held Organized by ICAR on 22 June 2021.

Dr. M. Muthukumar attended the two-day virtual orientation workshop for ICAR Labs on R&D Exports organized by the Federation of Indian Export Organizations, Ministry of Commerce, Govt. of India during 12-13 August 2021.

Dr. M. Muthukumar attended the Nutri-Cereals Multi-stakeholders Mega Convention 3.0 organized by the Indian Institute of Millet Research, HyderabadHhhhh Hyderabad during 17-18 September 2021.

Dr. S. B. Barbuddhe and Dr. M. Muthukumar attended three Days Onsite NABL Assessor's Training held at Gurgaon from 23 to 25 September 2021.

Dr. M. Muthukumar attended a (Online) Management development programme on leadership development organized by NAARM, Hyderabad during 13-24 December 2021.

Dr. P. Baswa Reddy attended a training programme for the Evaluation Committee members under NPOP by APEDA at New Delhi 7-8 January 2021.

Dr. Girish Patil, S., Dr. Kandeepan. G, Dr. Rituparna Banerjee and Dr. B. M. Naveena attended the online training program "10th Asian Buffalo Congress on Buffalo production for food security and livelihood" organized by Agriculture and Forestry University, Rampur, Chitwan, Nepal during 25-29 October 2021.

Dr. Kandeepan G attended the 31st Anniversary World Congress on Biosensors (online) at Busan, South Korea during 26-29 July 2021.

Dr. Gireesh Babu P. attended a training program on "Transparency Audit with Respect of Compliance under Section 4 of RTI Act, 2005", IRMRA during 20 – 21st May 2021.

Dr. Gireesh Babu P. attended an online training program on "Transcriptomic Data Analysis", ICAR-IASRI during 28-30 September 2021.

Dr. L. R. Chatlod attended the "International mini-symposium on "Essentials of One Health", NIAB-Hyderabad on 13th October 2021.

Dr. L. R. Chatlod attended One health interactive session and an international symposium on "The essentials of a One Health Program", NIAB-Hyderabad on 20 and 21st October 2021.

Dr. L. R. Chatlod attended a workshop on Hindi Rajbhasha, NIRD &PR, Hyderabad on 2nd December 2021.

Dr. M. Muthukumar, Dr. Yogesh P Gadekar, and Dr. Rituparna Banerjee attended a training program on LC-MS/MS by M/S Waters India, 5 Floor, Splendid Towers, S. P. Road, Begumpet, Hyderabad on 11-12 January, 04-05 Feb &16 March 2021.

Dr. Yogesh P Gadekar attended training National e-Training on 'Chemical Residue Analysis, NAHEP-CAAST, MAFSU, Mumbai Veterinary College, Mumbai during 4-6th May 2021.

Dr. Yogesh P Gadekar attended training on "Reservation in Service", ICAR-NAARM, Hyderabad from 28-30th June, 202.

Dr. Yogesh P Gadekar attended an international webinar on "Safe Food Now for Healthy Tomorrow", Kerala Veterinary and Animal Sciences University, Kerala on 8th June 2021.

Dr. Yogesh P Gadekar attended a national webinar on National Security in India, ICAR-Research Centre for Eastern Region on 4th September 2021.

K. Varalakshmi attended an online training programme on Geospatial Analysis using QGIS&R, Conducted by NAARM, Hyderabad from1-6th February 2021.

K. Varalakshmi attended an online Workshop on "Farmer's income and research impact assessment", conducted by ICAR-NIAP, New Delhi on 29th November 2021.

K. Varalakshmi attended Webinar on "Assessing the Economic Impact of Agricultural Research" by Dr. Keith Fuglie, Senior Economist, Economic Research Service, USDA conducted by ICAR-NIAP, New Delhi on 17th December 2021.

Dr. Rituparna Banerjee attended online training on "Meat frauds and authenticity-Recent analytical approaches", Regulations & Molecular application in meat and poultry industry, Assurance of Claims for Vegan, Vegetarian and Halal foods and Setting by a lab with NGS capability for food industry organized by Food Safety and Standards Authority of India in collaboration with Thermo-Fisher Scientific from 26th to 29th April 2021.

Dr. Rituparna Banerjee attended National E-Training on "Chemical Residue Analysis", ICAR-NAHEP-CAAST project entitled "Centre of Excellence for Advanced Research on Animal Food Safety", Mumbai Veterinary College, Mumbai on 4 to 6th May 2021.

Dr. Rituparna Banerjee and Dr. Vishnuraj M.R. attended "67th International Congress on Meat Science and Technology", Krakow, Poland from 23-27th August 2021.

Dr. Rituparna Banerjee attended the 13th Annual meeting of the Proteomics Society of India and International Conference (OMICS, 2021) from 20th to 23rd October 2021.

Dr. Vishnuraj, M. R attended a training program on EMBO Laboratory Leadership from 15th to 18th Nov 2021.

Dr. Vishnuraj, M. R attended a training program on 5th PTP/RMP Conclave NABL on 30th and 31st August 2021.

Dr. Vishnuraj, M. R attended a training program on "Application of Bioinformatics in Agricultural Research & Education", NAARM during 20-24 September 2021.

Dr. Vishnuraj, M. R attended a training program on "Implementation Guidance on TACCP & VACCP", ITCFSAN during 24-25 May 2021.

Dr. Vishnuraj, M. R attended a training program on Online Internal Auditor Training to FSSC 22000 Ver 5.1, ITCFSAN during 26-29th April 2021.

Dr. Vishnuraj, M. R attended the 17th Annual Conference of the Indian Association of Veterinary Public Health Specialist, GADVASU, Ludhiana from 28th to 29th May 2021.

Awards and Recognition

- Dr. M. Muthukumar was selected as member of National Academy of Veterinary Sciences, New Delhi.
- Dr. Naveena, B.M. was selected as a Member of "Board of Studies" since March 2021 for Banaras Hindu University (BHU), UP.
- Dr. Naveena, B.M. was elected as Fellow of National Academy of Agricultural Sciences (NAAS) for the year 2021.
- Best paper award: Kandeepan G., Spoorthy A.S., Shivaji A., Babji Y. (2021). Development of an optical nano-sensor for identifying the cold chain breakdown in frozen meat. 10th Conference of Indian Meat Science Association and International Symposium on holistic approach to the meat food quality and safety in continuum from farm to fork. 25-27 November 2021, SVPUAT, Meerut (UP).p
- Best paper (oral presentation) First Prize**:** Kandeepan G., Spoorthy A.S., Shivaji A., Babji Y. (2021). Detecting the cold chain breakdown in frozen meat supply chain through an enzymatic nano-sensor. 5th Convention of Association of Meat Scientist and Technologist and International Conference on convergence of technology and policy for sustainable meat production. 25-28, October, 2021. KVASU, Thrissur.
- Early Career Researcher Editorial Board: Kandeepan G. Packaging Technology and Science, Springer.
- Dr. Kandeepan G: First prize: Essay writing, Vigilance awareness week-2021, ICAR-NRC on Meat, Hyderabad.
- Dr. Girish Patil and Dr. Kandeepan G: Post graduate diploma in technology management in agriculture (PGDTMA) with distinction from University of Hyderabad-NAARM.
- Dr. S. Kalpana bestowed with best oral presentation award (third position) in 5th AMST International Conference "Confirmatory analysis of colistin A and colistin B antibiotic residues in chicken meat by liquid chromatography coupled to tandem mass spectrometry" under technical session Food Safety and Quality organized by College of Veterinary and Animal Sciences, Mannuthy, Kerala from 25-28th October, 2021.
- Dr. Girish Patil, S., Dr. B. M. Naveena, Dr. M. Muthukumar and Dr. Vishnuraj have received Best Scientist Award in the Annual Day of ICAR – National Research Centre on Meat, Hyderabad held on 21st February 2021.
- Dr. Girish Patil, S., Principal Scientist has been selected as National Level Resource Person by Ministry of Food Processing Industries for implementation of PM Formalization of Micro Enterprises.
- Best Oral Presentation Award for the presentation**:** Girish Patil, S., C. Ramakrishna, Balamanikandan Raja and S.B. Barbuddhe (2021) Portable Meat Production and Retailing Facility (P-MART): A novel technology for hygienic meat production from sheep and goats. In the X Indian Meat Science Association Conference held from 25th to 27th November 2021 at College of Veterinary

Science, SVPUAT, Meerut, Uttar Pradesh

- Best poster and Best paper award: Gireesh Babu, P., Girish Patil, S. and C. Ramakrishna (2021) Novel DNA mini bar code primers for authentication of cooked/ processed meat products. In the X Indian Meat Science Association Conference held from 25th - 27th November 2021 at College of Veterinary Science, SVPUAT, Meerut, Uttar Pradesh
- Dr. Y. Babji, Principal Scientist was awarded with AMST Fellow 2021 award during the 5th Annual Convention of Association of Meat Scientists and Technologists & International Conference on Convergence of Technology and Policy for Sustainable Meat Production, October 25-28, 2021, Kerala Veterinary and Animal Sciences University, Kerala.
- Dr. Vishnuraj, M. R received Indian Meat Science Association (IMSA) – Dr K Dushyanthan Best Doctoral Thesis Award – 2021.
- Dr. Vishnuraj, M. R received Best oral paper award for "Novel molecular quantification technique using Droplet Digital PCR to tackle buffalo adulteration in traditional meat products" during Tenth Conference of Indian Meat Science Association (IMSACON-X).
- Dr. Vishnuraj, M. R received "Best Research Article" for the year 2020 from Journal of Indian Veterinary Association for the manuscript "Correlation of spoilage micro flora in chiller stored buffalo meat with chemical indicators.
- Dr. Rituparna Banerjee received best oral presentation award (IInd prize) for 'Absolute point-of-care technique based on lateral flow immunoassay for pork authentication in raw, cooked and commercial meat products' in 10th conference on Indian Meat Science Association and International Symposium on Holistic approach to the meat food quality and safety in continuum from farm to fork, Meerut, UP, 25-27th November, 2021.
- Dr. Rituparna Banerjee received best poster presentation award (IIIrd prize) for 'In-gel and GEL-FrEE fractionation and MALDI-TOF Mass spectrometry identification for meat authentication' in 10th conference on Indian Meat Science Association and International Symposium on Holistic approach to the meat food quality and safety in continuum from farm to fork, Meerut, UP, 25-27th Nov, 2021.
- Dr. A.R. Sen received (IMSACONX) best Researcher Award awarded by Indian Meat Science Association.

Publications

Research Papers

Girish, P.S., Kumari A., Gireesh Babu, P., Karabasanavar, N.S., Raja B., Ramakrishna C. and Barbuddhe S.B. (2021). Alkaline lysis-loop mediated isothermal amplification assay for rapid and on-site authentication of buffalo (*Bubalus bubalis*) meat. *Journal of Food Safety*, DOI: 10.1111/jfs.12955.

Naveena, B.M., Banerjee, R., Muthukumar, M., Barbuddhe, S.B., Sowmya, D. and Varakumar, P. (2021). Optimization of novel GELFREE fractionation for molecular weight based in-solution protein separation from buffalo meat, pork and chicken. *Food Analytical Methods,* 14(1): 88-97.

Muthukumar, M., Pathak, V., Rathod, K.S., Ambadkar, R.K. and Kulkarni, V.V. (2021). Carcass traits and value of meat and byproducts of sheep. *Indian Journal of Animal Sciences*, 91(7): 572- 576.

Kandeepan, G., Aliya, T., Shashikumar, M., Babji, Y. and Muniswamy, K. (2021). The effect of aerobic and modified atmospheric packaging on the color chemistry of refrigerated chicken leg meat. *Indian Journal of Animal Health*. 60(2)-Special Issue. https://doi.org/10.36062/ijah.2021.spl.01321.

Jagdish, S., Girish P.S., Shashi Kumar, M., Aparana, K., Praneetha, D.C., Santosh, K. and Nagappa, K. (2021) Species identification of biological samples derived from wild ungulate species by forensically informative nucleotide sequencing of Mitochondrial 12S rRNA Gene. *International Journal of Livestock Research*, 11 (06), 43-55.

Sahu, R., Vishnuraj, M.R., Srinivas, Ch., Dadimi, B., Megha, G.K., Pollumahanti, N., Malik, S.S., Vaithiyanathan, S., Rawool, D.B. and Barbuddhe, S.B. (2021). Development and comparative evaluation of droplet digital PCR and quantitative PCR for the detection and quantification of *Chlamydia psittaci*. *Journal of Microbiological Methods, 190*, 2021, 106318.

Kiran, M., Naveena, B.M., Banerjee, R., Venkatesh, Ch. and Rapole, S. (2021). Impact of stunning before slaughter on expression of skeletal muscles proteome in sheep. *Animal Biotechnology,* doi: 10.1080/10495398.2021.1976198.

Hearn, K., Denzer, M., Mitacek, R, Naveena, B.M., McDaniel, C., Jadeja, R., Mafi, G.G., Beker, A., Pezeshki, A. and Ramanathan, R. (2021). Effects of modified atmospheric packaging on ground chicken color and lipid oxidation. *Meat and Muscle Biology,* 5(1): 36, 1-9.

Hussan, F., Krishna, D., Preetam, V.C., Reddy, P.B. and Gurram, S. (2021). Dietary Supplementation of nano zinc oxide on performance, carcass, serum and meat quality parameters of commercial broilers. *Biological Trace Element Research*. 200(2):1-6

Kumar, P., Wisdom, K.S., Ram, R.K., Gireesh-Babu, P., Nayak, S.K., Nagpure, N.S. and Sharma R., (2021). Gonadotropin inhibitory hormone receptors (GnIHRs): Molecular characterization and synergistic effect of different drugs in Indian major carp, *Labeo catla*. *General and Comparative Endocrinology*, 314, 113904

Mamidala, S.P., Ande, M.P., Karthireddy, S., Chadha, N.K., Sawant, P.B., Xavier, B., Chintada B. and Gireesh-Babu P. (2021). Effect of Different Dietary Protein Levels on Physio-metabolic Response during Stunting of Milkfish, *Chanos chanos* (Forsskal, 1775) Reared under Pond Conditions. *Indian Journal of Animal Research*, DOI: 10.18805/IJAR.B-4813.

Vergis, J., Malik, S.V.S., Pathak, R., Kumar, M., Sunitha, R., Barbuddhe, S.B., Rawool, D.B. (2020). Efficacy of Indolicidin, Cecropin A (1-7)-Melittin (CAMA) and their combination against Biofilm-Forming Multidrug-resistant enteroaggregative *Escherichia coli. Probiotics and Antimicrobial Proteins*, 12(2):705-715.

Abishad, P., Niveditha, P., Unni, V., Vergis, J., Kurkure, N.V., Chaudhari, S., Rawool, D.B., and Barbuddhe, S.B. (2021). *In silico* molecular docking and *in vitro* antimicrobial efficacy of phytochemicals against multi-drug-resistant enteroaggregative *Escherichia coli* and non-typhoidal *Salmonella* spp. *Gut Pathogens*, 13(1):46.

Malla, B.A., Ramanjeneya, S., Vergis, J., Malik, S.V.S., Barbuddhe, S.B., and Rawool, D.B. (2021). Comparison of recombinant and synthetic listeriolysin- O peptide- based indirect ELISA vis-à-vis cultural isolation for detection of listeriosis in caprine and ovine species. *Journal of Microbiological Methods,* 188:106278.

Yadav, J.P., Malik, S.V.S., Dhaka, P., Kumar, A., Kumar, M., Bhoomika, S., Gourkhede, D., Singh, R.V., Barbuddhe, S.B. and Rawool, D.B. (2021). *Coxiella burnetii* in cattle and their human contacts in a gaushala (cattle shelter) from India and its partial *com*1 gene sequence-based phylogenetic analysis. *Animal Biotechnology* 12:1-10.

Nishanth, M.A.D., Bhoomika, S., Gourkhede, D., Dadimi, B., Vergis, J., Malik, S.V.S., Barbuddhe, S.B. and Rawool, D.B. (2021). Antibacterial efficacy of in-house designed cell-penetrating peptide against multi-drug resistant strains of *Salmonella enteritidis* and *Salmonella typhimurium*. *Environmental Microbiology,* doi: 10.1111/1462-2920.15778.

Vergis, J., Malik, S.V.S., Pathak, R., Kumar, M., Kurkure, N.V., Barbuddhe, S.B. and Rawool, D.B. (2021). Exploring *Galleria mellonella* larval model to evaluate antibacterial efficacy of Cecropin A (1-7)-Melittin against multi-drug resistant enteroaggregative *Escherichia coli*. *Pathogens and Disease,* 79(3):ftab010.

Vidyarthi, A.K., Biswas, S., Banerjee, R., Patra, G., Mahapatra, G., Waghaye, P. and Patel, R.K. (2021). Bioactive compounds from selected fruits improve quality and oxidative stability of *Wallago Attu* fish nuggets. *Indian Journal of Animal Research*, doi: 10.18805/IJAR.B-4506.

Pal, P., Kumar, B., Avasthe, R.K., Bhutia K.T. and Chatlod, L.R. (2020). Prevalence of gastrointestinal parasites in Tibetan sheep in alpine zone of North Sikkim, India. *Indian journal of Animal Sciences,* 90 (12):1567-1571.

Policy Papers

Girish Patil, S., Barbuddhe, S.B., Ganapathi S., Malik, P., Kondaiah, N., Joshi, V., Shah, M.C. and Tripathi B.N. (2021). Traceability System for Indian Meat Sector: Concept and Way forward. Policy Paper No. 3, ICAR – National Research Centre on Meat, Hyderabad, 32 pages

Brochures

Ramakrishna, C., Girish Patil, S. and Barbuddhe, S.B. (2021). Portable Meat Production and Retailing Facility (P-MART) for sheep and goats. Published by ICAR – National Research Centre on Meat, Hyderabad

Muthukumar, M., Banerjee, R., Naveena, B.M., Sen, A.R. and Barbuddhe, S.B. (2021). Booklet on "Cook like a pro-chef: Easy cook meat recipes" published by Centre for Agribusiness Incubator, ICAR-National Research Center on Meat, Hyderabad.

Kalpana, S., Muthukumar, M., Kandeepan, G., Vishnuraj, M.R. and Baswa Reddy P. (2021). Technical Leaflet on 'Reverse-Phase Liquid Chromatographic Determination of Fluoroquinolones in Buffalo Meat.' Published under National Livestock Mission (NLM) Project.

Kalpana, S., Muthukumar, M., Kandeepan, G., Vishnuraj, M.R. and Baswa Reddy P. (2021). Technical Leaflet on 'Quantitative Analysis of Residual Tetracyclines in Buffalo Meat using RP-HPLC.' Published under National Livestock Mission (NLM) Project.

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Kandeepan, G., Babji, Y., Baswa Reddy, P., Devatkal, S. and Kalpana, S. (2021). Technical Leaflet on 'Model Retail Meat Shop for Small Ruminants.' Published under National Livestock Mission (NLM) Project.

Vishnuraj, M.R., Baswa Reddy P. and Barbuddhe, S.B. (2021). Leaflet on 'Dos and Don'ts while collecting and forwarding meat samples for testing to Meat Species Identification Laboratory (MSIL). Published under National Livestock Mission (NLM) Project.

Reviews/Technical/Popular Articles

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Muthukumar, M., Nair, R.G., Naveena, B.M., Devatkal S.K. and Mandal, P.K. (2020). Online meat marketing: Technical, socio-economic, and regulatory challenges *J. Meat Sci*. 2020, 15(2): 1-5

Baswa Reddy, P. (2021). 'Organic Livestock and Organic poultry production in India: Opportunities and Bottlenecks' published online in the e-magazine 'Pure & Eco India' Oct 2021.

Kandeepan, G. (2021). Biodegradable Nanocomposite Packaging Films for Meat and Meat Products: A Review. *Journal of Packaging Technology and Research*, 5: 143-166.

Kandeepan, G. (2021). Doubling income by adopting technologies for processing value added meat products. *Fleishwirtschaft International* 3: 40-42.

Banerjee, R., Naveena, B.M., Sowmya, D., Sushma, S.A. (2021). OFFGEL and GELFrEE fractionation: Novel liquid-phase protein recovery strategies in proteomics studies. *Trends in Analytical Chemistry,* 140: 116282.

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Banerjee, R., Naveena, B.M., Gadekar, Y.P., Biswas, S., Patra, G., Bhattacharyya, D., Mahapatra, G. and Vidyarthi, A.K. (2021). Authentication of muscle foods: A proteomic and metabolomic insight. *Indian Journal of Animal Health,* 60(2): 131-142.

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Babji, Y., Kandeepan, G., Gadekar, Y.P., Sen, A.R., Kalpana, S., Muthukumar, M., Girish Patil S. and Barbuddhe, S.B. (2021). Sustainable eco-friendly natural plant-based antimicrobials for augmenting meat food safety and quality assurance at the X Indian Meat Science Association Conference held from 25th to 27th November 2021 at College of Veterinary Science, SVPUAT, Meerut, Uttar Pradesh, 34-39.

Kandeepan, G., Babji, Y., Gadekar, Y., Kalpana, S., Baswa Reddy P. (2021). Intelligent packaging solutions for safety and quality assurance of meat and meat products in the value chain. Tenth Conference of Indian Meat Science Association (IMSACON-X) and International Symposium on "Holistic approach to the meat food quality & safety in continuum from farm to fork" held at SVPUAT Meerut, UP during 25-27 November 2021 Pp:67-70.

Babji. Y., Kandeepan, G., Gadekar Y.P. and Kalpana, S. (2021). Green technologies for resilient livestock production and processing for rural economy and in automated system in Climate Smart Technologies for Food Animal Production and Products, pgs 19-23 April 2021.

Kandeepan, G., Babji, Y., Kalpana, S., Spoorthy, S.A., Aliya, T. (2021). Smart packaging of meat and meat products: a possible solution for climate change in Climate Smart Technologies for Food Animal Production and Products, 19-23 April 2021, pg24- 37.

Kandeepan G., Babji, Y., Gadekar. Y.P., Kalpana S. (2021). Climate smart innovations for livestock product processing in Climate Smart Technologies for Food Animal Production and Products, 19-23 April 2021pgs.89-95.

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Kandeepan, G., Babji. Y., Gadekar, Y.P., Kalpana, S. (2021). Effect of thermal stress on the quality and safety of meat and meat products in Climate Smart Technologies for Food Animal Production and Products,19-23 April 2021, pp. 132-138.

Kalpana, S., Kandeepan, G., Gadekar, Y.P. and Babji, Y. (2021). Impact of climate change on livestock: Mitigation and adaptation strategies in Climate Smart Technologies for Food Animal Production and Products, 19-23 April 2021, pp. 164-171.

Rawool, D.B. (2021). Microbial Safety of Meat and Meat borne Zoonoses. Invited lecture in 'Master Trainers training program on Meat & Poultry Processing', organized at ICAR- NRC on Meat, Hyderabad, 9 – 13 August, 2021.

Rawool, D.B. (2021). Climate change and new diseases in animals. Invited lecture in n Climate-smart technologies for food animal production and products., organized jointly by MANAGE, Hyderabad and ICAR- NRC on Meat, Hyderabad, 19-23 April, 2021.

Rawool, D.B. (2021). An Overview on Q fever: Indian Perspective. Invited lecture In IDP training and capacity building programme under NAHEP, organized by GADVASU, Ludhiana, 16 July, 2021.

Rawool, D.B. (2021). AMR Crisis Research Initiatives and Way forward. Invited lecture in Short-term Training Course on "Current Scenario and Future Challenges of Animal Health and Production in the North-western Himalayan Region" organized by ICAR-Indian Veterinary Research Institute (IVRI), Regional Station, Palampur, H.P. 8 - 13 November, 2021.

Girish Patil, S. and Balamaninkandan R. (2021). Farm to fork traceability system for meat food quality and safety assurance at the X Indian Meat Science Association Conference held from 25th to 27th November 2021 at College of Veterinary Science, SVPUAT, Meerut, Uttar Pradesh, 110-113.

Girish Patil, S (2021). Invited lecture on Portable meat production and retailing facility (P-MART) for sheep and goats. organized by Department of Livestock Production Management, Post Graduate Institute of Veterinary and Animal Sciences, MAFSU, Akola, on 14th July 2021

Girish Patil, S. (2021). Invited lecture on Techniques and hygienic practices during slaughter and meat handling in the National e-Training on "Recent Advances in Quality Assurance of Meat and Meat Products" organized by Centre for Excellence for Advanced Research on Animal Food Safety, Mumbai Veterinary College, Mumbai, 02nd February 2021.

Girish Patil, S. (2021). Invited lecture on Packaging of meat and meat products. organized by Indian Institute of Packaging, Mumbai& ITCFSAN from 3rd April to 26th June 2021.

Girish Patil, S. (2021). Invited lecture on, 'Enhancing collaboration between VEEs and related agencies for under graduate training – Perceptions of meat sector' in the OIE Virtual Workshop for Veterinary Education Establishments (VEEs) in India in Association with Department of Animal Husbandry & Dairying, Ministry of Fisheries, Animal Husbandry & Dairying, Govt of India and Veterinary College- Bengaluru on 7th June 2021.

Girish Patil, S. (2021). Invited lecture on, 'Significance of animal proteins in human well-being' in the national e-Training programme on "Role of Proteins in Human Nutrition: Challenges and Opportunities" organized by Veterinary College, Mumbai under ICAR-NAHEP-CAAST Project on 24th December, 2021.

Muthukumar, M. (2021). Presentation on "Climate-smart technologies for slaughterhouse management" at the National Institute of Agricultural Extension Management (MANAGE), Hyderabad sponsored training programme on "Climate Smart Technologies for Food Animal Production and Products" Organised by ICAR-National Research Centre on Meat, Hyderabad

Muthukumar, M. (2021). An online presentation on "Perspective of buffalo meat sector" at the Agri benchmark – Beef and sheep Conference 2021 hosted by Institute of Farm Economics, Germany on 14 June 2021.

Muthukumar, M. (2021). Online lecture on "Role of ICAR-NRCM Agribusiness incubator on entrepreneurship development" at the workshop on "Production Livestock Products for micro,

small and start Ups entrepreneurs organized by Veterinary College, Thanjavur, TANUVAS on 25th August 2021.

Muthukumar, M. (2021). Lecture on "Service abattoirs – Indian perspective" at the online training for Master trainers on "Meat and Poultry Processing" sponsored by Ministry of Food Processing Industries, Govt. of India under PMFME" organised on 10 August 2021.

Muthukumar, M. (2021). Online lecture on "Technology of meat, fish, egg and poultry products" at the industry oriented add-on course on "Food Science & Technology: Farm to Fork" offered by the Department of Chemistry, Sri Venkateshwara College, University of Delhi on 18 September 2021.

Muthukumar, M. (2021). Presentation on "Slaughtering and processing of small ruminants" at the National summit on "Building organized meat sector in India towards ensuring Atmanirbhar Bharat" held at National Academy of Agriculture Research and Management, Hyderabadon 3rd September 2021.

Muthukumar, M. (2021). Presentation on "Trends in refrigeration for Meat & Poultry at the International Exhibition and Conference (Virtual) on Cold-Chain, Industrial Refrigeration &Reefer Transportation held on 17-18 December 2021.

Muthukumar, M. (2021). Lead paper presentation on topic entitled, "Ensuring sustainability of livestock sector through innovative meat processing and policy interventions" at IMSACON-X organized at Department of Livestock Products Technology, College of Veterinary & Animal Sciences, Meerut, U.P from 25th to 27th November, 2021.

Reddy, P.B. (2021). Invited lecture on 'Organic farming and Meat production' on 14th Dec 2021 as part of the 5 days EDP programme on 'Value added meat products and processing' organized by ICAR-NRC on Meat from 14th to 18th Dec 2021.

Reddy, P.B. (2021). A lecture virtually on 'Climate smart small ruminant feeding' on 21-04-2021 as part of MANAGE sponsored 5 days virtual training programme on 'Climate smart technologies for food animal production and products' organized by ICAR-NRC on Meat during 19-23 April 2021.

Reddy, P.B. (2021). Invited lecture on 'Organic meat production: A new entrepreneurial opportunities' on 22nd Oct 2021 as part of MANAGE sponsored training programme on 'Market oriented entrepreneurship in value added meat poultry products' organized by ICAR-NRC on Meat during 20-22 October 2021.

Reddy, P.B. (2021). Invited lecture online on 'Organic sheep and goat production- Standards and certification procedures' as part of online lecture series organized by Satya zero grazing on 22nd Sep 2021.

Reddy P.B. (2021). Invited lecture on 'Concepts in Organic meat production and certification' on 11th Nov 2021 as part of the five days 'Entrepreneurship Development programme (EDP) on clean meat production, value addition and quality assurance' organized by ICAR-NRC on Meat during 9-13 Nov 2021.

Reddy, P.B. (2021). Lead paper on 'Organic meat production and certification protocols: Challenges and prospects' during the International symposium on 'Holistic approach to the meat food quality and safety continuum from farm to fork' organized by the Indian Meat Science Association (IMSACON-X) at Dept of LPT, College of Vety Science, SVPUAT, Modipuram, Meerut during 25-27 Nov 2021.

Reddy, P.B. (2021). Delivered an invited lecture on 'Organic meat production and marketing' during the training programme for the progressive farmers on 'Commercial sheep and goat farming under intensive system' organized jointly by Regional fodder Station, Hyderabad and Veterinary Vignanam youtube channel at RFS, Hyderabad on 26th Dec 2021.

Kalpana, S. (2021). Veterinary drug residues in animal derived foods: concerns and current regulations. In 5th AMST International Conference on "Convergence of technology and policy for sustainable meat production" organized by College of Veterinary and Animal Sciences, Mannuthy, Kerala from 25-28th October, 2021.

Banerjee, R. (2021). Invited lecture on 'Meat quality and authenticity: A proteomics approach' during Training program on "Value addition to sheep products with special reference to wool and mutton" during 12-16th April 2021 organized by CSWRI, Avikanagar and MANAGE, Hyderabad.

Banerjee, R. (2021). Invited lecture on 'Processing and Value Addition in Livestock products' during "Training program on "Innovative Ideas for Entrepreneurship Development in Livestock Sector" during 15-17 June, 2021 at MANAGE, Hyderabad.

Banerjee, R. (2021). Invited lecture on 'Storage and preservation of meat and meat products and analytical techniques for evaluation of meat quality and shelf-life' during Entrepreneurship development program (EDP) on 'Clean meat production, value addition and quality assurance' from 9-13th November, 2021

Banerjee, R. (2021). Invited lecture on 'Ingredients and equipment for value added meat processing' during Online training for Master trainers on 'Meat and poultry processing' under PM-FME scheme of MoFPI, GoI in collaboration with IIFPT, Thanjavur during 10-13th August, 2021.

Babji, Y., Kandeepan, G., Kalpana, S., Baswa Reddy, P., Devatkal, S.K., Sen, A.R., Naveena, B.M., Muthukumar, M., Gadekar, Y.P., Girish Patil, S. and Barbuddhe, S.B. (2021). Effects of process variables on physical characteristics of microencapsulated *Cinnamomum zeylanicum* essential oil using emulsion extrusion method in 5thAnnual Convention of Association of Meat Scientists and Technologists & International Conference on Convergence of Technology and Policy for Sustainable Meat Production, Kerala Veterinary and Animal Sciences University, Kerala, October 25-28,2021.

Girish Patil, S., Ramakrishna, C., Raja, B. and Barbuddhe, S.B. (2021). Portable Meat Production and Retailing Facility (P-MART): A novel technology for hygienic meat production from sheep and goats. In the X Indian Meat Science Association Conference at College of Veterinary Science, SVPUAT, Meerut, Uttar Pradesh, 175, held from 25th to 27th November 2021.

Girish Patil, S., Kacham, S., Praneetha, D. C., Raja, B., Dhawan, J. and Radha, V. (2021). Characterization of extracellular matrix from sheep skeletal muscle tissue and utilization of sheep serum for culturing of myoblasts. In the X Indian Meat Science Association Conference at College of Veterinary Science, SVPUAT, Meerut, Uttar Pradesh, 221held from 25th to 27th November 2021.

Gireesh-Babu, P. (2021). Designing of novel universal primers against selected mitochondrial genes for meat speciation. In International conference on 'Convergence of Technology & Policy for Sustainable Meat Production' held during 25-28 Oct 2021.

Gireesh-Babu, P., Girish Patil, S., Ramakrishna, C. (2021). Novel DNA mini-barcode primers for authentication of cooked/processed meat products. In International Symposium on 'Holistic Approach to the Meat Food Quality & Safety in Continuum from Farm to Fork' (IMSACONX) held during 25-27 Nov 2021.

Gadekar, Y.P., Girish Patil, S., Sen, A. R., Muthukumar, M., Rawool, D.B., Baswa Reddy P. and Barbuddhe, S.B. (2021). Waste to wealth: poultry slaughter coproducts-based pet snack. In the X Indian Meat Science Association Conference at College of Veterinary Science, SVPUAT, Meerut, Uttar Pradesh, 232held from 25th to 27th November 2021.

Banerjee, R., Naveena, B.M., Subhasish, B., Sowmya, D., Barbuddhe, S.B., Patra, G. and Bhattacharyya, D. (2021). Point-of-care extraction and GELFrEE electrophoresis for pork protein fractionation. In: 67th International Congress on Meat Science and Technology, Krakow, Poland, Pp 245, 23-27 August, 2021.

Banerjee, R., Naveena B.M., Biswas, S., Dasoju, S., Barbuddhe, S.B., Patra, G., Bhattacharyya, D. (2021). GELFrEE Fractionation and MALDI-TOF MS identification of Buffalo Meat and Pork Specific Carbonic Anhydrase-3 Peptides for Meat Species Authentication. In: 13th Annual meeting of Proteomics Society of India and International Conference (OMICS, 2021), Hyderabad, Pp 101-102, 20-23 October, 2021.

Banerjee, R., Naveena, B.M., Biswas, S., Dasoju, S., Barbuddhe, S.B., Gadekar, Y.P. (2021). Point-of-Care Extraction and GELFrEE Electrophoresis for Buffalo Protein Fractionation. In: 10th Asian Buffalo Congress, 2021, Nepal, Pp. 86, 25-29th Oct, 2021.

Banerjee, R., Naveena B.M., Dasoju, S., Muthukumar, M. and Barbuddhe, S.B. (2021). In-gel and GELFrEE fractionation and MALDI-TOF Mass spectrometry identification for meat authentication. In: 10th conference on Indian Meat Science Association and International Symposium on Holistic approach to the meat food quality and safety in continuum from farm to fork, Meerut, UP, 25-27th Nov, 2021.

Banerjee, R., Naveena, B.M., Biswas, S., Dasoju, S., Vishnuraj, M.R. and Barbuddhe, S.B., Patra, G., Bhattacharyya, D. (2021). Absolute point-of-care technique based on lateral flow immunoassay for pork authentication in raw, cooked and commercial meat products. In: 10th conference on Indian Meat Science Association and International Symposium on Holistic approach to the meat food quality and safety in continuum from farm to fork, Meerut, UP, Pp. 225, 25-27th Nov, 2021.

Gadekar, Y.P. Girish Patil, S., Sen, A.R., Muthukumar, M., Rawool, D.B., Baswa Reddy P. and Barbuddhe, S.B. (2021). Abstract presented orally on 'Waste to wealth: poultry slaughter co-products based pet snack' presented during International symposium on 'Holistic approach to the meat food quality and safety continuum from farm to fork' organized by the Indian Meat Science Association (IMSACON-X) at Dept of LPT, College of Vety Science, SVPUAT, Modipuram, Meerut during 25-27 Nov 2021.

Kandeepan, G., Spoorthy, A.S., Shivaji, A., Babji, Y. (2021). Development of an optical nano-sensor for identifying the cold chain breakdown in frozen meat. 10th Conference of Indian Meat Science Association and International Symposium on holistic approach to the meat food quality and safety in continuum from farm to fork. 25-27 November 2021, SVPUAT, Meerut (UP). Pp.202-203.

Kandeepan, G., Sneha, S., Hariharan, N.M., Vishnuraj, M.R., Babji, Y. (2021). Designing a DNA nano biosensor for verification of pork in minced meat. 10th Conference of Indian Meat Science Association and International Symposium on holistic approach to the meat food quality and safety in continuum from farm to fork. 25-27 November 2021, SVPUAT, Meerut (UP). Pp.224.

Kandeepan, G., Spoorthy, A.S., Shivaji, A., Babji, Y. (2021). Detecting the cold chain breakdown in frozen meat supply chain through an enzymatic nano-sensor. 5th Convention of Association of Meat Scientist and Technologist and International Conference on convergence of technology and policy for sustainable meat production. KVASU, Thrissur, 25-28, October, 2021.

Kandeepan, G., Sneha, S., Hariharan, N.M., Vishnuraj, M.R., Babji, Y. (2021). Development of DNA nanobiosensor for authentication of pork in minced meat. 5th Convention of Association of Meat Scientist and Technologist and International Conference on convergence of technology and policy for sustainable meat production. KVASU, Thrissur, 25-28, October, 2021.

Kalpana, S. (2021). Confirmatory analysis of colistin A and colistin B antibiotic residues in chicken meat by liquid chromatography coupled to tandem mass spectrometry. In 5th AMST International Conference on "Convergence of technology and policy for sustainable meat production" organized by College of Veterinary and Animal Sciences, Mannuthy, Kerala from 25-28th October, 2021.

Kalpana, S. (2021). Confirmation and quantitation of Sulphonamides and Trimethoprim antibiotic residues in buffalo meat using UPLC-ESI-MS/MS. In IMSACON X International Symposium on "Holistic approach to the meat food quality and safety in continuum from farm to fork" organized by College of Veterinary and Animal Sciences, SVPUAT, Meerut from 25-27 November, 2021.

Gadekar, Y.P., Shinde, A.K., Soni, A., Bhatt, R.S. (2021). Effect of Variable Live Weights on Carcass Attributes of Malpura Ram Lambs and Rams. In: Proceedings 5th Annual Convention of Association of Meat Scientists and Technologists & International Conference on Convergence of Technology and Policy for Sustainable Meat Production organized by Kerala Veterinary and Animal Sciences University, Kerala. October 25-28, 2021.

Gadekar, Y.P., Thirumurugan, P., Soni, A. and Shinde, A. K. (2021). Effect of Azolla Feeding on Carcass Traits and Meat Quality of Rabbits. In: Proceedings 5th Annual Convention of Association of Meat Scientists and Technologists & International Conference on Convergence of Technology and Policy for Sustainable Meat Production organized by Kerala Veterinary and Animal Sciences University, Kerala. October 25-28, 2021.

Gadekar, Y.P., Girish Patil S., Sen, A.R., Muthukumar, M., Rawool, D.B., Baswa Reddy P. and Barbuddhe, S.B. (2021). Waste to wealth: poultry slaughter coproducts-based pet snack. In: Proceedings Tenth Conference of Indian Meat Science Association (IMSACON-X) and International Symposium on "Holistic approach to the meat food quality & safety in continuum from farm to fork" organized by SVPUAT Meerut, Uttar Pradesh, Pp: 232, 25-27 November, 2021.

Vishnuraj, M.R., Aravind Kumar, N., Vaithiyanathan, S., Srinivas, Ch., Chauhan, A. and Barbuddhe, S.B. (2021). Development and validation of a droplet digital PCR targeting intron-based sequence for detection and quantification of buffalo meat substitution in beef. In: Proceedings of 67th International Congress of Meat Science and Technology, KRAKÓW, Poland. Pp 286, 23-27, August, 2021.

Vishnuraj, M.R., Devatkal, S.K., Vaithiyanathan, S., Mendiratta, S.K, Srinivas, Ch. and Barbuddhe, S.B. (2021). Detection and specific identification of giblets in processed chicken meat products using droplet digital PCR based quantification of miRNAs. In: Proceedings of 67th International Congress of Meat Science and Technology, KRAKÓW, Poland. Pp 286, 23-27, August, 2021.

Vishnuraj, M.R., Devatkal, S.K., Vaithiyanathan, S., Barbuddhe, S.B., Srinivas, Ch. and Mendiratta, S.K.. (2021). Detection of offal meats in processed chicken meat products quantifying tissue specific miRNA markers. In proceedings of 17th Annual Conference of Indian Association of Veterinary Public Health Specialist organized during 28-29, May, 2021 by GADVASU, Ludhiana.

Aravind Kumar, N., Vishnuraj, M.R., Vaithiyanathan, S., Srinivas, Ch., Chauhan, A. and Barbuddhe, S.B. (2021). Novel molecular quantification technique using Droplet Digital PCR to tackle buffalo adulteration in traditional meat products. In proceedings of Tenth Conference of Indian Meat Science Association (IMSACON-X) and International Symposium during organized, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut. Pp. 312, 25to 27th November, 2021.

Aravind Kumar N., Vishnuraj, M.R., Barbuddhe, S.B., Srinivas Ch. and Vaithiyanathan, S. (2021). Digital droplet PCR assay in food fraud investigation: A validated protocol for robust detection of buffalo ghee substitution in cow ghee. In proceedings of 17th Annual Conference of Indian Association of Veterinary Public Health Specialist organized during 28-29, May, 2021 by GADVASU, Ludhiana.

Prasanna, M., Kandeepan, G., Nagamallika, E., Eswara Rao, B. (2021). Development and evaluation of lysozyme–pectin complexes for antimicrobial packaging of chicken patties. 10th Conference of Indian Meat Science Association and International Symposium on holistic approach to the meat food quality and safety in continuum from farm to fork, SVPUAT, Meerut (UP). Pp.193,25-27 November 2021.

Gadekar, Y.P. (2021). Invited lecture on 'Value addition to mutton' during annual workshop on 'Deccani Sheep' organized by College of Veterinary And Animal Sciences, Parbhani, MAFSU, Nagpur, Maharashtra on 17/03/2021.

Gadekar, Y. P. (2021). Invited lecture on 'Functional Mutton Production' by National Institute of Agricultural Extension Management (MANAGE), Hyderabad' sponsored training programme on "Value addition to sheep products with special reference to wool and mutton" organized at ICAR-CSWRI, Avikanagar during 12-16 April 2021.

Gadekar, Y.P. (2021). Invited lecture on 'Waste to wealth: climate resilient livestock production and product processing' on 22.04.2021 during National Institute of Agricultural Extension Management (MANAGE), Hyderabad sponsored training programme on "Climate Smart Technologies for Food Animal Production and Products" organized at ICAR-NRCM, Hyderabad during 19-23 April 2021.

Gadekar, Y.P. (2021). Invited lecture on "Opportunities in value addition to meat' during an International webinar organized by Sathya0garzing in association with Alembic Pharmaceuticals on 13th June 2021.

Gadekar, Y.P. (2021). Invited lecture on "Value addition to goat meat: A way forward" on 17.07.2021 during National online training programme on Sustainable Goat Production under Changing Climate organized by Post Graduate Institute of Veterinary and Animal Sciences, Akola (MAFSU, Nagpur) during13-17 July 2021.

Gadekar, Y.P. (2021). Lecture on 'Slaughter co-product Management-Need of the hour' in weekly webinar during Azadi ka Amrit Mahotsav celebrations at ICAR-NRC on Meat Hyderabad on October 8, 2021.

Gadekar, Y.P. (2021). Invited lecture on 'Value addition of byproducts and entrepreneurship opportunities' during Four days training programme for Master Trainers on Meat and Poultry Processing" under PM Formalization of Micro Food Processing Enterprises (PM-FME) Scheme sponsored by MOFPI in joint collaboration of ICAR-NRC on Meat Hyderabad and Indian Institute of Food Processing Technology (IIFPT), Thanjavur, Tamil Nadu during 10-13 August 2021.

Gadekar, Y.P. (2021). Invited lecture on 'Wholesome meat production' during the Entrepreneurship Development Training Program Entrepreneurship development program (EDP) on Value added meat products processing" during November 14-18, 2021.

Gadekar, Y. P. (2021). Invited lecture on value added egg and poultry meat production during the training 'Commercial Poultry Farming and Entrepreneurship development' organized by Postgraduate Institute of Animal and Veterinary Sciences, Akola, MAFSU, Nagpur on 16.12.2021.

Gadekar, Y.P. (2021). Lecture on 'Co-product utilization in meat industry' on 13.11.2021during the Entrepreneurship Development Training Program Entrepreneurship development program (EDP) on Value added meat products processing" during November 14-18, 2021.

Gadekar, Y.P. (2021). Lecture on Value added egg and poultry meat production on 16.12.2021 during the training 'Commercial Poultry Farming and Entrepreneurship development' organized by Postgraduate Institute of Animal and Veterinary Sciences, Akola, MAFSU, Nagpur.

Barbuddhe, S.B., Gadekar Y.P. and Muthukumar, M. (2021). One health perspective on meat sector. Tenth Conference of Indian Meat Science Association (IMSACON-X) and International Symposium on "Holistic approach to the meat food quality & safety in continuum from farm to fork" held at SVPUAT Meerut, UP, pp:1-7 during 25-27 November 2021.

Babji, Y., Kandeepan, G., Gadekar, Y.P., Sen, A.R., Kalpana, S., Muthukumar, M., Girish Patil S. and Barbuddhe, S. B. (2021). Sustainable eco-friendly natural plant-based antimicrobials for augmenting meat food safety and quality assurance. Tenth Conference of Indian Meat Science Association (IMSACON-X) and International Symposium on "Holistic approach to the meat food quality & safety in continuum from farm to fork" held at SVPUAT Meerut, UP during 25-27 November 2021 pp: 34-39.

Kandeepan, G., Babji, Y., Gadekar, Y.P., Kalpana, S., Baswa Reddy P. (2021). Intelligent packaging solutions for safety and quality assurance of meat and meat products in the value chain. Tenth Conference of Indian Meat Science Association (IMSACON-X) and International Symposium on "Holistic approach to the meat food quality & safety in continuum from farm to fork" held at SVPUAT Meerut, UP during 25-27 November 2021 Pp:67-70.

Vishnuraj, M.R. (2021). Application of digital droplet PCR in food forensics. Lead paper presented in "Emerging technology - Droplet digital PCR" organized by Department of Genetics and Biotechnology, Osmania University, Hyderabad, 1-3, September, 2021.

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Committees

Quinquennial Review Team (QRT)

1. Dr. Suresh Honnappagol, Former Animal Husbandry Commissioner & Former Vice Chancellor, Chairman
2. Dr. V. Appa Rao, Professor and Head, Deptt., of Livestock Products Technology (Meat Science), Madras Veterinary College, Chennai, Member
3. Dr. Dewnand R Kalorey, Former Director of Research, MAFSU, Nagpur, Member
4. Dr. D.N. Kamra, Former National Professor, Animal Nutrition Division, ICAR-IVRI, Izatnagar, U.P., Member
5. Dr. Subeer S. Majumdar, Director, NIAB, Hyderabad, Member
6. Dr. N.K. Praharaj, CEO, Hitech Hatch Fresh Ltd., Bhubaneswar, Member
7. Dr. Girish Patil, S., Principal Scientist, ICAR-NRC on Meat, Member Secretary

Research Advisory Committee (RAC)

1. Dr. A. T. Sherikar, Former Vice Chancellor, Navi Mumbai, Chairman
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4. Dr. B. C. Patnayak, Ex-Director, ICAR-CSWRI, R/o S-30, Chandrasekharpur, Bhubaneshwar-751023, Member
5. Dr. A. S. R. Anjaneyulu, Former Emeritus Scientist, Member
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7. Dr. Ashwin Raut, Principal Scientist, National Institute of High Security Animal Diseases, Bhopal- 460 022, Member
8. Dr. Nitin V. Kurkure, Prof & Head, Dept. of Pathology, Nagpur Veterinary College, Nagpur -440 006, Member
9. Sh. Subash Chanderji, Member
10. Sh. Ravi Kumar, Member
11. Dr. B. M. Naveena, Principal Scientist, ICAR-NRC on Meat, Hyderabad, Member Secretary

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1. Dr. S. B. Barbuddhe, Director, ICAR-NRC on Meat, Chengicherla, Hyderabad
2. Director, Animal Husbandry Department, Govt. of Telangana

3. Director, Animal Husbandry Department, Govt. of Andhra Pradesh
4. Dean, Sri P. V. Narsimha Rao, Telangana State University for Veterinary Animal Fishery Sciences, Rajendranagar, Hyderabad – 500 030
5. Shri. G. Subash Chanderji, 16-1-289, Saidabad, Hyderabad
6. Shri Ravi Kumar. 5-8-61. Nampally, Hyderabad
7. Dr. S. Senthil Vinayagam, Principal Scientist ICAR-NAARM, Rajendranagar, Hyderabad – 500030
8. Dr. S. P. Fonglan, General Manager, AOV Experts, Vijayawada, Andhra Pradesh
9. Dr. M. V. L. N. Raju, Principal Scientist ICAR-DPR, Rajendranagar, Hyderabad – 500030
10. Dr. Narasaiah, Principal Scientist, ICAR- CIPHET, Ludhiana, Punjab- 141004
11. Dr. Amrish Tyagi, Asst. Director General (ANP), ICAR, Krishi Bhavan, New Delhi – 110 001
12. Shri Jakir Hussain Khilji, Chief Finance & Accounts Officer, NAARM, Hyderabad
13. Sh. B.P.R.Vithal, I/c. Admin Officer, ICAR-NRCM, Hyderabad
14. Dr. Girish Patil S., Principal Scientist, I/c. PME Cell, ICAR-NRCM
15. Sh. M. N. V. Rao, AF&AO, ICAR-NRCM, Hyderabad

Institutional Animal Ethics Committee (IAEC)

1. Dr. S. B. Barbuddhe, Chairman
2. Dr. P. Baswa Reddy, Scientist In-Charge of Animal House Facility, Member Secretary
3. Dr. G. Kandeepan, Biological Scientist, Member
4. Dr. S. Kalpana, Scientist from different biological discipline, Member
5. Dr. C. Ramakrishna, Veterinarian, Member
6. Prof. A. Gopala Reddy, Main Nominee, Member
7. Dr. B. D. P. Kala Kumar, Link Nominee, Member
8. Dr. Jayasree Chiring Phukon, Scientist from outside the Institute, Member
9. Dr. K. Venkaiah, Socially Aware Nominee, Member

Institutional Biosafety Committee (IBSC)

1. Dr. S. B. Barbuddhe, Director, ICAR-NRCM, Hyderabad, Chairman
2. Dr. Ravi Kumar G.V.P.P.S, Principal Scientist, NIAB, Hyderabad, DBT Nominee
3. Dr. T. K. Bhattacharya, National Fellow & Principal Scientist, ICAR-Directorate of Poultry Research, Hyderabad, Outside Expert

4. Dr. K. Madhava Reddy, Consulting Medical Officer, ICAR-NRCM, Hyderabad, Bio-Safety Officer
5. Dr. Suresh Devatkal, Principal Scientist, ICAR-NRCM, Hyderabad, Internal Member
6. Dr. Vishnuraj M.R, Scientist, ICAR-NRCM, Hyderabad, Internal Member
7. Dr. Girish Patil S., Principal Scientist, ICAR-NRCM, Hyderabad, Member Secretary

Institute Technology Management Committee (ITMC)

1. Dr. S. B. Barbuddhe, Director, ICAR-NRCM, Hyderabad, Chairman
2. Dr. Girish Patil S., Principal Scientist, ICAR-NRCM, Hyderabad, Member
3. Dr. P. Baswa Reddy, Principal Scientist, ICAR-NRCM, Hyderabad, Member
4. Dr. B. Dayakar Rao, Principal Scientist, ICAR-NAARM, Hyderabad, Member (IPR Expert)
5. Dr. M. Muthukumar, Principal Scientist, ICAR-NRCM, Hyderabad, Member Secretary

Internal Complaints Committee (ICC)

1. Dr. B. Shoba, Associate Professor, School of Mathematics & Statistics, University of Hyderabad, Presiding Officer
2. Dr. Rituparna Banerjee, Scientist, ICAR-NRCM, Hyderabad, Member
3. Smt. D. Usha, President, Abhaya Association for Empowerment of Women, Hyderabad, Member
4. Shri. B. P. R. Vithal, Private Secretary (PS) to Director, ICAR-NRCM, Hyderabad, Member

Student Corner

Sl. No	Student Name	Degree Pursuing	University Name	Research Project Topic	Mentor/ Guide
1.	Dr. V. Prasastha Ram	Ph.D.	ICAR- IVRI	Efficacy of encapsulated green nanosilver conjugated phyto-chemicals against multi-drug resistant enteroaggregative *Escherichia coli*	Dr. S. B. Bar-buddhe, Director
2.	Dr. Megha G. K.	Ph.D.	ICAR- IVRI	Development of lateral flow as-says for the detection of *Listeria monocytogenes* from foods of animal origin and listeriosis in ruminants	Dr. S. B. Bar-buddhe, Director
3.	Dr. Prasad M G	Ph.D.	ICAR- IVRI	Yet to be decided	Dr. B M Naveena, Principal Scientist
4.	Dr. Belore Balaji	M.V.Sc.	CAU, Imphal	Differentiation of the cold slaughtered chicken meat from the regularly slaughtered chick-en meat under raw and cooked conditions	Dr. B M Naveena, Principal Scientist
5.	Dr. Diksha P. Gourkhede	Ph.D.	ICAR- IVRI	Efficacy studies of encapsulated antimicrobial peptides against multi-drug-resistant strains of *Salmonella enteritidis* and *Sal-monella typhimurium*	Dr. D. B. Rawool, Principal Scientist
6.	Dr. Maria Anto Dani Nishanth J	Ph.D.	ICAR- IVRI	Yet to be decided	Dr. D. B. Rawool, Principal Scientist
7.	Dr. Tallapudi Suvarna	M.V.Sc.	CAU, Imphal	Effect of different decontamina-tion techniques on the quality of poultry meat	Dr. M. Muthuku-mar, Principal Scientist

8.	Ajay G	B.Tech	Bharathidasan University, Tiruchirappalli	Detection and comparative evaluation of real-time and droplet digital PCR assays for detection and quantification of *Listeria spp.*	Dr. Vishnuraj, Scientist
9.	Renuka J	B.Tech	Sree Sastha Institute of Engineering And Technology, Chennai	Heptaplex real-time PCR assay with melt characterization for different identification of India food animals.	Dr. Vishnuraj, Scientist
10.	Aravind Kumar N	B. Tech	Sree Sastha Institute of Engineering And Technology, Chennai	Development and validation of a droplet digital PCR(ddPCR) technique for detection and quantification of buffalo derived materials in foods and feedstuffs	Dr. Vishnuraj, Scientist
11.	Mr. Balamanikandan Raja	B.Tech	Sree Sastha Institute of Engineering And Technology, Chennai	Amplification and Characterization of Myogenic Markers of sheep Native skeletal Muscle Tissue and Ex-Vivo cultured skeletal Muscle cells using Molecular Biology Techniques.	Dr. Girish Patil,S.
12.	Dr. Yuvaraj Chavan	M.V.Sc	Karnataka veterinary , Animal and Fishery Sciences University, Bidar	Studies on extraction and characterization of skeletal muscle Extra cellular Matrix of chicken (*Gallus gallus domesticus*)	Dr. Girish Patil,S.
13.	Dr. Jagadish Swami Nagnath	Ph.D	P.V.N.R. Telangana veterinary University, Hyderabad	Development of forensically important nucleotide sequencing based assay for species identification of biological samples derived from wild animals	Dr. Girish Patil,S.

Personnel

S. No.	Name	Designation
Scientific		
1.	Dr. S. B. Barbuddhe	Director
2.	Dr. A. R. Sen	Principal Scientist
3.	Dr. Y. Babji	Principal Scientist
4	Dr. C. Ramakrishna	Principal Scientist
5	Dr. Suresh K. Devatkal	Principal Scientist
6	Dr. Girish Patil S.	Principal Scientist
7	Dr. Deepak B. Rawool	Principal Scientist
8	Dr. B. M. Naveena	Principal Scientist
9	Dr. M.Muthukumar	Principal Scientist
10	Dr. P. Baswa Reddy	Principal Scientist
11	Dr. G. Kandeepan	Senior Scientist
12	Dr. S. Kalpana	Senior Scientist
13	Dr. L. R. Chatlod	Senior Scientist
14	Dr. Gireesh Babu P.	Senior Scientist
15	Dr. Yogesh P. Gadekar	Senior Scientist
16	Smt. K. Varalakshmi	Scientist
17.	Dr. Rituparna Banerjee	Scientist
18.	Dr. Vishnuraj, M.R.	Scientist
Administrative		
19	Sh. P. Gowri Shankar	Administrative Officer
20	Sh. G. Jagan Mohan Rao	Finance & Accounts Officer
21	Sh. B. P. R. Vithal	Private Secretary to Director
22	Sh. M. N. V. Rao	Assistant Finance & Accounts Officer
23	Sh. T. Devender	Assistant Administrative Officer
24	Smt. C. Padmaja	Personal Assistant to Director
25	Smt. Kola Alekya	Assistant
26	Smt. V. Kalpana	Assistant
27	Sh. N. Vijay Kumar	Upper Division Clerk
28	Smt. G. Navneetha	Upper Division Clerk
Technical		
29	Smt. Kanchana Kommi	Technical Assistant
30	Sh. Phani Kumar	Technical Assistant
31	Sh. B. V. D. Srinivasa Rao	Sr. Technician
32	Sh. M. Srinivas	Sr. Technician

Promotions

1. Dr. C. Ramakrishna, Senior Scientist, has been promoted to Principal Scientist w.e.f. 01.01.2011 under career advancement scheme
2. Dr. Deepak B. Rawool, Senior Scientist, has been promoted to Principal Scientist w.e.f. 16.04.2017 under career advancement scheme
3. Dr. L. R. Chatlod, Scientist, has been promoted to Senior Scientist w.e.f. 01.01.2016 under career advancement scheme
4. Smt. K. Varalakshmi, Scientist, has been promoted to Scientist (Senior scale) w.e.f. 23.06.2016 under career advancement scheme
5. Dr. Yogesh P. Gadekar, Scientist has been promoted to Senior Scientist w.e.f. 20.04.2019 under career advancement scheme

New Joining

1. Sh. P. Gowri Shankar, Administrative Officer, transferred from ICAR-IIOPR, Pedavegi and joined ICAR-NRC on Meat on 08.11.2021
2. Sh. G. Jagan Mohan Rao, Finance & Accounts Officer, transferred from ICAR-CRIDA, Hyderabad, and joined ICAR-NRC on Meat on 01.12.2021
3. Sh. N. Vijay Kumar, Upper Division Clerk, transferred from ICAR-ATARI, Hyderabad and joined ICAR-NRC on Meat on 30.01.2021
4. Smt. G. Navneetha, Upper Division Clerk, transferred from ICAR-ATARI, Hyderabad and joined ICAR-NRC on Meat on 06.10.2021

Rajbhasha

हिन्दी चेतना सप्ताह -2021

हर वर्ष की भांति इस वर्ष भी भा.कृ.अनु.प राष्ट्रीय मांस अनुसंधान केंद्र में "हिन्दी चेतना सप्ताह" का आयोजन कोविड-19 महामारी को ध्यान में रखकर पूरी सावधानी बरतते हुए 14 सितंबर से 21 सितंबर 2021 तक की अवधि के दौरान किया गया। हिन्दी चेतना पखवाड़ा का शुभारंभ 14 सितंबर 2021 को भा.कृ.अनु.प-राष्ट्रीय मांस अनुसंधान केंद्र के निदेशकके करकमलों द्वारा किया गया ।

"हिन्दी चेतना सप्ताह" में विभिन्न कार्यक्रमों का आयोजन किया गया जिसका वर्णन इस प्रकार है।

1. निबंध लेखन
2. श्रुतलेख
3. हिन्दी प्रश्नोत्तरी
4. सुंदर लिखाई
5. समापन समारोह

प्रतियोगिताओं में संस्थान के सभी वैज्ञानिकों, अधिकारियों,कर्मचारियों, आर.ए., एस.आर.एफ., जे.आर. एफ., विद्यार्थीगण एवं संविदा कर्मचारियों ने उत्साहपूर्वक भाग लिया और प्रथम, द्वितीय, तृतीय एवं सांतवना पुरस्कार प्राप्त किए। हिन्दी चेतना सप्ताह का समापन 21 सितंबर 2021 को किया गया जिसमें भा.कृ.अनु.प-राष्ट्रीय मांस अनुसंधान केंद्र के निदेशकद्वारा पुरस्कार वितरण किया गया।

हिंदी सप्ताह समारोह-२०२१

हिन्दी सप्ताह में विजेताओं का सम्मान

Swachhta Pakhwada (16th- 31st Dec, 2021)

Swachhta Pakhwada campaign started with Dr. S. B. Barbuddhe, Director, administering Swachhta pledge on 16th December, 2021. During the period, different activities were undertaken and all the staff participated actively.

The office premises like Guest house, Trainees hostel, Children's park, Auditorium, Experimental Animal sheds and mango orchards were cleaned during the fortnight.

Dr. S. B. Barbuddhe, Director, administering the Swachhta pledge to staff

Tree plantation

Tree plantation activities were undertaken at the centre to keep the campus green and to improve the aesthetic look of the centre. More than 200 saplings were planted under the programme which include flower, fruit, shade and avenue trees.

Soil and water conservation

Soil & water conservation is maintained through mulching by using the grass and residual leaves generated in the campus. By efficient mulching water requirement is reduced drastically and soil health is also maintained in a very good condition.

Mulching in the mango orchard

Compost Pit

Three compost pits have been set up in the campus for preparation of organic material for the garden.

Compost pits in the campus

Awareness program on Swachh Bharat

ICAR-NRC on Meat, Chengicherla, Hyderabad successfully organized Swachh Bharat Abhiyan under Swachhta Pakhwada Campaign on 20th December, 2021 at Keesara village (adopted village under MGMG); appraised the currently implemented hygienic practices and encouraged about 20 butchers and meat shop owners of Keesara village to endure the adoption of hygienic slaughter practices. Dr. Y. Babji, Principal Scientist coordinated the programme.

Awareness program at village Keesara adopted under Mera Gaon Mera Gaurav

Under "**Swachhta Pakhwada**" campaign, an awareness rally on Swachh Bharat Abhiyan was taken out from NRC on Meat to Chengicherla village on 27th December, 2021. Many placards-slogans/ quotes and banner about Swachh Bharat were carried by the staff. The procession traversed many streets of the village.

Awareness rally in Chengicherla village on 27th Dec, 2021

Dr. L. R. Chatlod, Senior Scientist and Nodal Officer, Swachhta Mission coordinated all the activities under the program Swachh Bharat Abhiyan.

Distinguised Visitors

1. Shri G. Srinivas, IAS, Additional Secretary and Financial Advisor, ICAR visited the institute on 30th June, 2021
2. Dr. M. Sathyanarayana, Commissioner and Director of Muncipal Administartion (CDMA), Hyderabd visited the institute on 17th August, 2021
3. Dr. B. N. Tripathi, Deputy Director General (Animal Sciences), ICAR visited the institute on 23rd October, 2021
4. Dr. Amrish Kumar Tyagi, Assistant Director General (AN and P), ICAR visited the institute on 23rd October, 2021
5. Dr. Pandith Madhnure, Director, Ground Water Department, Govt. of Telangana visited the institute on 28th October 2021

ICAR-NRC on Meat in News

ఆఫ్ వార్త 3

మాంస ఉత్పత్తుల తయారీ విధానంపై శిక్షణ

తరగతులు ప్రారంభించిన ఘట్కేసర్ ఎంపీపీ ఏనుగు సుదర్శన్ రెడ్డి

(మేడిపల్లి) ఘట్కేసర్ -ఫైవ్ ఆఫ్ వార్త: జాతీయ మాంస పరిశోధన సంస్థ ప్రధాన శాస్త్రవేత్త డాక్టర్ పి.బస్వారెడ్డి ఆధ్వర్యంలో జరుగుతున్న శిక్షణా తరగతులను మేడ్చల్ జిల్లా ఘట్ కేసర్ మండల ఎంపీపీ ఏనుగు సుదర్శన్ రెడ్డి శుక్రవారం ప్రారంభించారు. అనంతరం ఆయన మాట్లాడుతూ అవుషాపూర్ గ్రామ మహిళలు ఇక్కడ శిక్షణ పొందుతున్నారని, మాంస ఉత్పత్తుల తయారీ విధానాన్ని నేర్చుకుని ఉపాధి పొందాలని మహిళలను ఈ సందర్భంగా కోరారు. చికెన్, మటన్ పచ్చళ్లు, స్నాక్స్, బిర్యాని తదితర వంటలు తయారీ చేయడంలో మరింత మెలకువలు నేర్చుకునేందుకు ఈ శిక్షణ శిబిరం ఎంతో దోహదపడుతు ందని సుదర్శన్ రెడ్డి చెప్పారు. మాంస ఉత్పత్తుల తయారీ కోసం శిక్షణ పొందిన మహిళలకు ప్రభుత్వం నుంచి ప్రోత్సాహం ఉంటుందని సుదర్శన్ రెడ్డి హామీ ఇచ్చారు.

మొబైల్ క్యాంటిన్ పెట్టుకునే వారికి వాహన రుణాలు ఇప్పించేందుకు బ్యాంకర్లతో మాట్లాడుతానని సుదర్శన్ రెడ్డి చెప్పారు. ఈ కార్యక్రమంలో జాతీయ మాంస పరిశోధన సంస్థ ప్రధాన శాస్త్రవేత్త డాక్టర్ బస్వారెడ్డి, ఏఆర్ సేన్, డాక్టర్ జి కండీపన్, డాక్టర్ కల్పన, అవుషాపూర్ సర్పంచ్ ఏనుగు కావేరి మచ్చేందర్ రెడ్డి, ఘట్కేసర్ మండల మహిళా సమాఖ్య అధ్యక్షురాలు మచ్చ జయశ్రీ తదితరులు పాల్గొన్నారు.

మాభూమి

మాంస ఉత్పత్తుల తయారీలో మహిళలు రాణించాలి

చెంగిచెర్లలో మహిళలకు మూడు రోజుల శిక్షణా తరగతులను ప్రారంభించిన ఎంపిపి

ఘట్ కేసర్ ఎంపిపి ఏనుగు సుదర్శన్ రెడ్డి

మాభూమి, ఘట్ కేసర్

మాంస ఉత్పత్తుల తయారీ విధానంలో మెళకువలు నేర్చుకుని స్వయం ఉపాధి రంగంలో రాణించాలని మేడ్చల్ జిల్లా ఎంపిపిల ఫోరం అధ్యక్షులు , ఘట్ కేసర్ ఎంపిపి ఏనుగు సుదర్శన్ రెడ్డి పిలుపునిచ్చారు . మేడ్చల్ జిల్లా చెంగిచెర్ల లోని జాతీయ మాంస పరిశోధన సంస్థ లో ప్రధాన శాస్త్రవేత్త డా.పి .బస్వారెడ్డి ఆధ్వర్యంలో మాంస ఉత్పత్తుల తయారీ విధానంపై మూడు రోజుల పాటు జరుగుతున్న శిక్షణా తరగతులను ఎంపిపి సుదర్శన్ రెడ్డి ప్రారంభించారు . ఈ సందర్భంగా ఎంపిపి మాట్లాడుతూ ... నిష్ణాతుల పర్యవేక్షణలో నిర్వహిస్తున్న ఈ శిక్షణలో చికెన్ , మటన్ పచ్చళ్లు , స్నాక్స్ , బిర్యాని తదితర వంటలతో పాటు మాంస ఉత్పత్తుల తయారీ విధానాన్ని నేర్చుకుని మహిళలు స్వయం ఉపాధి పొందాలని పేర్కొన్నారు. మాంస ఉత్పత్తుల తయారీ కోసం శిక్షణ పొందిన మహిళలకు ప్రభుత్వం నుంచి

ప్రోత్సాహం ఉంటుందని, మొబైల్ క్యాంటిన్ పెట్టుకునే వారికి బ్యాంకర్లతో మాట్లాడి వాహన రుణాలు ఇప్పించేందుకు కృషి చేస్తానని సుదర్శన్ రెడ్డి హామీ ఇచ్చారు. ఈకార్యక్రమంలో జాతీయ మాంస పరిశోధన సంస్థ ప్రధాన శాస్త్రవేత్త డాక్టర్ బస్వారెడ్డి, ఏఆర్. సేన్, డాక్టర్ జి .కండీపన్ , డాక్టర్ కల్పన, అవుషాపూర్ సర్పంచ్ ఏనుగు కావేరి మచ్చేందర్ రెడ్డి , ఘట్కేసర్ మండల మహిళా సమాఖ్య అధ్యక్షురాలు మచ్చ జయశ్రీ , సామాజిక కార్యకర్త కె రవిచంద్ర తదితరులు పాల్గొన్నారు.

హలీమ్ లడ్డూలు కావాలా?

స్వయం ఉపాధి శిక్షణా తరగతులు ప్రారంభం

మేడ్చల్/మేడిపల్లి/జులై23, అక్షరం న్యూస్:-

బోడుప్పల్ మున్సిపల్ కార్పొరేషన్ పరిధిలోని చెంగిచెర్ల లో మాంస ఉత్పత్తుల తయారీ విధానం పై మూడు రోజుల పాటు జరిగే శిక్షణ కార్యక్రమాన్ని ఘట్కేసర్ ఎంపీపీ ఏనుగు సుదర్శన్ రెడ్డి ప్రారంభించారు.జాతీయ మాంస పరిశోధన సంస్థ ప్రధాన శాస్త్రవేత్త డాక్టర్ పి.బస్వారెడ్డి అధ్వర్యంలో జరుగుతున్న శిక్షణా తరగతులకు మేడ్చల్ జిల్లా ఘట్ కేసర్ మండలం లోని అవుషాపూర్ గ్రామ మహిళలు శిక్షణ పొందుతున్నారు. ఈ సందర్భంగా ఎంపీపీ ఏనుగు సుదర్శన్ రెడ్డి మాట్లాడుతూ మాంస ఉత్పత్తుల తయారీ విధానాన్ని నేర్చుకుని స్వయం ఉపాధి పొందాలని మహిళలను కోరారు. చికెన్, మటన్ పచ్చళ్లు, స్నాక్స్, బిర్యాని తదితర వంటలు తయారీ చేయడంలో మరింత మెలకువలు నేర్చుకునేందుకు ఈ శిక్షణ శిబిరం ఎంతో దోహదపడుతుందని సుదర్శన్ రెడ్డి తెలిపారు. మాంస ఉత్పత్తుల తయారీ కోసం శిక్షణ పొందిన మహిళలకు ప్రభుత్వం నుంచి ప్రోత్సాహం ఉంటుందని హామీ ఇచ్చారు. మొబైల్ క్యాంటీన్ పెట్టుకునే వారికి వాహన రుణాలు ఇప్పించేందుకు బ్యాంకర్లతో మాట్లాడుతానని తెలిపారు. ఈకార్యక్రమంలో జాతీయ మాంస పరిశోధన సంస్థ ప్రధాన శాస్త్రవేత్త డాక్టర్ బస్వారెడ్డి, ఏ ఆర్ సేన్, డాక్టర్ జి కుందీమన్ డాక్టర్ కల్పన, అవుషాపూర్ సర్పంచ్ ఏనుగు కావేరి మచ్చేందర్ రెడ్డి, ఘట్కేసర్ మండల మహిళా సమాఖ్య అధ్యక్షురాలు మచ్చ జయశ్రీ తదితరులు పాల్గొన్నారు.

అక్షరం Aksharam Telugu Daily 24.7.21 Tab - 24 Jul 2021 - Page 14

చికెన్, మటన్ పచ్చళ్లు, స్నాక్స్, బిర్యాని వంటల శిక్షణ శిబిరం

ఘట్కేసర్ జూలై 23 (జనంతక రిపోర్టర్): మాంస ఉత్పత్తుల తయారీ విధానం పై చెంగిచర్ల లో మూడు రోజుల పాటు జరిగే శిక్షణ కార్యక్రమాన్ని ఇవ్వాల ఘట్కేసర్ ఎంపీపీ ఏనుగు సుదర్శన్ రెడ్డి ప్రారంభించారు. జాతీయ మాంస పరిశోధన సంస్థ ప్రధాన శాస్త్రవేత్త డాక్టర్ పి.బస్వారెడ్డి ఆధ్వర్యంలో జరుగుతున్న శిక్షణా తరగతులకు మేడ్చల్ జిల్లా ఘట్ కేసర్ మండలం లోని అవుషాపూర్ గ్రామ మహిళలు శిక్షణ పొందుతున్నారు. ఈసందర్భంగా ఏనుగు సుదర్శన్ రెడ్డి మాట్లాడుతూ మాంస ఉత్పత్తుల తయారీ విధానాన్ని నేర్చుకుని స్వయం ఉపాధి పొందాలని మహిళలను కోరారు. చికెన్, మటన్ పచ్చళ్లు, స్నాక్స్, బిర్యాని తదితర వంటలు తయారీ చేయడంలో మరింత మెలకువలు నేర్చుకునేందుకు ఈ శిక్షణ శిబిరం ఎంతో దోహదపడుతుందని సుదర్శన్ రెడ్డి చెప్పారు. మాంస ఉత్పత్తుల తయారీ కోసం శిక్షణ పొందిన మహిళలకు ప్రభుత్వం నుంచి ప్రోత్సాహం ఉంటుందని సుదర్శన్ రెడ్డి హామీ ఇచ్చారు. మొబైల్ క్యాంటీన్ పెట్టుకునే వారికి వాహన రుణాలు ఇప్పించేందుకు బ్యాంకర్లతో మాట్లాడుతానని సుదర్శన్ రెడ్డి చెప్పారు. ఈకార్యక్రమంలో జాతీయ మాంస పరిశోధన సంస్థ ప్రధాన శాస్త్రవేత్త డాక్టర్ బస్వారెడ్డి, ఏ ఆర్ సేన్, డాక్టర్ కుందీమన్, డాక్టర్ కల్పన, అవుషాపూర్ సర్పంచ్ ఏనుగు కావేరి మచ్చేందర్ రెడ్డి, ఘట్కేసర్ మండల మహిళా సమాఖ్య అధ్యక్షురాలు మచ్చ జయశ్రీ తదితరులు పాల్గొన్నారు.

ఈనాడు epaper.eenadu.net

రుచి ఎక్కువ.. విదేశాల్లోనూ మక్కువ

- సేంద్రియ మాంసానికి భలే డిమాండ్
- ద్రుపీకరణ కోసం ఎన్ఆర్సీఎం దరఖాస్తు
- అధ్యయనానికి రాజస్థాన్ వెళ్లిన అధికారులు

చెంగిచర్లలోని జాతీయ మాంస పరిశోధన కేంద్రం

ఈనాడు, హైదరాబాద్: మాంసంలో మాంసకృత్తులే కాదు.. విటమిన్లు, ప్రొటీన్లూ ఎక్కువే. తాజా మాంసం తోనే రుచి ఎక్కువ. ఆరోగ్యకరం కూడా. ఇవేవీ సేంద్రియ మాంసానికి వేళ, విదేశాల్లో డిమాండ్ పెరుగుతోంది. రసాయనాలు వాడని కాదా, గ్రాసం పెట్టి పెంచిన కోళ్లు, గొర్రెలు, మేకల మాంసమే అది. మన దేశంలోనే కాకుండా విదేశాల్లోనూ దీనికి డిమాండ్ పెరుగుతోందని 'జాతీయ మాంస పరిశోధన కేంద్రం' (నేషనల్ రీసెర్చ్ సెంటర్ ఆన్ మీట్-ఎన్ఆర్సీఎం) అధ్యయనంలో తేలింది. అయితే.. మాంసానికి 'సేంద్రియ' గుర్తింపు ఎవరు, ఏ ప్రాతిపదికన ఇవ్వాలనేదే సమస్యగా మారింది. ప్రస్తుతం వంటలను ఒక పాలంలో పరగునా మాడేళ్లు ఎలాంటి రసాయనాలు వాడకుండా పండిస్తే 'రాష్ట్ర సేంద్రియ ద్రుపీకరణ మండలి' పత్రాలు జారీ చేస్తోంది. పంటల సాగు చేయొచ్చే కుపేలు గాని, పైతులు గాని దరఖాస్తు చేస్తే సాగు సమయంలో తని బీలు చేసి, మట్టి నమూనాలను పరీక్షించి పత్రాలను ఇస్తోంది. అదేవిధంగా గొర్రెలు, మేకలు, కోళ్ల ఫారంలనూ తనిఖీ చేసి మాంసానికి ద్రుపీకరణ పత్రం జారీ చేయాలని మండలికి ఎన్ఆర్సీఎం తాజాగా దరఖాస్తు చేసింది. ఈ పత్రాలంటే తెలంగాణ, ఏపీ, ఒడిశా, ఛత్తీస్‌గఢ్‌లలో విక్రయించడమే కాకుండా విదేశాలకూ ఎగుమతి చేయవచ్చు. ఐదుగు మేకలు, గొర్రెలకు చేప్పన్న గ్రాసం సేంద్రియ పైర్ల నుంచే తెచ్చారా, కోళ్లకు వేసే మొక్కజొన్న, సోయా గింజలను సేంద్రియ పద్ధతుల్లోనే పండించారా అనేవి పరిశీలించాల్సి ఉంటుంది.

ఈ అంశంపై అధ్యయనానికి రాజస్థాన్‌కు అధికారుల బృందాన్ని పంపించినట్లు మండలి సంచాలకుడు డాక్టర్ కేశవులు తెలిపారు.

మండలికే అధికారం
-డాక్టర్ బస్వారెడ్డి, ఎన్ఆర్సీఎం శాస్త్రవేత్త

కొందరు వ్యాపారులు సేంద్రియ తాజా పెట్టే గొర్రెలు, మేకలు పెంచుతున్నారు. తాము అమ్మే మాంసానికి సేంద్రియ ద్రుపీకరణ పత్రాల కోసం ఎన్ఆర్సీఎంకు విన్నవిస్తున్నారు. కానీ, వాటిని జారీ అధికారం మండలికే ఉంది. గతేడాది (2020-21)లో మన దేశం నుంచి విదేశాలకు 11.22 లక్షల టన్నుల మాంసం ఎగుమతి చేయగా.. రూ. 24,672.39 కోట్ల ఆదాయం వచ్చింది. ఏపీ నుంచి 16,496 టన్నులు, తెలంగాణ నుంచి 2136 టన్నుల మాంసాన్ని విదేశాలకు గతేడాది ఎగుమతి చేశారని 'భారత వ్యవసాయ, ఉత్పత్తి ఎగుమతి వేదిక' (అపెడా) తాజాగా వెల్లడించింది. సేంద్రియ మాంసం ఇంకా ఎగుమతులు మరింత పెరుగుతాయి.

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Telangana Today

Organic fodder for sheep developed

B KRISHNA MOHAN
Hyderabad

ICAR-National Research Centre of Meat is working on developing packaging products and technologies to improve the shelf life of meat

Organic is in. It is not uncommon to find organic vegetables and fruits. But now, there will also be meat from organically raised sheep. The ICAR-National Research Centre of Meat at Chengicherla has developed organic fodder and will certify the sheep that is fed on it, said its director Dr SB Barbuddhe.

"We certify the sheep reared organically. This is being done for the first time in India," he said adding meat from organically reared sheep is part of the efforts being taken up to offer value-added products in the meat segment.

It is working to develop an organised meat sector through meat production, processing, and utilisation technologies and serve the cause of meat animal producers, processors, and consumers. The institute is also working with Crida at Santoshnagar on evolving protocols for rearing various animals organically, he said.

Among others, ICAR-NRCM is working on developing packaging products and technologies to improve the shelf life of meat. It has recently entered into a memorandum of understanding with the Indian Institute of Packaging on this.

The institute has already developed a sensor that will tell if the stored meat is usable or has spoiled. "Meat is perishable. Some shops store the meat for more than the required period. Our sensor identifies changes the colour if it is spoilt. This sticker is made up of natural pigments and a nanomaterial. It senses biochemical or microbial changes in the food. It can detect specific pathogen developing in the food or the specific gases from food spoiling and change the colour accordingly. We have this technology ready for commercialisation," he explained.

It has also developed a bio-degradable packaging for meat products using biopolymers, nanomaterials and bioplastics.

"Meat sector has immense business potential. Already a lot of new-age entrepreneurs have taken up meat and value addition as their main business," he said adding its agri-business incubator has already helped a self-help group in Siddipet in setting up a business that involves selling pickles and raw meat.

"The Telangana Government has introduced a pioneering sheeprearing scheme with huge outlay. That will galvanise the entire chain-producers, processors, retail, storage and consumers," he said.

Among others, it is working on technologies to identify adulteration of meat. Packaging technologies, online trade, value-added products, and allied aspects have good demand.

Citing the demand, he said Hyderabad sells Haleem worth about Rs 1,000 crore in just one month. Also, Hyderabadi Biryani is the most preferred dish of locals as well as those visiting Hyderabad, he said.

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మాంసం ఉత్పత్తులపై మూడు రోజుల శిక్షణ

- ఉపాధి అవకాశాలపై మహిళలు ముందుండాలి
- ఛత్తీస్‌గఢ్ ఎంపీకీ ఉమంగు సుల్కర్ వెల్లి

హలీమ్ లడ్డూలు!

- ఏడాదంతా అందుబాటులో
- వేడి చేసుకొని తినేయటమే
- పేటెంట్‌కు ఎన్‌ఆర్‌సీఎం దరఖాస్తు

హైదరాబాద్, డిసెంబర్ 9 (నమస్తే తెలంగాణ): రంజాన్ అనగానే తక్కున గుర్తొచ్చేది.. హలీమ్. హైదరాబాద్‌లో తయారయ్యే హలీమ్ ప్రపంచ దేశాలకు ఎగుమతి అవుతుంది. నోరూరించే ఈ వంటకం వ్యాపారం రంజాన్ సమయంలో వందల కోట్లలో ఉంటుంది. రంజాన్ తర్వాత మరుసటి ఏడాది వరకు ఏ హోటల్‌లోనూ కనిపించదు. ప్రజల అవసరాలు, డిమాండ్‌ను దృష్టిలో పెట్టుకొని హలీమ్ ప్రియుల కోసం జాతీయ మాంసం అభివృద్ధి సంస్థ (ఎన్‌ఆర్‌సీఎం) హలీమ్‌ను నిల్వ చేసుకొని, ఎప్పుడంటే అప్పుడు తినేలా పరిశోధనలు చేసింది. శాస్త్రవేత్తలు హలీమ్‌ను లడ్డూలా తయారు చేశారు. రుచిలో ఏమాత్రం తేడా రాకుండా, నిల్వ చేసినా పుంగస్ రాకుండా విజయవంతంగా పరిశోధనలు చేశారు. వీటికి హలీం బాల్స్ అని నామకరణం చేశారు. పేటెంట్ కోసం ఇప్పటికే దరఖాస్తు చేశారు కూడా. త్వరలోనే పేటెంట్ వస్తుందనే విశ్వాసాన్ని శాస్త్రవేత్తలు వ్యక్తం చేస్తున్నారు. పేటెంట్ వచ్చాక టెక్నాలజీని ప్రైవేటు సంస్థకు బదిలీ చేస్తారు. ఆ తరువాత బహిరంగ మార్కెట్‌లో హలీమ్ బాల్స్ లభ్యం కానున్నాయి. వాటిని ప్యాక్ చేసి నిల్వ చేసుకోవచ్చు. సులువుగా రవాణా చేసుకోవచ్చు. ఎప్పుడైనా తినాలనుకుంటే వేడి చేసి గుటుకేయొచ్చు.

హలీమ్ ప్రియుల కోసమే!

హలీమ్‌ను ప్రజల్లో ఉన్న అపోహ, డిమాండ్ దృష్ట్యా దాన్ని నిల్వ చేసి తినేలా పరిశోధనలు చేశాం. రుచిలో తేడా రాకుండా అన్ని జాగ్రత్తలు తీసుకొన్నాం. రంజాన్ సమయంలోనే కాకుండా మామూలు సమయాల్లోనూ ఇవి అందుబాటులో ఉంటాయి. లడ్డూల ఆకారంలో ఉండే వీటిని వేడిచేసుకొని తినేయొచ్చు. హీట్ అండ్ ఈట్ విధానంలో వీటిని తయారుచేశాం. వీటి రవాణా సులువు. పేటెంట్ వచ్చాక టెక్నాలజీని బదిలీ చేస్తాం.

- డాక్టర్ సులేఖ మోతక్కల్, సీనియర్ శాస్త్రవేత్త, ఎన్‌ఆర్‌సీఎం


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