Compendium

NATIONAL SCIENTIFIC CONVENTION CUM XXII NAVS CONVOCATION

"Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare and Nutrition of Pets"

8th - 9th March, 2025

Organizers

Veterinary College, Hebbal, Bengaluru
Karnataka Veterinary Animal and Fisheries Sciences University, Bidar
and
National Academy of Veterinary Sciences, India

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NATIONAL SCIENTIFIC CONVENTION CUM XXII NATIONAL ACADEMY OF VETERINARY SCIENCES (NAVS) CONVOCATION

"Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare and Nutrition of Pets"

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Veterinary College, Hebbal, Bengaluru

Karnataka Veterinary Animal and Fisheries Sciences University, Bidar

and

National Academy of Veterinary Sciences, India

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Disclaimer

सत्यमेव जयते

ಥಾವರ್‌ಚಂದ್ ಗೆಹ್ಲೋಟ್
थावरचंद गेहलोत
THAAWARCHAND GEHLOT
Governor of Karnataka

No. GOV/KAR/MSG/116/2025

MESSAGE

I am happy to know that the XXII Convocation cum National Scientific convention of ***National Academy of Veterinary Sciences*** *is conducted at Veterinary College, Bengaluru. The theme of the convention "Challenges and priorities for optimal production of livestock, poultry, healthcare and nutrition of pets" is very appropriate considering the important role of livestock, poultry and the pet animals play in our National economy in terms of the food security, livelihood, employment, health and the social well being of all the citizens.*

Livestock sector is a major source of livelihood to over 70% of the rural households and a significant proportion of the population are small and marginal farmers and landless labourers. This sunrise sector provides employment to over 80 million people across India. At National level, the livestock sector contributes to 5.5% of the Total Gross value (GVA). Current challenges in livestock sector are increasing input costs specially feed, shrinking grazing land, common property and water resources, Veterinary infrastructure and emerging diseases.

I send my best wishes and Warm greetings to the National Academy of Veterinary Sciences, members and wish a great success in its future endeavors.

4.3.25

(Thaawarchand Gehlot)

K. VENKATESH
Minister for Animal Husbandry &
Sericulture and Chamarajanagar
District In-charge Minister

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No. MAS/ 568 / 2025

Date: 27/02/2025.

-: *MESSAGE* :-

I am happy to note that the National Academy of Veterinary Sciences (NAVS) is organising the XXII Convocation cum Scientific Convention at Veterinary college, Bengaluru from 8-9 March 2025. I cordially welcome all the delegates from all parts of the country. The NAAS is the Apex body of Animal Husbandry and Veterinary sector for education, research, extension and policies. Livestock and poultry sector plays a great role in National economy in providing employment and nutritional security. This convention honors scientists and teachers who have contributed significantly to Veterinary profession. I heartily congratulate each of the awardees. The convention has technical sessions covering all the aspects and it is an unique opportunity to meet resource persons to discuss the present and future. I hope the two day convention will bring out major issues facing the Animal Husbandry sector and suggest suitable measures.

I wish the meeting a great success.

ಕೆ. ವೆಂಕಟೇಶ್

(K.VENKATESH)

भारतीय कृषि अनुसंधान परिषद
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डा. राघवेंद्र भट्टा
उप महानिदेशक (पशु विज्ञान)
Dr. Raghavendra Bhatta
Deputy Director General (Animal Science)
M. V. Sc. Ph.D., Postdoctorate (Japan, USA)

MESSAGE

I am truly pleased to learn that the National Academy of Veterinary Sciences (NAVS), India is organizing the XXII Convocation and National Scientific Convention on the theme 'Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare, and Nutrition of Pets,' which is scheduled to take place from March 8 to 9, 2025, at the Veterinary College, KVAFSU, Hebbal, Bengaluru. This convention will provide an invaluable platform for experts and stakeholders in the field of veterinary sciences to come together and focus on critical issues related to animal health and sustainable production practices, which are indispensable for ensuring food security, protecting the environment, and supporting economic stability across the globe.

As we are all aware, livestock farming has been a cornerstone of both our livelihoods and the economy, particularly in rural areas. It supports millions of families and provides a source of income, nutrition, and resources. Furthermore, companion animals, such as dogs, cats, and other pets, have become an integral part of modern society, contributing significantly to our well-being, social interactions, and mental health. This convention will bring attention to both the science and the socio-economic importance of these areas, encouraging collaborative discussions on the sustainable development of animal farming, the welfare of pets, and the future of veterinary education and research.

The National Scientific Convention will offer a diverse range of technical sessions that will explore various dimensions of veterinary sciences, addressing both the challenges and advancements in the past, present, and future of animal farming and pet care. These sessions will provide an opportunity for meaningful exchanges between experts, researchers, policymakers, and industry leaders, and I am confident that these discussions will generate impactful insights and contribute to well-informed policy recommendations that can guide the future of animal health and welfare in India.

I wholeheartedly wish the convention great success, and I am certain that the outcomes and insights from this event will help foster progress and innovation in animal health, production, and veterinary education for years to come. I look forward to the discussions, collaborations, and recommendations that will emerge from this gathering, which will undoubtedly contribute to shaping a more sustainable and prosperous future for both animals and humans alike.

(Raghavendra Bhatta)

डॉ. अभिजित मित्र
Dr. Abhijit Mitra
पशुपालन आयुक्त
Animal Husbandry Commissioner

सत्यमेव जयते

आजादी का अमृत महोत्सव

भारत सरकार
मत्स्यपालन, पशुपालन एवं डेयरी मंत्रालय
पशुपालन एवं डेयरी विभाग
नई दिल्ली–110001
Government of India
Ministry of Fisheries, Animal Husbandry & Dairying
Department of Animal Husbandry and Dairying
Krishi Bhawan, New Delhi-110001

Message

I am pleased to extend my heartfelt greetings to all the distinguished participants of the **XXII NAVS Convocation cum National Scientific Convention** on *"Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare, and Nutrition of Pets."* This convention serves as an essential forum to deliberate on scientific advancements, policy imperatives, and sustainable strategies for strengthening India's livestock and poultry sectors.

With the livestock sector contributing nearly **30% to agricultural GDP** and supporting the livelihoods of over **70 million rural households**, its resilience is vital for food security and economic stability. Indigenous livestock breeds play a crucial role in climate adaptation, disease resistance, and low-input sustainable production systems. Recognizing their significance, efforts must be enhanced to **conserve, promote, and integrate indigenous breeds into modern production systems** for long-term sustainability.

The **21st Livestock Census**, with a renewed focus on **pastoralist communities**, is a landmark initiative to ensure inclusive policy planning. Pastoralists are key stewards of indigenous livestock and contribute significantly to genetic diversity, yet their role often remains underrepresented in mainstream policies. Accurately capturing their livestock holdings and migration patterns is essential for effective resource allocation and support mechanisms.

Additionally, the implementation of **Index-Based Livestock Insurance** can provide much-needed financial resilience to livestock farmers against climate shocks, disease outbreaks, and market fluctuations. Strengthening disease management remains a national priority, with initiatives like the **Standard Veterinary Treatment Guidelines (SVTG)** and the **Crisis Management Plan (CMP)** enhancing disease preparedness and response. A robust **National Disease Surveillance Plan** is imperative to detect, prevent, and control high-impact animal diseases, ensuring biosecurity and minimizing economic losses.

Intersectoral collaboration is key to addressing emerging zoonotic threats, mitigating antimicrobial resistance (AMR), and strengthening biosecurity. A well-integrated **disease surveillance network**, along with robust laboratory infrastructure and early warning systems, will enhance national preparedness and response capabilities.

As we navigate evolving challenges, I am confident that the deliberations at this convention will foster innovative solutions, informed policymaking, and strengthened collaborations. My best wishes for the success of this esteemed event.

(Abhijit Mitra)

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No. VC/KVAFSU-NAVS/2024-25

Date: 19.02.2025

MESSAGE

It is with great pleasure that the we invite you to the Convocation cum National Convention of the National Academy of Veterinary Sciences (NAVS), to be held on 8-9th March 2025 at Karnataka Veterinary, Animal, and Fisheries Sciences University (KVAFSU), Bengaluru. This gathering promises to be a significant milestone in the advancement of Veterinary Science and its associated fields. The theme of this year's event, "Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare and Nutrition of Pets," reflects the critical issues facing the Veterinary profession today.

As the global demand for animal products continues to grow, so does the need for innovative solutions to enhance livestock and poultry production, while ensuring animal welfare, healthcare, and nutritional standards. The event will bring together distinguished teachers, scientists, policymakers, Veterinarians, and industry leaders to deliberate on these vital topics. This convention serves as a platform for exchange of knowledge, fostering collaborations, and addressing pressing challenges. Your presence and contribution to the discussions will undoubtedly drive forward the collective mission to improve the health and productivity of animals, ensuring sustainable practices that will benefit both society and the National economy.

I Wish the Convention a grand success.

(K. C. Veeranna)
Vice-Chancellor

Vice-Chancellor
Karnataka Veterinary and Fisheries
Sciences University, Bidar.

डॉ. उमेश चन्द्र शर्मा
Dr. Umesh Chandra Sharma
अध्यक्ष, वी.सी.आई.
President, VCI

भारतीय पशु चिकित्सा परिषद
Veterinary Council of India
(भारत सरकार का वैधानिक निकाय)
(Statutory body of the Government of India)
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फोन/Ph. : 011-26182434, मो./M. : 09826294714
ईमेल/E-mail : president.vci@dahd.nic.in / vciinfo@nic.in

MESSAGE

I am delighted to know that the Karnataka Veterinary, Animal and Fisheries Sciences University is hosting 22nd Annual Convocation cum Scientific Convention of National Academy of Veterinary Sciences (India) on 8-9th March, 2025 at Veterinary College, Bengaluru. The much - desired goal of doubling the income of our farmers cannot be realized without harnessing the potential of Animal Husbandry and Poultry. I wish and hope that the Scientific Convention on "Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare and Nutrition of Pets" will offer a platform to Professionals and Academicians to discuss the need of revamping the Veterinary and Animal Husbandry sector for entrepreneurship development and acceleration of the Livestock Production and Health Sustainance. I am confident that the organizing team from Veterinary College, Bengaluru will provide the best platform to the delegation of NAVS (I).

I extend my best wishes for the grand success of the Convocation-cum-Scientific Convention.

(Dr. Umesh Chandra Sharma)

DR. D.V.R. PRAKASH RAO

B.Sc., B.V.Sc & A.H (Hons)., M.V.Sc., Ph.D.,
D.Sc (HC) GADVASU., D.Sc (HC) NDRI., D.Sc (HC) OUAT
Fellow - National Academy of Veterinary Sciences (India)
Fellow - National Academy of Dairy Science (India)
Fellow - Animal Nutrition Association
Fellow - Indian Poultry Science Association
Member - Research Advisory Committee (IVRI)
Former International Consultant - UNIDO Vienna

President
National Academy of Veterinary Sciences (India)
New Delhi

Chairman & Managing Director
Prakash Foods & Feed Mills Private Ltd
Chennai

MESSAGE

It is with great pleasure and pride I extend my warmest greetings to all the distinguished Scientists, Policymakers and Stakeholders participating in the 22nd Convocation Cum Scientific Convention of National Academy of Veterinary Sciences (India) New Delhi. This prestigious event is hosted by Karnataka Veterinary Animal and Fisheries Science University in the Karnataka Veterinary Council Auditorium, Hebbal, Bengaluru on 8th & 9th March 2025. This brings together the finest minds to deliberate on "Challenges and Priorities for Optimal Production of Livestock, Poultry; Healthcare and Nutrition of Pets".

Livestock and Poultry production play a vital role in ensuring food and nutritional security, livelihoods and economic prosperity. However this sector faces challenges including climate changes, emerging diseases, feed and fodder shortage and anti microbial resistance. It requires a multi disciplinary approach, innovative research and policy support to address these challenges. The canine nutrition and disease management is becoming prominent as an integral part of veterinary science.

The National Academy of Veterinary Sciences (India) remains committed to fostering scientific advancements and policy advocacy in these crucial areas. I urge all the participants to engage in meaningful discussions, share cutting - edge research and contribute towards shaping a resilient and progressive animal husbandry sector.

I express my sincere gratitude to Hon. Governor of Karnataka, the Union Minister of State of Fisheries, Animal Husbandry and Dairying and the Karnataka Minister for Animal Husbandry for their esteemed presence which underscores the importance of our mission.

I wish the Scientific Convention a great success with impactful deliberations that will drive the future of Veterinary and Animal Sciences in India.

Date: 21/02/2025
Place: Chennai

(Dr. D.V.R. Prakash Rao)
President, NAVS(I),New Delhi

सत्यमेव जयते

मेजर जनरल देवेन्द्र कुमार, वी एस एम, पी एच डी
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Maj Gen Devender Kumar, VSM, PhD
Offg DG RVS
Tel. : 011-20862665 (O)
Ascon : 35431 (O)

महानिदेशालय रिमाउन्ट वेटेरिनरी सेवाएं
क्वार्टरमास्टर जनरल शाखा
एकीकृत मुख्यालय रक्षा मंत्रालय (सेना)
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New Delhi-110 066

FOREWORD

It is a great sense of pride and privilege to know that **XXII NAVS Convocation cum National Scientific Convention on "Challenge and Priorities for Optimal Production of Livestock, Healthcare and Nutrition of Pets"** is being organized at KVAFSU, Hebbal, Bengaluru.

In a short span of time, NAVS has emerged as India's think tank for policy decisions on Animal Husbandry and Veterinary Sciences. In consonance to its mission statement of consolidating scientific views on policy matters, NAVS has made remarkable breakthroughs in bridging the gap amongst policy makers and researchers. To inculcate scientific aptitude, NAVS is successful in disseminating scientific information through national seminar/conventions, awarding fellowships and Awards to budding veterinarians.

NAVS is also engaged in advancing contribution of livestock sector in national economy. NAVS has to play a vital role in India's journey to become a developed national by 2047- a goal envisioned by Govt of India, as part of mission **Viksit Bharat 2047**. NAVS has potential to advocate policymakers for livestock sector, and making it a potent economic driver for Indian economy.

The National Scientific Convention will be the beacon of light, to plan out common strategies and chalk out role of different stakeholders. I am sanguine the scientific deliberations during the seminar will deliver desired impetus and collaborations, with aim to be of great relevance in nation building.

Jai Hind!

ಶ್ರೀರೂಪಾ ಭಾ.ಆ.ಸೇ.
ಆಯುಕ್ತರು
ಪಶುಪಾಲನಾ ಮತ್ತು ಪಶುವೈದ್ಯಕೀಯ ಸೇವಾ ಇಲಾಖೆ

ಕರ್ನಾಟಕ ಸರ್ಕಾರ

SHREEROOPA I.A.S
Commissioner
Department of Animal Husbandry &
Veterinary Services

MESSAGE

It is a privilege to reflect on the theme of the XXII NAVS Convocation cum National Scientific Convention, "Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare and Nutrition of Pets", organized by the National Academy of Veterinary Sciences (NAVS). this convention serves as an ideal platform to address the critical issues facing the livestock and poultry sectors, which are vital for food security, economic stability, and environmental conservation. The theme highlights the need for sustainable practices in animal health and production. Challenges such as disease management, antimicrobial resistance, animal welfare, and environmental impact demand urgent attention. By focusing on innovation, nutrition, and healthcare systems, we can achieve optimal production and ensure a healthier future for both animals and humans. Equally important is the role of policy, governance, and smallholder integration in overcoming these challenges.

Entrepreneurship in the animal health sector plays a pivotal role in fostering resilience and sustainability. By prioritizing ethical practices and innovation, businesses can meet market demands while addressing environmental concerns and improving animal welfare. We are honoured to have the Karnataka Veterinary, Animal, and Fisheries Sciences University (KVAFSU) as the host. The university's dedication to education, research, and extension services plays a pivotal role in advancing Veterinary and Animal Sciences, ensuring that we remain responsive to the evolving needs of society.

This event brings together experts and innovators, fostering collaboration and inspiring solutions to address the challenges in Veterinary Science and Animal production.

Let this convention bring meaningful dialogue that shapes the future of the farm animal and pet industry. Wish the Convention all the success.

Shreeroopa I.A.S

ಕಛೇರಿ : "ಪಶುಪಾಲನಾ ಭವನ", ಸಿ.ಬಿ.ಐ. ಕಛೇರಿ ಎದುರು, ಹೆಬ್ಬಾಳ, ಬೆಂಗಳೂರು – 560024
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ಡಾ. ಮಂಜುನಾಥ ಎಸ್. ಪಾಳೇಗಾರ ಎಂ.ವಿ.ಎಸ್ಸಿ
ನಿರ್ದೇಶಕರು
ಪಶುಪಾಲನಾ ಮತ್ತು ಪಶುವೈದ್ಯಕೀಯ
ಸೇವಾ ಇಲಾಖೆ

ಕರ್ನಾಟಕ ಸರ್ಕಾರ

Dr. Manjunath S. Palegar M.V. Sc
Director
Department of Animal Husbandry &
Veterinary Services

MESSAGE

I am delighted that the 22nd Convocation of National Academy of Veterinary Sciences (India), (NAVS) and National Scientific Convention is being organized in Bengaluru. I extend my congratulations to all the awardees and to the office bearers for organizing this important event on "Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare and Nutrition of Pets."This theme is highly relevant, considering the crucial role that livestock, poultry, and pets play in India's economy—impacting food security, livelihoods, employment, health, and the well-being of citizens. The NAVS established in 1993, has been a pivotal body for the overall development of Veterinary Sciences.

Livestock rearing involves around 21 million people, providing income to agricultural and landless households. The sector employs 8.8% of the population and contributes 30% to agriculture's economy, with an annual growth rate of 8%. It supports over 70% of rural households, particularly small farmers and labourers. India ranks first in milk production, second in eggs, and fifth in meat, contributing 5.5% to the Gross Value Added (GVA).

Despite this, challenges such as rising feed costs, limited resources, poor veterinary infrastructure, and emerging diseases persist. I am confident that this convention will offer valuable insights and policy recommendations to strengthen India's livestock sector.

I wish the convention great success.

Director
Department of Animal Husbandry
and Veterinary Services
Government of Karnataka

ಕಛೇರಿ : 1 ನೇ ಮಹಡಿ, 'ಪಶುಪಾಲನಾ ಭವನ', ಸಿ.ಬಿ.ಐ ಕಛೇರಿ ಎದುರು, ಬಳ್ಳಾರಿ ರಸ್ತೆ, ಹೆಬ್ಬಾಳ, ಬೆಂಗಳೂರು – 560024
Office : 1st Floor, Pashupalana Bhavana, Opp to C.B.I Office, Bellary Road, Hebbal, Bengaluru - 560 024.

Prof (Dr.) Suresh S Honnappagol
Former: Animal Husbandry Commissioner, GoI
and Vice Chancellor, KVAFSU-Bidar

MESSAGE

As a National Coordinator of NAVS (I) much delighted to extend my warmest greetings to all the dignitaries, Key Note speakers, Lead Speakers, Panelist's, Moderators , Rapporteurs, scholars, Scientists, Field ambassadors, Industrial Partner's and distinguished delegates of the XXII NAVS Convocation cum National Scientific Convention-2025, organized by the National Academy of Veterinary Sciences (India). This is a joint task shouldered by Veterinary College- Bengaluru a premier academic unit of KVAFSU-Bidar, Karnataka Veterinary Council, ICAR-NIVEDI, NIANP and CEAH-GoI Bengaluru. The theme of the convention "Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare and Nutrition of Pets," is well coined in view of its relevance towards Vikasit Bharat-2047. It is commendable that the National Academy of Veterinary Sciences fosters an environment that encourages knowledge sharing and the development of new ideas.

With its vast agricultural landscape and abundance of biodiversity, India is a major producer of livestock and poultry worldwide. In addition to supporting the rural economy, our livestock industry is crucial for advancing national food security and nutritional well-being. However, this industry faces a number of challenges, such as climate change, disease outbreaks, and the pressing need for sustainable methods that can meet the growing demand for human diets with adequate animal protein. This convention's focus emphasizes the comprehensive approach needed to handle the variety of issues that the sector is facing. It emphasizes how important are research, creativity, and sound policy making in raising livestock productivity, advancing veterinary medicine, education and promoting animal welfare. The latest methods in animal husbandry, contemporary veterinary care, and the dietary requirements of pets—who are becoming more and more recognized as essential members of Indian families, will all be covered in the talks and insights exchanged at this event. I have no doubt that the knowledge acquired here will be converted into practical plans that will advance veterinary education, improve pets' health and well being in addition to helping our livestock and poultry sectors.

I hope this convention will be a success with all your inputs and I am excited to see how your combined knowledge and efforts will benefit our country's animal husbandry and pet animal industry. As a duty bound I am indebted to the entire Apex Advisory Committee and Organizing Team for their untried efforts in making your stay at this beautiful garden city over the period of Convention.

Prof (Dr.) Suresh S Honnappagol

ಕರ್ನಾಟಕ ಪಶುವೈದ್ಯಕೀಯ, ಪಶು ಹಾಗೂ ಮೀನುಗಾರಿಕೆ ವಿಜ್ಞಾನಗಳ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೀದರ
ಪಶುವೈದ್ಯಕೀಯ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು
Karnataka Veterinary, Animal & Fisheries Sciences University, Bidar
Veterinary College, Hebbal, Bengaluru

Dr. N.K.S.Gowda
Dean

MESSAGE

It is my pleasure and honor to greet each one of you who are gracing this event of National Academy of Veterinary Sciences(NAVS), hosted at Veterinary college, Hebbal, KVAFSU. I am thankful to NAVS for considering our college and the University as the venue to organize this event. The theme of the convention "Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare and Nutrition of Pets," is very appropriate to the present scenario. Having diverse biodiversity, India leads in production of livestock and poultry globally. Besides, livelihood, the livestock sector is essential for national food and nutritional security. The sector faces many problems like effect of climate change, resource shortage, change in disease outbreak pattern, anti-microbial resistance, lower productive efficiency, etc. Companion animals like dogs and cats also play an important role in our social life. Of late, they are inseparable part of our life and getting integrated into the human-animal life cycle.

I am happy to note that many distinguished teachers, scientists, academicians and industry partners are attending this convention and some are being honored with Fellow, Associate Fellow and Members of this prestigious Academy during this occasion. This National Scientific Convention has different technical sessions to discuss and deliberate the issues of past, present and future of animal farming, pet animals and Veterinary education. It is an ideal platform for the students to understand the recent developments in livestock,poultry and pet animal sector. I wish good deliberations and hope suitable policy recommendations will emerge from the discussion. I once again heartily welcome the delegates from all over the country for this event.

I wish the convention all the best.

Dr N K S Gowda

Dean, Veterinary college, Bengaluru

KARNATAKA VETERINARY COUNCIL
Hebbal, Bangalore

Dr. H. C. Indresh
President, KVC

MESSAGE

It is a great pleasure for me to learn that Karnataka Veterinary, Animal and Fisheries Sciences, Bidar in Collaboration with National Academy of Veterinary Sciences (NAVS) is organizing XXII NAVS Convocation and National Scientific convention on " Challenges and Priorities for optimal production of livestock, poultry, healthcare and nutrition of pets" at Veterinary College, Bangalore from 8th – 9th March, 2025.

In India, the livestock has emerged tremendously over the last few decades in terms of productivity and contributed immensely to our nation's economy. However, there have been several challenges owing to the changes in climatic conditions, new emerging diseases, shrinkage of land and increased vector population resulting in emergence of new trans-boundary diseases which requires revamp of existing healthcare system in the livestock sector to augment better productivity and sustainability.

The theme of this scientific convention has been suitably selected to the present day need and I hope that the deliberations during this convention would pave way for development of appropriate policy decisions towards addressing challenges of production, nutrition and healthcare of livestock, poultry and pets.

As President of Karnataka Veterinary Council, I wholeheartedly welcome all the eminent delegates from across the country to the Garden City of India, Bengaluru.

(H. C. Indresh)

Message from Organizing Secretaries, NAVS-2025

Dr. B. M. Veeregowda

Dr. Ananda K. J.

Dr. Krishnamurthy T. N

Dr. Vivek M. Patil

We would like to extend a warm welcome to all the distinguished Dignitaries, Delegates, Speakers, Awardees, and Industry-Academic Representatives to the XXII NAVS Convocation and National Scientific Convention on the theme "Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare, and Nutrition of Pets," being held at the Veterinary College Campus, Hebbal, Bengaluru a hub for higher learning and innovative research.

The Convention is carefully structured into several impactful sessions, each designed to address critical areas in the fields of Livestock & Poultry Production, Health, and Pet Nutrition & Health. The primary focus will be on disease management, nutrition, policy and governance, and sustainable animal health and production, all of which are vital for ensuring food security, economic stability, and sustainable livestock production. Investment in these areas holds the potential to drive resilient and sustainable business models, while ethical practices in livestock production and consumer engagement are fundamental to the success of entrepreneurship in the Animal Husbandry sector. Additionally, the conference will explore key perspectives on "Viksit Bharat 2047," focusing on the future of Veterinary Education in India.

Organizing an event of this scale and significance presents its challenges; however, the dedication and teamwork of our Technical and Compendium Committee members have made this experience incredibly rewarding. Despite being tasked with this responsibility on short notice, meticulous planning, collaboration, and the hard work of every committee member have played an integral role in the successful creation of this 'Compendium.' We deeply grateful for their unwavering support, commitment, and energy.

Your presence and participation in the discussions will be invaluable to the success of this convention, and we truly appreciate your contribution to these deliberations.

(B. M. Veeregowda)

(Ananda K .J.)

Dr. Krishnamurthy T. N

Dr. Vivek M. Patil

National Scientific Convention Cum
XXII National Academy of Veterinary Sciences
Convocation -2025
"Challenges and Priorities for Optimal Production of Livestock Poultry, Healthcare and Nutrition of Pets"

8th-9th, March 2025

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TS1-LP-01

Optimizing livestock health: Data-driven surveillance and One Health strategies for sustainable disease management

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Ensuring optimal livestock health is essential for food security and economic stability in India. Diseases such as Foot-and-Mouth Disease, Brucellosis, Bovine Tuberculosis, Lumpy Skin Disease, and African Swine Fever have resulted in significant economic losses. Data-driven surveillance systems like NADRES, powered by AI analytics, enable early detection and rapid response, helping mitigate their impact on the livestock economy. The One Health approach, which integrates public health, veterinary, and environmental sectors, is crucial for managing transboundary and zoonotic diseases, as well as addressing the growing threat of antimicrobial resistance. Strengthening disease surveillance, diagnostics, and intersectoral collaboration is key to ensuring sustainable livestock health and securing India's food security and economic growth.

Ensuring optimal livestock health is critical for India's food security, economic stability, and public health resilience. The livestock sector contributes about 4.5 % to the national GDP and supports over 80 million rural households. However, disease outbreaks, particularly zoonotic diseases, present severe challenges to productivity and trade. Emerging transboundary animal diseases (TADs) and zoonoses over the past decade have significantly affected both livestock and human health, with projections indicating over 4,000 instances of virus spillover from animals to humans in the next 50 years, highlighting the need for robust disease management strategies.

The economic toll of livestock diseases exceeds INR 70,000 crore annually, with Foot-and-Mouth Disease (FMD) alone causing damages of INR 23,000 crore. Brucellosis, affecting 6-8 % of the bovine population, is a major cause of infertility and human cases. Bovine tuberculosis (bTB) remains prevalent at 7-8 % in dairy cattle, further compounding the economic and health burden. Infectious Bovine Rhinotracheitis (IBR) leads to an annual loss of $220 per cow due to 2.6 Liters of milk loss daily. Additionally, the Lumpy Skin Disease (LSD) outbreak between 2019-2024 affected over 5 million cattle, causing the deaths of over 250,000 cattle and incurring losses of approximately Rs. 20,254.40 crore. African Swine Fever (ASF), devastating India's pig sector since 2020, continues to cause widespread economic losses, with no treatment or vaccine available, further straining food security and economic stability.

To address these challenges, a data-driven surveillance system is crucial for effective disease management. ICAR-NIVEDI has pioneered AI and machine learning-powered disease analytics that enhance predictive capabilities and enable early intervention. The National Animal Disease Referral Expert System (NADRES) has reduced outbreak response times through real-time analytics, predicting risk of outbreaks up to two months in advance for 15 livestock diseases. Additionally, over one crore SMS alerts were sent to farmers and veterinarians across 14 states in 2024, ensuring timely action. Platforms like NADEN and LIVESTACK under the National Livestock Digital Mission provide scalable cloud-computing infrastructure for real-time disease reporting, further strengthening India's digitalized disease surveillance network.

The One Health approach, integrating veterinary, public health, and environmental sectors, is essential for managing zoonotic diseases and antimicrobial resistance (AMR). Zoonotic diseases, such as Rabies, Anthrax, Brucellosis, Japanese Encephalitis, and Leptospirosis, remain persistent threats, with Rabies causing 18,000–20,000 human fatalities annually, 99 % from dog bites. India reports over 2.2 million dog bites annually, including over 500,000 in children under 15, requiring coordinated cross-sector efforts to eliminate dog-mediated rabies. Leptospirosis, linked to livestock, impacts over 30,000 people yearly. Unregulated antibiotic use in animal husbandry is further exacerbating AMR. Strengthening intersectoral collaboration is critical to address these risks. India's Integrated Disease Surveillance Project (IDSP), which collects data at the district level, can greatly benefit from integration with advanced initiatives like NADRES and LIVESTACK. By combining AI-driven early detection and rapid response, this collaboration could significantly enhance disease surveillance and provide a proactive approach to managing emerging zoonotic diseases.

Technological advancements are transforming disease management in the livestock sector. Molecular diagnostics, including PCR and CRISPR-based rapid testing, have greatly improved detection accuracy. Thermostable vaccines are expanding immunization coverage in remote areas by eliminating the need for stringent cold chain logistics. Drone technology and remote sensing are enhancing surveillance for transboundary diseases. Furthermore, genomic research in livestock breeding is identifying disease-resistant traits, contributing to stronger herd immunity, while blockchain for livestock traceability strengthens food safety, biosecurity, and trade compliance.

The prevalence of diseases like IBR and bTB across India highlights the need for a national surveillance and control program. Effective control requires inter-institutional collaboration, drawing on global best practices and local surveillance insights. Surveillance networks like NADEN provide a comprehensive understanding of disease dynamics, enabling timely interventions.

For long-term sustainability in livestock health management, India must expand AI-driven surveillance networks, enhance veterinary workforce training, and strengthen disease control frameworks. Public-private partnerships in vaccine production and research will be crucial for scaling up preventive measures. Policy reforms should prioritize increased investment in livestock health research while aligning with global health standards to ensure safe livestock production and disease-free exports. By integrating digital surveillance, One Health initiatives, and evidence-based policy making, India can strengthen the resilience of its livestock sector, ensuring sustainable growth, food security, and public health safety.

TS1-LP-02

Optimization towards sustainable livestock production

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Nature optimizes sustainability through eliminating weak unthrifty genotypes in a population through early embryonic, foetal, neonatal and early lifetime mortality, while also dictating propagation of dominating individuals in a population by allowing greater success in reproduction so that following generation have the stronger genotype of superior quality. However, domestication has altered natural processes through assured and improved nutrition, healthcare, and selective breeding ensuring that livestock meet human needs for livestock products. Key aspects influencing sustainability of livestock production are genetics, management including nutrition, optimal reproduction and longevity.

In monotocus animals like cattle and buffaloes, the frequency of births in an individual's lifetime will also determine life-time milk production. In polytocus animals, fecundity is another fundamental yardstick for optimal productivity of the species like small ruminants and pigs, primarily for meat. India has been the leader in milk production for over 25 years now and it has to consolidate its position through emphasizing on good genetics, nutrition, reproduction and healthcare.

The strategies for optimized dairy cattle productivity can be grouped under three categories, based on the lag period after which the impact of the strategy can be expected, into Long, Medium and Short-term strategies.

Long-term measures (over generations)

Long term strategies primarily are those which have their impact evidenced only in next or the subsequent generations. Therefore, primary component of improvement under this category is the genetic improvement. Following domestication, major improvement in cattle productivity started in late 19th century with the introduction of herd books, animal identification and performance recording. In mid-twentieth century, the advent of Artificial Insemination (AI) with frozen semen revolutionized cattle breeding by allowing global dissemination of superior genetics. Only recently, hardly two decades ago, implementation of the modern method of Genomic selection enabled precise selection of elite bulls at a younger age, thus further accelerating genetic progress.

After over 40 years of popularisation of AI with frozen semen, selective breeding had altered 40 % of the Holstein genome worldwide. The accelerated improvement in productivity of cattle is evident from the fact that while the US dairy herds registered an increase of 1.3 % in population, the milk production recorded an increase of 8.6 %. An important aspect of sustainable production is the heifer replacement rate. Currently, in US herds, heifers expected to calve in the next year represent as high as 27.7 % culling rate, thereby ensuring robust herd renewal with new genetics. Application of sexed semen for AI has potential to produce 98 % female calves in herds. In USA and Israel, the average productivity of cattle herds is in the range of 11,000 to 12,000 kg milk in each lactation.

In India, government's efforts towards genetic improvement programs, started in mid 1960s, suffered from lack of conviction of those who were supposed to be providing a direction for its implementation, and the implementers themselves. In the process, unplanned crossbreeding with exotic germplasm took

its toll of the elitest animals amongst indigenous zebu breeds by relegating their genetic merit into oblivion as taurus crossbreds. Time-tested strategies of pedigree selection and progeny testing were being implemented but that too half-heartedly, thereby maintaining status quo or failing to achieve the anticipated progress. It is only in the more recent years when some scientific components were incorporated in animal breeding by NDDB that a ray of hope is seen. However, till today, the selection of bulls in India is made on the basis of dam's lactation yield alone, while in developed dairy world, each bull is evaluated on the basis of over 150 parameters including productive life and fertility, which are prioritized over higher milk yield.

Nevertheless, the milk production and productivity witnessed an increase over the years. Besides the increased numbers of livestock heads, probably, this could largely be owing to the fact that ample concentrate feed nutrition could be made available for livestock with green revolution ensuring surplus production of grains after meeting demand to feed increasing human population. Moreover, strict control over quality of frozen semen with introduction of MSP and CMU monitoring ensured quality semen availability thus the benefits of AI technology could be accrued. A good scheme introduced in 2019 – National Artificial Insemination Program – is really going to yield desired results in due course.

Practical contribution of NDDB to genetic improvement of Indian livestock needs further accolades for churning out low-cost indigenously developed genotyping chips for cows and buffaloes and practically applying the same to selection of bulls resourced from Progeny testing and Pedigree section programs. While another chip by NIAB also got released in a short period of time, however, the ICAR developed genomic chip for cattle and buffaloes remains elusive so far. The top bull of 2010 Badger Bluff Fanny Freddie was declared so even before it had even a single daughter in milk, based on the predicted merit through genomics.

While genetics plays a great role in sustainable improvement in productivity, but it also enormously relies on simultaneous culling rates. Where the culling is not performed, it is bound to strike a dead-end where the undesired or lower merit animals will continue to compete for the available resources of space and nutrition while also compromising the vaccination programs and quality healthcare service. For India, this question needs to be discussed at the highest political policy circles to make amendments in the Acts of various states to ensure protection only to the 'indigenous Holy cow family'.

Medium-term measures (in the lifetime of an animal)

Maximum output in terms of productivity of an animal in its lifetime can only be realized with optimal reproduction. The more the number of times a cow gives birth to a calf, not only that calf is added to the next generation gene-pool, but also initiates another cycle of milk production, thereby increasing a cow's lifetime milk production. Therefore, efficient reproduction becomes central to medium term strategies for achieving optimal productivity.

Although Artificial Insemination is aimed at propagating the genetics of superior selected bull, but from reproduction aspect, this fits in the medium term options to get the maximum productive output from an individual in its lifetime.

On the female side too, application of timed AI with estrus synchronization / estrus induction in the female aims to make the process less taxing on manpower. The technique of ultrasound scanning of

genitalia and ovaries is a boon in the hand of reproduction practitioners, but its restricted mobility under PNDT Act is a serious impediment for AH sector. Newer discoveries of molecules for early pregnancy diagnosis hold the promise for wider application for reducing reproductive losses. The exemplary progress made by Brazil in cattle productivity is through application of embryo transfer technology with ovum-pickup and IVF for rapid propagation of superior females. India has also started utilizing the technology for propagation of remaining few superior females of indigenous breeds. The technique is also being applied for propagating elite HF and Jersey cows and buffaloes too. In recent months, China has exported as many as 10,000 IVF produced embryos from superior Pakistani buffaloes and a number of IVF labs, mostly in private sector, have been established in Pakistan. RGM program of Govt. of India is supporting the technology through establishing nearly 30 IVF-ET labs, but any headway is evident only in a few of these. Some private IVF labs are providing good services and there are signs that this technology is going to yield desired results in coming years. Prevention of infertility can also play an important role in realizing full potential of a female during its lifetime.

Another important component for optimization of production is nutrition. The country is deficient in all types of feeds and fodders viz. dry fodder, green fodder as well as concentrate. The burgeoning cattle (cow and buffalo species) population (31 crores i.e. 33% of global) is an important determinant of relative feed and fodder availability. India sustains many unproductive or low productive animals at the cost of compromising feed and fodder availability for those with potential. There is dire need to look at non-conventional feed resources to avoid competition for human food resources. Worldwide, 2.5 billion hectares or nearly 50% of the total agricultural area and 20% of the total land on earth, is being used for livestock farming. Total of 0.55 billion hectares, corresponding to 40% of arable land, is used to grow food for livestock. Land is a non-expandable asset and it can only sustain a certain population of human and livestock. Therefore, there is need to judiciously utilize the land by growing crop varieties which meet the requirements of both the humans as well as the livestock.

Developments in precision nutrition and in-depth understanding of reproductive mechanisms has allowed control and optimization of both these crucial components of livestock development. The progress made in preventive healthcare and clinical care, which otherwise compromise productivity as well as reproductive ability, paved the way for realising the optimum production from livestock. Even survival of an animal in its calfhood has several carryover effects during the later productive life.

Short-term measures (during the current cycle of production)

Amongst the short-term measures which help realize optimal production from an animal, the most important is optimal nutrition in accordance with the production performance of the animal. The fact that early postpartum period, when the animal attains peak production, that is also the window during which it should get pregnant again for giving ‘a calf a year’. Therefore, nutrition becomes crucial during this period and utmost care should be taken to avoid the likely ‘negative’ energy balance and calcium depletion, which have deleterious effects on animal’s productivity. Even pre-partum nutrition is important in determining optimal production performance in the following lactation. Right from ensuring the availability of required amounts of dry matter and crude fiber, the calculated needs of proteins, carbohydrates, fats, energy, minerals and vitamins also should be met through the economically formulated diet of the animals.

One of the major limitation and concern in our dairy cattle husbandry practice is tie-stall system where the animals remain tied all day-long, and gets deprived of ad-lib availability of water at its will. Apart from impacting animal's health, this also compromises animal welfare and thus needs to be curbed through some regulation like that for hen-cage.

In the short-term, the health of animal plays an important role, right from ease of calving to udder health and overall well-being. This requires vigorous field extension system, a robust preventive vaccination program together with availability of appropriate diagnostics and healthcare facilities to ensure healthy animals for realising their optimal productivity.

Availability of artificial intelligence lead precision dairy farming applications makes it possible to accurately monitor the requirements of the animal aligned to its production, reproduction and health, as well as nutrition and management. This not only helps optimise production but also holds the promise to reduce drudgery and labour in the process, which are major cause of disinterest of new generation in dairying.

Buffaloes also perform well under optimal management condition with good nutrtion and heat stress amelioration setup. Taking the quality of milk in consideration, the fat-corrected milk of buffalo is twice the yield in comparison to cow milk. The support to buffalo dairy has not been commensurate to its potential and contribution to the milk pool. The fact that buffaloes, which are indigenous to this country and showed resilience in the face of devastating LSD outbreaks in cows recently, warrant strategizing improvement in buffalo improvement.

Conclusion

Optimizing reproduction and production in dairy animals requires a multi-faceted approach encompassing genetic selection, reproductive efficiency, optimization of nutrition and management strategies. The future of dairy farming lies in the application of advanced genetic tools, AI-driven monitoring and precision breeding techniques. With continued investment and research, India can enhance its position as a leading milk producer while ensuring sustainable livestock development. The states of Bihar and Odisha got specific roadmaps prepared and implemented for structured and well-planned dairy development, which should be an example for other states to emulate. The public interest can be aroused through organising milk recording competitions and livestock championships.

TS1-PP-01

Economic gain of farmers through intervention of osmanabadi goat farming (4+1 model) in Maharashtra

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ABSTRACT

Baseline survey of farmer was done to compare socio economic condition of farmers before and after the intervention of package of practices for goat production. Information was collected in pre constructed preforms about the farmer's profile, livestock production system, socio - economic condition at the onset of project. Afterwards 45 ST farmers of Nashik and Nandurbar districts, 51 SC farmers of Pune, Nashik, Ahmednagar and Hingoli districts, 96 resource poor farmers were selected randomly for this study. This study was continued from November, 2020 to March, 2024. Necessary training was imparted to the farmers on goat farming. Farmers were given one unit of adult Osmanabadi goat (one male and four females), 200 kg pelleted goat feed, 2 kg mineral mixture, feeder, waterer and tarpaulin sheet. Goats were maintained in semi intensive system. Animals were monitored quarterly and facilities for diagnosis, treatment and medicine was provided. The data on productive and reproductive performances, mortality, disposal of goats was collected. Average weight of male and female adult Osmanabadi goats was recorded to be 23.893 ± 0.238 kg and 25.152 ± 0.081 kg respectively. Average birth weight of kid was observed to be 2.485 ± 0.061 kg. Average daily gain of kids was found to be 108.07 ± 0.35 g / day. 422 kids were born from 241 kiddings and average kidding per cent was triplet 6.36 %, twinning 62.51 % and single 31.13 %. Average daily milk yield of doe was observed to be 451.08 ± 13.48 ml / day. Average annual mortality rate was recorded to be 8.24 ± 0.55 %. 54 farmers sold goats during the period of study and earned Rs. 12,37,000/- which was an additional income through selling of goats. The farmers attained an overall increase of annual income over baseline income by 51.62 ± 3.87 %. Even five farmers attained doubling of income. So, this intervention benefitted farmers economically towards livelihood security. So, goat farming would be adopted by the farmers for economic upliftment and self-employment in the rural India.

Keywords: Economic Gain, Farmer, Goat farming, Maharashtra

TS1-PP-02

Impact of specific trace minerals on nutrient utilization, growth performance and reproductive development in Sahiwal male calves

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ABSTRACT

The present study was conducted to find the effect of specific trace minerals supplementation on nutrient utilization, growth performance and reproductive parameters in Sahiwal male calves. The experiment was carried out on 18 Sahiwal male calves for 180 days. The animals were grouped into three (n=6 animals) groups. The G1 group, which served as control was not fed with any other mineral supplementation other than the basal diet. The G2 group was supplemented with the specific trace minerals (70 ppm Zn, 17.5 ppm Cu, 65 ppm Mn & 1.75 ppm Cr) and the G3 group was fed as the G2 with an extra 25% more supplementation for trace minerals (87.5 ppm Zn, 81.875 ppm Cu, 81.25 ppm Mn & 2.185 ppm Cr). The result data revealed that there was no significant effect on the body weight, metamorphic measurements, DMI, ADG, FCR, nutritive value, digestibility, and nitrogen retention of the animals due to specific trace mineral treatment. Plasma alkaline phosphatase (ALP) activity increased significantly ($P<0.05$) in G2 and G3 but IGF-1 remained similar in all the experimental groups. Plasma mineral concentrations of Zn, Cu, and Mn increased significantly ($P<0.05$) in G2 and G3. Specific trace mineral-supplemented groups (G2 and G3) showed a significant change ($p<0.05$) in testosterone production during the 120^{th} and the 180^{th} day of the trial. The scrotal circumference and temperature gradient of the scrotal surface did not show any significant change between the groups.

Keywords: Bull calves, Chromium, Copper, Immunity, Manganese, Testosterone, Zinc

TS1-PP-03

Immunogenic response of buffalo calves to reduced dose of *Brucella abortus* S19 vaccine: A field comparison with experimental full dose regimen

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ABSTRACT

Brucella abortus S19 vaccine is a widely used vaccine for preventing bovine brucellosis. This study evaluated the immunogenic response of a reduced-dose of *B. abortus* S19 vaccine (4×10^9 CFU/dose) compared to the experimental full-dose regimen (40×10^9 CFU/dose) in 26 buffalo calves aged 4-8 months. Calves were divided into a control group (n-11) and a reduced-dose group (n-15). Immune responses, including innate, humoral, and cell-mediated immunity were assessed using the Rose Bengal Plate Test (RBPT), Serum Agglutination Test (SAT), IgG IgM levels, and inflammatory biomarkers (TNF-á, IL-6, IL-12, IFN-ã) at various days of post vaccination intervals (DPV): <21, 21-45, 46-60, 61-90, 91-120, and >120 days. Statistical analysis was performed using GraphPad Prism 10. Results showed comparable antibody titers (RBPT, SAT, IgG) and inflammatory marker (TNF-á, IL-6, IL-12, IFN-ã) responses between reduced and full doses with no significant differences until DPV >120. Both doses elicited significantly stronger immune responses than the control group ($p<0.05$). Additionally, strong immunological responses were observed in IgM, IL-8, IL-10, and IL-1â levels, which were significantly higher in the reduced-dose group compared to the control ($p<0.05$). Antibody persistence and immunological responses were similar in both reduced and full doses with a peak immune response observed at DPV 46-60, which was sustained up to DPV >120. The study concluded that the reduced-dose *B. abortus* S19 vaccine is safe, immunogenic, and comparable to the full-dose experimental regimen, demonstrating its efficacy in preventing brucellosis in buffalo calves. These findings highlight the potential of using a reduced-dose vaccine as a cost-efficient and viable strategy for brucellosis prevention in buffalo populations.

Key words: *B. abortus*, Brucellosis, Buffalo calves, S-19 Vaccine.

TS1-PP-04

Surveillance of Classical Swine Fever virus: Molecular and serological analysis of clinical samples from Karnataka and Telangana

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ABSTRACT

Classical swine fever virus (CSFV) is a highly contagious pathogen affecting domestic and wild pigs. Rapid and accurate diagnosis is essential for disease control. This study was designed to detect CSFV in clinical samples from Karnataka and Telangana states of India. A total of 933 clinical samples, including tissue (18), blood (375), serum (523), and swabs (17), were collected randomly from pigs of both the states. The **52 -UTR region** of the virus was targeted for analysing the samples using **RT-PCR and *E*^{rns} iELISA** for serological evaluation of CSFV antibodies. O**verall surveillance positivity rate in Karnataka and Telangana state was 10% and 44.81% respectively, further the combined surveillance positivity rate among both the states was 37.72%.** In total **20 blood samples (5.33%) and 4 swab samples (23.52%) were positive by RT-PCR** whereas 62.71% (328/523) of serum samples were positive by serology. The Estimated true prevalence and predictive values were seen at 66.34% (CI at 95%: 61.49% - 70.98%). The **Fisher's Exact test, indicated** a significant association between the state and CSFV positivity with Karnataka having lower odds of infection **(p < 2.2e-16, OR = 0.13697)** indicating that the pigs in Karnataka were **86% less likely** to be infected than those in Telangana. Further Welch's **t-test** confirmed a significant difference in mean positivity rates between these states **(t = -13.259, p < 2.2e-16)**. The above study revealed that the Telangana state had a significantly higher CSFV prevalence compared to Karnataka. As per the anecdotal data collected from farms the Telangana state had a greater number of stray pigs than Karnataka state and hence this study concludes that a stricter biosecurity measure has to be in place like stringent vaccination protocol and restricted animal movements in Telangana state to reduce the prevalence of CSFV.

Key words: Classical swine fever virus (CSFV), RT-PCR, ELISA, Fisher's Exact Test, Odds ratio (OR), Welch's t-test,

TS1-PP-05

Epidemiological investigation of African swine fever outbreak in two farms adjoining the Karnataka and Tamilnadu state

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ABSTRACT

An epidemiological investigation was conducted to assess the African Swine Fever (ASF) outbreak that affected two farms located along the border of Karnataka and Tamil Nadu states, India. The study aimed to identify the source, spread, and impact of the outbreak and analyse the potential risk factors contributing to the disease transmission. A combination of field investigations, laboratory diagnostics, and surveillance data was utilized to trace the origin and movement of ASF within the affected regions. Blood, serum, tissue samples and swabs were collected from both farms and subjected to PCR assay targeting the p72 region and ELISA was carried out using a commercial kit. Spleen, liver, kidney and pharyngeal lymph node tissues were collected from autopsied pigs one from each farm. Out of the 14 serum samples tested, 5 tested positive for the presence of ASFV antibodies. Both the tissues collected were positive by PCR, sequenced and the circulating serotype was Genotype II. Incidentally, 2 swab samples collected from the feed collection drums belonging to Tamilnadu state tested positive for ASFV by PCR. The investigation revealed critical insights into farm management practices, biosecurity measures, and environmental factors that may have facilitated the spread of the virus. Additionally, the close proximity of the two farms to high-risk areas, including live pig markets along with the common point of feed collection, were identified as potential sources of virus introduction. In conclusion, the investigation revealed that feeding swill feed along with the movement of farm personnel to live pig markets and slaughterhouses as the main source of infection. Control measures, such as culling, quarantine, and enhanced surveillance, were implemented to contain the outbreak and prevent further spread. The findings highlight the need for improved biosecurity protocols, better surveillance infrastructure, and inter-state cooperation to manage ASF outbreaks effectively.

Key words: African Swine Fever, epidemiological investigation, outbreak, Karnataka, Tamil Nadu, seropositivity, biosecurity, transmission, risk factors.

TS1-PP-06

Glycoproteins C based genetic characterisation of Indian Bovine Herpesvirus-1 with other ruminant herpesviruses

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ABSTRACT

To characterise immunodominant glycoprotein located on the Unique long (UL44) region of BoHV-1 viz., glycoprotein C (gC) of Indian origin at genetic and phylogenetic level. In this study, archival isolates stored at the ICAR-NIVEDI BSL-2 facility were selected and revived on MDBK cell lines. Partial open reading frames of the gC genes were amplified using conventional PCR, and the resulting sequences were deposited in NCBI. Genome alignment, annotation was performed by GeneTool and phylogenetic analysis by Mega 11 software. Broadly BoHV-1, BuHV-1, BoHV-5, CeHV-1 formed one cluster and CaHV-1 and RanHV-1 formed another. The phylogenetic analysis of the partial gC gene revealed that all BoHV-1 (including BoHV-1.1 and BoHV-1.2) isolates, including those under study, are highly conserved and grouped within a single clade. In contrast, the bovine herpesvirus 5 (BoHV-5), bubaline herpesvirus-1 (BuHV -1), caprine herpesvirus 1 (CaHV-1), cervine herpesvirus 1 (CvHV-1),) and rangiferine herpesvirus 1 (RanHV-1) each formed separate clusters specific to their respective viruses, showing homology ranging from 67.8% to 92.2%. with BoHV-1 isolates. This study will lay the groundwork for future research on BoHV1, particularly in the development of new diagnostic tools.

Keywords: Bovine herpesvirus (BoAHV), Glycoprotein C(gC), ruminant herpesviruses, phylogenetic tree

TS1-PP-07

Anaesthetic efficacy of Xylazine-Ketamine- Guaifenesin combination for cesarean section in buffalo

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ABSTRACT

Present study was undertaken in 12 clinical cases of buffaloes with the history of dystocia they were subjected to anaesthetic protocol by using ketamine and Guaifenesin combination, premedicated with xylazine hydrochloride aiming to relieve dystocia either by obstetrical or cesarean section. Among the dystocia, uterine torsion (n=7); followed incomplete uterine dilatation (n=2) and mal-positioned foetus (n=2) and one case with oversized foetus. Among maternal dystocia, uterine torsion was most common (7 cases; 58.3%) followed by incomplete cervical dilation (2 cases; 16.6%) whereas in foetal dystocia, mal-positioned foetus (2 cases; 16.6%) and emphysematous foetus (1 case; 8.3%) were reported. Mean duration of general anaesthesia for obstetrical and cesarean procedure was 35.00±0.25min and 132.00±0.18min, respectively required for relieving dystocia. The Mean average score of relaxation jaw, limb and tail muscles in cases of manoeuvring and cesarean section were 2.167±0.307 and 1.66±0.218, respectively. The degree of analgesia in all cases was observed to be moderate to excellent quality, characterized by occasional to no response to pin prick at coronary band. In addition to that, those animals underwent for cesarean section has not showed nociceptive stimuli during surgical trauma indicative of heavy depth of anaesthesia of ketamine and Guaiphenesin combination (double drip). To conclude, combination of Ketamine-Guaifenesin premedicated with xylazine hydrochloride produced excellent muscle relaxation during obstetrical and cesarean procedure in buffaloes to relieve dystocia characterized by loss of abdominal muscle tone, stable respiration and minimal cardiopulmonary changes.

Keywords: Buffalo, Cesarean section, Dystocia, Ketamine, Uterine torsion.

TS1-PP-08

Assessment of dairy cattle welfare in Karnataka

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ABSTRACT

This study was undertaken to compare the status of cattle welfare in dairy farms of different sizes and regions, and to assess the attitude of dairy farmers towards cattle welfare in Karnataka, India. A total of 401 adult crossbred cattle in 60 dairy farms of Karnataka were considered. The mean housing component welfare score of small, medium, large, peri-urban and rural dairy farms, out of total score of 30, was 16.33 ± 0.671, 15.93 ± 0.719, 16.00 ± 0.429, 15.63 ± 0.398 and 16.53±0.577, respectively; with no significant differences between groups. The mean feeding component welfare score of small, medium, large, peri-urban and rural dairy farms, out of total score of 30, was 18.23 ± 0.213, 18.80 ± 0.197, 19.53 ± 0.234, 19.03 ± 0.182 and 18.67 ± 0.670, respectively; Large dairy farms had significantly better scores. The mean animal health welfare score of small, medium, large, peri-urban and rural dairy farms, out of total score of 40, was 22.25 ± 0.801, 20.90 ± 0.839, 21.824 ± 0.206, 20.80 ± 0.592 and 21.97 ± 0.733, respectively; with no significant differences between groups. The overall mean welfare score of small, medium, large, peri-urban and rural dairy farms, out of total score of 100, was 56.80 ± 1.265, 55.63 ± 1.230, 56.53 ± 0.887, 55.47 ± 0.813 and 57.17 ± 1.005, respectively. The predominant welfare ranking in all groups was Average. The mean attitude score of dairy farmers towards animal welfare, out of a maximum score of 5, ranged from 3.3 ± 0.16 to 4.4 ± 0.08, with an overall mean of 3.9 ± 0.03, indicative of the sensitivity of Indian dairy farmers to issues of animal welfare.

Key words: dairy cattle welfare, farm size, farmers' attitude, rural, peri-urban

TS1-PP-09

Assessment of vaccine efficacy and population immunity in goats and sheep in Odisha: Advancing towards PPR eradication in India

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ABSTRACT

The study focuses on evaluating the status of population immunity within the Peste des petits ruminants (PPR) eradication programme implemented in Odisha, India. It specifically assesses seroconversion/vaccine efficacy and population immunity following annual vaccination. The study aligns with the World Organisation for Animal Health (WOAH) and the Food and Agriculture Organization (FAO) guidelines for post-vaccination Evaluation (PVE) under the Global Control and Eradication Strategy (GCES), with the ultimate goal of global PPR eradication. The present cross-sectional study was conducted during 2023 and 2024, in the pre-vaccination phase in 2023, 3466 random serum samples were collected from goats and sheep across 120 epidemiological units (epi-units) spanning 82 taluks in 28 districts. The PPR seropositivity rates in the were: 6–12 months: 60%; 1–2 years: 62% and 2 years: 66% with overall, the average seroprevalence was 61.1%, suggesting a considerable level of prior vaccination, with 43% of the epi-units demonstrating antibody prevalence rates of e”70%. Following the first round of vaccination in 2023, 1125 serum samples were collected from goats and goats in the 6–12-month age group within 90 days post-vaccination across 119 epi-units, covering 64 taluks in 23 districts. The observed seroconversion in this age group was 76.9%, confirming the efficacy of the vaccine. Additionally, over 68% of the epi-units achieved a response of e”70% seroprevalence, marking a notable improvement from 51% during the pre-vaccination phase. Further PVE conducted after the second-round mass annual vaccination in 2024 showed continued progress in herd immunity, with vaccine effectiveness reaching 81.85%. A total of 2650 serum samples were collected across all three age groups, covering 90 epi-units in 77 taluks in 28 districts revealing that over 80% of the epi-units achieved a seroprevalence response of e”70%. The findings emphasize the importance of continuing mass vaccination campaigns to achieve herd immunity. To effectively eradicate PPR, a vaccination coverage rate of over 95% is recommended, targeting small ruminants aged >3-4 months, to achieve a herd immunity threshold of >80%. This study provides key insights into post-vaccination population immunity and PPR vaccine efficacy, guiding national strategies for a PPR-free India and supporting global eradication efforts. The mass vaccination program’s impact will shape strategies for eradicating PPR, enhancing small ruminant health and productivity, and benefiting India’s agricultural economy and affected regions.

Keywords: India, Odisha state, Population Immunity, PPR-EP, Vaccine Efficacy

TS1-PP-10

Molecular characterization of PPRV in India: Genetic insights from field outbreaks

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ABSTRACT

Peste des Petits Ruminants (PPR) is a highly contagious viral disease that primarily affects sheep and goats, caused by the *Morbillivirus caprinae* species. Understanding the genetic variability and distribution of PPRV is critical for tracking viral evolution, especially in vaccinated regions, to develop effective diagnostic tools and control strategies. Detecting potential viral mutations and understanding transmission patterns are essential for refining disease control measures and ensuring the success of the PPR eradication program. Two PPR outbreaks were confirmed through passive surveillance in goat flocks from Mandi district of Himachal Pradesh (May 2024) and Betul district of Madhya Pradesh (February 2025). Both outbreaks resulted in high morbidity and considerable mortality, raising concerns about viral circulation despite ongoing control and eradication efforts. Clinical samples from affected animals submitted to the laboratory, were tested using ELISA, RT-PCR and qRT-PCR confirming the presence of PPRV genome. To further characterize the virus, nucleocapsid (N) and fusion (F) gene-specific RT-PCR products were sequenced, validating the infection at the molecular level and the NCBI BLAST analysis of the sequences confirmed that the isolates were identified as PPRV. Highly positive tissue and swab samples were selected for virus isolation in Vero cell cultures. The PPR virus was successfully isolated by blind passages, confirming its characteristics CPE of PPRV in Vero cells in laboratory conditions. Subsequent sequencing and phylogenetic analysis of partial N gene sequences using Maximum Likelihood method in MEGA 11 software, revealed that the isolates belong to Asian lineage IV. These isolates exhibit a strong genetic similarity with previously reported Indian PPRV strains. The findings reaffirm the continued circulation of lineage IV PPRV in India, underscoring the need for ongoing genetic surveillance. This study contributes valuable insights into the molecular characterization of PPRV, supporting national and global efforts to eliminate the disease.

Key words: Lineage IV, India, Phylogeny, PPRV, qRT-PCR, RT-PCR.

TS1-PP-11

Longevity of vaccine induced maternal antibodies against peste des petits ruminants in offsprings of vaccinated sheep and goats in Karnataka

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ABSTRACT

Peste des petits ruminants (PPR) is a highly contagious viral disease affecting sheep and goats and the persistence of maternal antibodies is crucial to the effectiveness of vaccination, as it creates a critical period where kids may be susceptible to infection despite the presence of maternal immunity. The study was conducted from April 2024 to October 2024 across 10 organized sheep and goat farms, each with a varied flock size of 25 to 233, located in Bengaluru Urban, Bengaluru Rural, and Ramanagara districts of Karnataka. A total of 160 pre-vaccination and 185 post-vaccination sera samples were collected from adult sheep and goats upon vaccination with PPR vaccine Sungri 96 Strain, 10^3 TCID50/mL S/C. Samples were also collected from pregnant or recently kidded/lambed sheep and goats. Postlambing or post-kidding, vaccinated dams and their offsprings were monitored, with serum samples collected every 30 days, up to 150 days. Maternal antibody titers in the serum of kids and lambs born to vaccinated animals were estimated using the Virus Neutralization Test (VNT) and/or PPR cELISA kits. Further, four newborns were vaccinated at 30 days of birth, monitored for immune status until four months, and studied for immune status. The pre-vaccination antibody titers measured by cELISA in adult sheep and goats showed an overall positivity rate of 74% (118 out of 160). After vaccination, antibody titers increased significantly, to 95% (175 out of 185). Serum samples from lambs and kids born to vaccinated dams were collected monthly for five months to assess the persistence of passively transferred maternal antibodies using cELISA. The results showed a gradual decline in protective antibody titers: 69% of one-month-old animals had protective titers, which decreased to 50% at two months, 49% at three months, 36% at four months, and 23% at five months, indicating a steady waning of maternal antibodies over time. Additionally, three out of the four lambs vaccinated showed significant antibody titers up to the fourth month, indicating protective immunity.

Key words: PPR vaccine Sungri 96 Strain, Passively transferred maternal antibodies, VNT, cELISA, Antibody persistence.

TS1-PP-12

Current status and epidemiology of Sheeppox and Goatpox in Karnataka

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ABSTRACT

The current study reports the epidemiology and seroprevalence of sheep and goatpox and the characterization of the circulating sheep and goatpox virus in Karnataka by molecular methods. Passive data from 2008 to 2023 resourced from the Department of AH & VS, showed endemicity of the disease in Karnataka. All 4 administrative divisions of Karnataka experienced SGP outbreaks with the highest incidence reporting from Bengaluru division (184) followed by Kalaburagi (81),Mysuru (55) and Belagavi (28) affecting 4222, 1814, 1037 and 821 sheep/goats respectively. Belagavi division, despite having a higher sheep and goat population, had fewer outbreaks than Mysuru division. Among the districts, Tumkur had the highest SGP outbreaks (79) followed by Davanagere (37) and Chikkaballapura (25) with CFR of 39,29and 31 percents respectively. Most SGP outbreaks were reported from December to May, revealing the seasonality of SGP outbreaks. Mouli breed seemed to be more susceptible to SGP outbreaks wherein we could record 19 deaths among 21 affected with a CFR of 90.4 per cent followed by Kenguri breed, in which 17 deaths occurred out of 22 affected with a CFR of 77.2 per cent. 1800 serum samples collected from all the districts of Karnataka were screened by iELISA, 95 samples were positive for anti-SGP antibodies yielding an overall seroprevalence of 5.28 per cent. Divisionally, Belagavi stood first with a seroprevalence of 11.19 per cent followed by Kalaburagi and Bengaluru with5.55and 3.52 per cents respectively. Mysuru division placed last with 1.88 per cent of seroprevalence rate. Of 164 samples, 132 from clinically affected and 32 healthy samples subjected to partial P32 PCR, 108 samples from clinically affected were found positive with an expected amplicon size of 237 bp on agarose gel electrophoresis. Among the clinical samples, scabs and nasal swabs were preferred for PCR diagnosis. Phylogenetic analysis showed the sequences of all the isolates in the present study belonged to the sheeppox virus.

Key words: ELISA, Epidemiology, goatpox, seroprevalence, sheeppox

TS1-PP-13

Investigations on the effect of chromium supplementation on nutrient and mineral metabolism, endocrine variables and biomarkers of immunity, antioxidant status and energy and lipid metabolism in dairy calves during the transition phase

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ABSTRACT

Twenty-four young dairy calves were used in a randomized complete block design and assigned to one of 4 treatments in a 2x2 factorial arrangement of treatments to determine the effects of supplemental chromium (Cr) on nutrient metabolism, immune and antioxidant response, and biomarkers of endocrine variables and energy and lipid metabolism. During the 90 days feeding trial (15 to 105 days of age), calves were fed one of four treatments: (1) a diet containing no supplemental Cr (CON); (2) diet supplemented with 0.05 mg of Cr/kg $BW^{0.75}$ (Cr-0.05); (3) diet supplemented with 0.10 mg of Cr/kg $BW^{0.75}$ (Cr-0.10); and (4) diet supplemented with 0.15 mg of Cr/kg $BW^{0.75}$ (Cr-0.15). Dietary Cr supplementation did not exert any significant effect on nutrients utilization. However, Cr supplementation exert positive effect ($p<0.05$) on its metabolism and plasma levels whereas; showed no interaction with the metabolism of other studied minerals. Plasma glucose level showed a negative association with the treatment and level was found lowest in Cr-0.15 group. There were no effect of treatment was observed on the plasma insulin concentration. Cr supplementation showed as a significant ($p<0.05$) effect on insulin: glucose ratio and ratio was found higher in $Cr_{0.10}$ and $Cr_{0.15}$ groups. There was no effect of treatment on the serum inulin receptor IRS-1, BHBA, HDL cholesterol, NEFA, triglyceride: HDL cholesterol and FFA concentration among all four groups. Cr supplementation did not exert any effect on the biomarkers of immunity and antioxidant like total immunoglobulin concentration, WBCs counts, SOD, CAT, GSH-Px activity, and total antioxidant status (TAS). The IGF-1 concentration was higher ($p<0.05$) in Cr supplemented group while cortisol concentrations remained unaltered among four groups. In conclusion, dietary Cr supplementation improved insulin sensitivity and IGF-1 concentration without affecting nutrient metabolism and immune and antioxidant response.

Keywords: Antioxidant, biomarkers, calves, chromium

TS1-PP-14

Inferring sperm expressed single nucleotide polymorphisms with spermatogenesis and fertility in Buffalo

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ABSTRACT

Single nucleotide polymorphisms (SNPs) influence the biological functions of genes that are crucial sperm development, hormone production, and overall reproductive processes. In order to understand the functional impact of sperm expressed SNPs, the present study was carried out using sperm transcriptomes from 21 bulls, categorized as high-fertile (HF) and sub-fertile (SF) based on field fertility rate. The SNP analysis using bcftools mpileup revealed 1222 SNPs between HF and SF groups of buffalo sperm transcriptome. These SNPS were visualized using IGV and based on visual differences, 186 variants were observed to be expressed only in any one of the group, i.e., 182 and 4 variants in HF and SF bulls, respectively. These SNPs were distributed across 150 genes. Of these, 45 SNPs annotated as "LOC", 25 SNPs are found to be non-synonymous. Additionally, 4 SNPs were classified as unknown, but mapped with *homo sapiens* corresponding to *HAP1* and *GPRC6A* genes and 3 SNPs were identified as chromosome homologues. The genes such as *ADAM18*, *LOC102392683*, *LOC102413945*, *CMSS1*, *MAPK3*, *LEXM*, *TRIM36* having SNPs might play a crucial roles in early stage of spermatogenesis. The genes might have regulatory role at different stages of spermatid development: *EFCAB3*, *UTRN*, and *CCDC27* in early spermatids; *EFCAB13*, *ZBBX*, *TXNDC2*, and *EFCAB12* in both early and late stages. Additionally, *CPLANE1*, *DNHD1*, *CASP8AP2*, and *AHCTF1* are highly expressed in testis and spermatid tissues. Further SNP analysis revealed that 1/3 (62 SNPs) of them were non-synonymous changes, which may directly alter protein function and influence bull fertility. Domain analysis of LOCs revealed that they are involved in DNA binding positive regulation of transcription by RNA polymerase II, localization to nuclear speckles, and transcription coactivator activity. This study documented the SNPs associated with the candidate genes influencing spermatogenesis and bull fertility.

Key words: Buffalo bull selection, sperm, transcriptome profiling, fertility regulating genes, SNPs

TS1-PP-15

Unveiling the impact of spray-dried encapsulated probiotics on growth, gut health, and immunity in indigenous cattle calves

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ABSTRACT

In the present study of 120 days duration, thirty two indigenous cattle calves were randomly divided in to four groups to evaluate the effect of spray dried encapsulated *L. reuteri* SW27 and *L. salivarius* RBL22 on the performance, gut health and immunity in indigenous cattle calves. The treatment groups were as follows: Group I (CT) – were fed on a basal diet alone (with no supplementation) referred as control; Group II (AT) - supplemented with antibiotic chlortetracycline (55 mg/kg of calf starter); Group III (FP) - supplemented with milk fermented with probiotics (*L. reuteri* SW27 and *L. salivarius* RBL22) @ 100 mL/d/calf having $1x10^9$ CFU/ 100 mL; and Group IV (SP) - supplemented with spray dried encapsulated probiotics of both *L. reuteri* SW27 and *L. salivarius* RBL22 (1 g/d/calf) having $1x10^9$ CFU/ g, respectively. The findings indicated that the final body weight (kg) and DMI (g/d) were significantly ($p<0.01$) higher in SP group followed by FP, AT, and CT groups. Similarly, ADG (g/d) and FCE (%) were significantly ($p<0.01$) higher in SP group in comparision to control (CT), with the intermediate values observed in FP and AT groups. The apparent digestibility of DM, OM, CP, EE, and ADF did not ($p>0.05$) vary among the different groups whereas, NDF digestibility was significantly higher ($p=0.014$) in spray dried encapsulated group compared to control. The structural growth parameters were significantly ($p<0.01$) higher in SP group followed by FP, AT, and CT groups. The average faecal score, faecal pH and moisture was significantly ($p<0.01$) reduced in SP group followed by FP which reduced the incidence of diarrhoea. Immunological parameters were significantly ($p<0.01$) improved in probiotic supplemented groups in comparision to AT and CT groups. Upon comparative analysis, the results were found to be better in probiotic supplemented groups as compared antibiotic and control groups. However, among the probiotic groups, spray-dried encapsulated group performed better as compared to the fermented group.

Keywords: *Lactobacillus*, Growth performance, Gut health, Immunity, Calves

TS1-PP-16

Geogenic fluorosis in Bihar and its impact on animal health

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ABSTRACT

Fluoride is a naturally occurring element that plays a significant role in environmental health and is an essential trace element in living organisms. It is present in various environmental components, including air, water, soil, plants, and animals, due to both natural processes and anthropogenic activities. Extended exposure to fluoride in animals can result in toxicity, leading to adverse health outcomes and the onset of fluorosis. WHO prescribes arsenic in drinking above the permissible limit of 1.5 ppm as unsafe for drinking. Bihar state is listed as a category III fluoride endemic state (>50% of the districts affected) in India. PHED, GoB reports that eleven districts of Bihar have high fluoride concentrations in groundwater. Water samples, cattle blood, and urine from reported sites in the Nawada and Gaya, districts of Bihar were collected for the study. We observed that animals suffered from dental and osteal fluorosis due to fluoride-contaminated water. The fluoride levels in groundwater ranged from 0.6-9.74 ppm. Affected cattle had visible symptoms of chronic fluorosis with serum levels ranging from 0.01-0.39 and in urine 1.86- 39.75 ppm. 36.8% of animals in the studied region had serum levels higher than 0.2 ppm and 54.7% had urine fluoride levels greater than 5.0 ppm.

Key words: Fluoride, Bihar, water, cattle, health

TS1-PP-17

Molecular phylogeny and genetic diversity analysis of *Trypanosoma evansi* isolates in India by employing beta-tubulin gene

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ABSTRACT

Trypanosoma evansi, a haemo flagellated protozoan parasite, is the causative agent of surra, a highly debilitating disease affecting a wide range of animal species. The parasite is mechanically transmitted by haematophagous flies. Beta-tubulin, a crucial cytoskeletal protein, plays a key role in maintaining structural integrity, intracellular transport, and parasite motility. To assess the genetic diversity of *T. evansi* isolates, blood samples were collected from clinically infected buffaloes and dogs from different geographical regions. The beta-tubulin gene was amplified using a known primer set, yielding 1131 bp amplicons, which were sequenced using the Sanger's method.Phylogenetic analysis was conducted by Maximum Likelihood approach employing Tamura 3-parameter (T92) model with gamma-distributed rate variation (+G) in MEGA 11 software. Sequence alignment was performed using the CLUSTAL W method, and the pairwise identity matrix was generated via DNASTAR software. The phylogenetic tree revealed a strong genetic affinity of Indian *T. evansi* isolates with their Asian counterparts, while divergence was observed from isolates of other geographical regions. The pairwise identity matrix showed a high degree of sequence similarity (98.9–99.9%) among *T. evansi* isolates from India. In contrast, the similarity with *T. brucei* isolates from the USA ranged between99.4-99.6%, while a more significant genetic divergence (21.5-21.6%) was observed when compared with beta-tubulin genesequenceof*T. cruzi* from Brazil.These findings indicate a strong genetic conservation of *T. evansi* within India while highlighting its evolutionary divergence from other *Trypanosoma* species. The study provides valuable insights into the genetic variability and phylogenetic positioning of *T. evansi*, which can contribute to better understanding its epidemiology and aid in developing improved diagnostic and control strategies.

Keywords: Beta tubulin gene, Genetic diversity, Molecular phylogeny, *Trypanosoma evansi*.

TS1-PP-18

A one health approach for assessing antibiotic resistance of *Staphylococcus aureus* in dairy cattle and their associated environment in the South Karnataka region

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ABSTRACT

The emergence of methicillin-resistant *Staphylococcus aureus* (MRSA) has significantly complicated therapeutic management of mastitis in dairy cattle. Through horizontal gene transfer, antibiotic resistant genes (ARGs) are transferred between livestock and their environment. Based on one health approach. a cross-sectional study was designed and through multistage random sampling, a total of 122 milk and 89 farm environment samples were collected from Kolar and Mandya districts of Karnataka during 2024-25. The antibiotic resistance was determined using disk diffusion method and ThermoScientific Sensititre™ AST System using specific bovine mastitis panels as per CLSI (2024) breakpoints. ARGs were detected using PCR assay targeting *mecA/mecC*, *Tet* and *Sul* genes. Based on California Mastitis test (CMT) screening at farm level, 78 milk samples were from clinical mastitis and 44 samples from healthy cows. A total of 31 isolates of *S. aureus* were confirmed (mastitis- 23; healthy-5 and environment-3) based on isolation, phenotypic and PCR detection of *nuc* and *23sRNA* genes of *S. aureus.* Phenotypic antibiogram of clinical isolates (n=23) showed highest resistance to cefoxitin (14, 60.8%) followed by Penicillin (12, 52%), Linezolid (6, 26%), Erythromycin (4, 17%), Tetracycline (2, 8.7%), Trime-sulfamethoxazole (2 8.7%), Gentamicin (2, 8.7%), Enrofloxacin (2, 8.7%), and Chloramphenicol (1, 4.3%). The multidrug resistance (MDR) was observed in six isolates with most predominant pattern was Cef+Ery+Enro+Pen. The non-clinical isolates showed highest resistance to Cefoxitin (2, 40%), Gentamicin (1, 20%), Enrofloxacin (1, 20%) and Penicillin (1, 20%). Environmental isolates (n=3) showed resistance to Penicillin and Erythromycin. The penicillin and erythromycin resistance was shared among dairy cows and environment. The marker gene for MRSA (*mecA*) was detected in three isolates (clinical mastitis-2 and healthy cows-1). The isolates from environment showed no evidence of MRSA however, healthy cows harboured *mecA* gene. Other ARGs *viz., tet* and *sul* were present in three clinical isolates. The study showed that, dairy cattle with mastitis showed MDR *S. aureus* and the associated farm environment was free from drug resistant bacteria and genes. Therefore, surveillance and testing of AMR bacteria in dairy cattle and environment through one health approach is required to ensure that farm environment is free from ARGs and AMR pathogens for clean milk production practices.

Key words: One health, MRSA, *mecA*, mastitis, environment, dairy cattle

TS1-PP-19

Ram semen processing, cryopreservation and sperm-oocyte binding

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ABSTRACT

Semen cryopreservation, also known as sperm banking, offers several advantages in assisted reproduction technology. One of the primary benefits is the preservation of fertility, allowing semen from livestock animals to store for future use. Additionally, semen cryopreservation provides an option for male animals with genetic conditions, or those exposed to harmful environmental factors, to safeguard their reproductive potential. Moreover, cryopreserved semen can be used in assisted reproductive technologies such as in vitro fertilization (IVF) and intrauterine insemination (IUI), enhancing the chances of conception. In the present study, we aimed to examine the effect of cryopreserved ram semen on oocyte–sperm binding. The ram semen was collected by electro-ejaculation method. The semen evaluation was done using CASA, sperm concentration was determined by CASA/ hemocytometer method and semen dilution as per conventional method. The samples were put in semen straw and did the styrofoam box method in freezing the semen straws. The oocytes were isolated from vitrified ovine ovarian cortex and were in vitro matured. The sperm-oocyte binding activity was evaluated. Sperm–zona binding into uncleaved oocytes was positively related to fertilization. Thus cyropreservation of both oocytes, particularly those isolated from preantral follicles and cryopreserved ovarian cortex and sperm can be used to improve the fertility of the domestic animals.

Keywords: Sperm, oocytes, cryopreservation, binding, sheep

TS1-PP-20

Effect of cryoprocessing stress on *HSPA1A* and *HSP90AA1* gene expression in spermatozoa and its correlation with semen quality in goat

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ABSTRACT

Heat shock proteins are prerequisite molecules for the functional competence of sperm cell from spermatogenesis to the process of fertilization and early embryonic development. The present study was aimed to study the effect of cryoprocessing on expression of *HSPA1A* and *HSP90AA1* in spermatozoa and its correlation with semen quality in Barbari goat. Thirty ejaculates were collected by employing artificial vagina from five Barbari bucks, aged between 2–4 years, weighing 25 to 35 Kg. After initial evaluation, the qualified semen ejaculates were diluted with cryoprotective extender, packed into French mini straws, equilibrated and then stored into liquid nitrogen. After dilution, equilibration and thawing the progressive motility, viability, abnormality, membrane integrity, acrosomal integrity and kinematic parameters of the spermatozoa were recorded. The relative expression of *HSPA1A* and *HSP90AA1* in spermatozoa after every stage of cryoprocessing was also studied. All the semen quality parameters and total motility, VCL, VAP, VSL and BCF deteriorated significantly ($p<0.01$) during successive stages of cryopreservation. However, the LIN, STR and WOB only decreased significantly ($p<0.01$) in post-thaw samples as compared to both pre-freeze and diluted semen. Relative expression of *HSPA1A* and *HSP90AA1*declined significantly ($p<0.01$) following the process of cryopreservation in buck spermatozoa, which was more evident after freeze-thawing. A significant ($p<0.01$) correlation was observed between semen quality parameters and both *HSPA1A* and *HSP90AA1*expression. It may be concluded that the relative expression *HSPA1A* and *HSP90AA1*may be used as one of the markers of spermatozoa quality in the post thaw semen.

Key Words: Goat,Spermatozoa, cryopreservation, acrosome, kinematics, heat shock proteins, genes

TS1-PP-21

High mitochondrial membrane potential coupled with inefficient mitigation of ROS in sperm lead to subfertility in bulls

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ABSTRACT

Understanding the sperm biology is important to predict and improve semen quality of a breeding bull. In this study, computer-assisted semen analyser, microscopic staining, and flow cytometry techniques were used for evaluating sperm kinematics, viability, mitochondrial function, and oxidative stress to strengthen the accuracy of fertility assessment techniques. Frozen semen samples from 14 buffalo bulls were classified based on field fertility rate (average fertility rate: 47.8±4). Accordingly, bulls were classified into two high (HF, 51.9±4), and sub fertile (SF, 43.3±4 groups. CASA analysis indicated no differences in total motility (%) between them (HF: 83.14, SF: 82.16). Similarly, the staining methods to assess sperm viability (55% vs. 53%), functional membrane integrity (27% vs. 27%), and sperm nuclear morphology (91% vs. 89.5%) also revealed no significant difference between the groups. However, flow cytometric analysis revealed significant functional differences, with a higher ($p<0.05$) percentage of live sperm in HF (43% vs. 27.64%) compared to SF bulls. SF bulls exhibited significantly higher ($p<0.05$) mitochondrial membrane potential (64.36% vs. 55.33%) compared to HF bulls. Similarly, the percentage of sperm with high production of reactive oxygen species (ROS) was significantly ($p<0.05$) higher in SF bulls (46.7% and 36.68%) compared to HF bulls, indicating excessive mitochondrial activity leading to oxidative stress and potential sperm dysfunction. The results revealed significantly higher intracellular non-enzymatic antioxidant concentrations in HF bulls (0.3428 mM) compared to SF bulls (0.297 mM). This suggests that the lower antioxidant levels in SF bulls fail to neutralize excessive ROS, leading to persistent oxidative stress, mitochondrial dysfunction, and impaired sperm function. Thus, oxidative stress-induced sperm dysfunction in SF bulls may be a consequence of inadequate antioxidant defense, emphasizing the importance of antioxidant balance in maintaining sperm fertility potential.

Key words: Artificial Insemination, Buffalo Fertility, Flow Cytometry, Mitochondrial Membrane Potential, Reactive Oxygen Species.

TS1-PP-22

Expression of positive surface markers of mesenchymal stem cells isolated from ovine ovarian tissue

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ABSTRACT

Stem cells are unique, undifferentiated cells with the ability to self-renew and develop into specialized cell types. Their high regenerative potential makes them essential in both medical and veterinary research. Recent advancements have led to an increased focus on MSCs obtained from ovarian tissue. The present study was undertaken to isolate the mesenchymal stem cells from the ovine ovarian cortex and characterize them. The ovarian cortex biopsies were sliced into1-2mm of small pieces using a sterile scalpel and incubated in 0.6 mg/ml collagenase for 30 min and were centrifuged at 400g for 10 min twice. The collagenase were inactivated using a 10 % foetal bovine serum and cells were washed via centrifugation in a basic medium consisting of DMEM, supplemented with $NaHCO_3$, 1 % penicillin/ streptomycin. The washed cells were resuspended in a basic medium with 10 % FBS, passed through a 40-ìm cell strainer in 50 ml conical tube and cultured into 25mm^3 culture flask. The cells were cultured in a CO_2 incubator 37°C, 5% CO_2 humidity and media were changed every 48 hrs and passage every 10–12 days using 0.15 % trypsin. To study the gene expression, cells from passage 3 and 5 were harvested. The harvested MSCs were used for RNA isolation and cDNA was prepared and RT-PCR was done for gene (CD105, CD73, and CD90, CD34 and CD45) expression studies. The isolated cells resembled the spindle like structure, had cluster formation, undergone plastic adherence. MSCs are also identified based their expression of specific markers. The isolated cells exhibited expressions of the positive surface markers such as CD105, CD73, and CD90, while did not express the surface markers like CD34 and CD45. Thus, In ovine ovarian tissue, the presence of MSCs has been confirmed through the expression of these markers, suggesting their potential role in reproductive biology.

Keywords: Mesenchymal stem cells, Ovine, Ovaries, Gene expression studies, RT-PCR.

TS1-PP-23

Effect of human chorionic gonadotrophin and Leutinizing hormone on the yield of oocytes from the in vitro grown preantral follicles in sheep

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ABSTRACT

Utilizing the preantral follicles, which are higher in number in comparison to the antral follicles in a ovary would facilitate in the production of more fertilizable oocytes from an ovary. Since, the female germ cells i.e. oocytes are limited in number in comparison to the availability of spermatozoa, which are in plenty A study on the effect of human chorionic gonadotrophin (hCG) and Leutinizing hormone (LH) on the yield of oocytes after the culture of the preantral follicles for 20 days was made. Ovine preantral follicles of 200-400 µm size were isolated from slaughter house derived ovaries by micro dissection method. The preantral follicles were cultured in base medium containing TCM 199 supplemented with Sodium pyruvate (0.23mM), Hypoxanthine, ITS(1%), Non essential amino acids, epidermal growth factor (50ng/ml), human recombinant Follicle stimulating hormone (50mIU/ml), Fetal bovine serum(10%) and Gentamicin(50µg/ml). The ovine preantral follicles were randomly distributed to three groups. Group 1 (control: only base medium), Group 2 (LH 10 mIU/ml starting from day 10 of culture) and Group 3: (LH, 10 mIU/ml starting from day 10 of culture + hCG, 9 IU/ml of culture medium on day 18 of culture). The follicles of all the groups were cultured in vitro at 38.5^{0}C, 95% relative humidity and 5% carbon di oxide in air in the Co2 incubator for 20 days. Every alternate day the culture medium was replaced with a fresh medium for in vitro culture. The mean size (diameter) (mean ± SEM) of the preantral follicles isolated from the Group I preantral follicles was 285.7± 3.51 µm, 339.2 ± 3.46 µm and 385.6 ± 3.43 µm on day 0, day 10 and day 20, respectively. The corresponding values for the Group 2 were 268.7± 2.51 µm , 317.2 ± 2.46 µm and 364.2 ± 2.46 µm, respectively and the corresponding values for the Group 3 were 288.2± 2.44 µm , 339.0 ± 2.38 µm and 385.9 ± 2.35 µm, respectively Only 15% and 16% of ovine preantral follicles could yield oocytes from the first and second group, respectively. Whereas from the third group of the experiment a significantly higher ($P<0.05$) percentage i.e 87% of preantral follicles yielded oocytes by 20 days of in vitro culture. It is concluded that the addition of LH is sufficient for the effective oocyte production from the ovine preantral follicles and there is no further benefit of adding hCG to the culture medium.

Key words: Sheep, preantral follicle, oocyte, human chorionic gonadotrophin, Leutinizing hormone)

TS1-PP-24

Sex-specific ovine embryo production *in vitro* using varied sperm processing methods for gender pre-selection during fertilization

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ABSTRACT

The desired sex offspring production is the main impediment for a successful and sustainable livestock industry. Sperm sorting is the current emphasis and available option; however, sorting methods reduce fertility and require further validation. Various sperm processing methods exhibit differences in recovery rates, motility, morphology, and DNA integrity. The two primary sperm processing methods used for *in vitro* embryo production are density-gradient centrifugation (DGC) and swim-up. Density-gradient centrifugation separates spermatozoa based on chromosomal packing, while the swim-up isolates highly motile sperm. Based on the differences in the sperm recovery, the present study was to elucidate the sex ratio and developmental potential of embryos produced *in vitro* using the sperms processed with standard Percoll density gradients (45/90% and 45/80%), mini Percoll (45/80%) and swim-up methods. Majority of the embryos generated from the semen processed with standard Percoll gradients were significantly (Pd”0.05) biased towards female as compared to mini Percoll and swim-up methods, which generated a significantly (Pd”0.05) higher percentage of male embryos. The developmental potential of embryos (cleavage to blastocyst) varied across the methods, with significantly (Pd”0.05) higher percentage generated by the semen processed with standard 45/80% Percoll gradient and swim-up methods than those processed with 45/90% Percoll and mini Percoll. However, the developmental rate to blastocyst stage was faster in the semen processed with swim-up and mini Percoll methods concluded that, the male embryos exhibit a faster growth rate than the female in *in vitro* culture condition.

Keywords: Sex ratio, ovine embryos, sperm processing, Percoll, mini Percoll, swim-up

TS1-PP-25

Embryos produced from cloned bull semen exhibit normal expression of growth-related genes

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ABSTRACT

Cloning possesses the potential for the rapid multiplication of valuable farm animals, including buffaloes. As buffalo sires have a major contribution to breeding programs, cloning of bulls could facilitate the rapid dissemination of superior traits within the population. However, studies pertaining to the fertility status of cloned bulls semen are limited. The present study was conducted to evaluate the in vitro embryo production efficiency of cloned bulls semen and expression of growth-related genes in the resultant embryos. The results were compared with those of their respective somatic cell donor bulls. For IVF, immature oocytes were matured in vitro for 24 h in a humidified CO_2 incubator (5% CO_2 in air; RH>95%) at 38.5°C. After 24 h, mature oocytes were co-incubated with processed semen in fertilization Bracket and Oliphant (BO) medium for 18 h. The presumptive zygotes were then cultured in Research Vitro Cleavage medium (RVCL; Cook, Australia) for up to 8 days. The cleavage and blastocyst rates for cloned bulls semen was similar to that of the donor bulls. Furthermore, the expression of growth-related genes (*IGF2* and *IGF2R*) was assessed in blastocysts produced in both groups. The expression of *IGF2* (0.77 ± 0.06 in cloned group vs 1.00 ± 0.00 in donor group) and *IGF2R* (0.91 ± 0.06 in cloned group vs 1.00 ± 0.00 in donor group) was also similar ($P<0.05$) between the blastocyst produced from cloned bulls semen and donor bulls semen. Thus, it can be concluded that the fertility of cloned bulls is comparable to their donor bulls with produced blastocyst having normal growth rates.

Key words: Buffalo, Semen, IVF, blastocyst

TS1-PP-26

Buffalo cloning: A new strategy for future breeding

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ABSTRACT

In India, due to a severe shortage of elite bulls, semen available from progeny-tested bulls covers a limited breedable population of buffalo. Animal cloning has proved to be beneficial in making the same genetic copies in the shortest possible time to meet the target of providing elite breeding bulls. ICAR-National Dairy Research Institute, Karnal has produced eight cloned breeding bulls, of which four breeding bulls were used to demonstrate the fertility of cloned bulls. The semen parameters such as volume, sperm concentration, mass motility, progressive motility, and acrosome integrity in cloned and non-cloned bull's semen had no significant ($P<0.05$) difference. Post-thaw motility was also similar to non-cloned bulls or their parents. When these spermatozoa were subjected to a transcriptomics and miRNAs study, the NGS data revealed that the expression pattern of some important transcripts and miRNAs associated with spermatogenesis, sperm motility, sperm capacitation, bull fertility, and early embryonic development was almost similar in cloned bulls spermatozoa and parent bulls spermatozoa. When cloned bull semen was used for IVF, it was observed that early embryonic developmental competence was similar to non-cloned bulls. To determine the fertility of cloned bulls, female buffaloes were inseminated with the semen of cloned bulls. Following insemination, the conception rate was achieved, which was normal in buffaloes. Several male and female healthy calves have been produced and further attempts are ongoing to produce more calves. These calves are physiologically normal, growing well and healthy. In conclusion, with this limited study, we can say that the semen produced by cloned bulls is similar to that of non-cloned bulls as well as parent bulls, which can be further used in various assisted reproductive technologies and in sustainable milk production.

Keywords: Cloned buffalo, Semen, Transcriptome, miRNA, Fertility.

TS1-PP-27

Evaluation of web module about Dairy farming by multistakeholders in Karnataka

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ABSTRACT

Dairy farming is a significant livestock rearing practices for livelihood security and entrepreneurship development in India. However, it is necessary to provide timely and credible information to farming community to practice scientific dairy farming. Among different methods of disseminating scientific information and technologies, digital tools like web modules have become very popular in the present context. The present study of developing and evaluating a web module was carried out in four administrative divisions of Karnataka. One district from each administrative division was purposively selected due to presence of veterinary colleges in each of these districts. Purposive sampling and random sampling method was followed to select 25 dairy farmers rearing dairy cattle / buffalo and possessing an android smart phone, 10 veterinary officers, 5 KMF officials, 10 University scientists from each district making a final sample size of 200 respondents in Karnataka. Evaluation of the developed Kannada web module in dairying was studied under four different components viz. technical, utility, information and user attribute component. The study revealed that dairy farmers perceived and preferred highest user attributes component (99.00 %), while veterinary officers perceived highest Information component (97.90%). Further, among University Scientists, 96.56 per cent perceived highest Utility component, while KMF officials recorded 97.78 per cent for User attributes component. Operational difficulties and inadequate service were the constraints faced by farmers and university scientists respectively in utilization of web modules while, inadequate technical knowledge/ skill was the constraint faced by majority of veterinary officers and KMF officials. Majority of the respondents appreciated the website and opined that the developed web module can be a firsthand information source for multi-stakeholders. The website would be helpful in disseminating the credible information and facilitate dairy farmers in implementing scientific dairy farming practices and strengthen their income by increasing production and productivity.

Keywords: Dairy farming, Economy, Karnataka, Multistakeholders and Web module

TS1-PP-28

Investigations into Epidemiology and Diagnosis of Lumpy Skin Disease in Karnataka

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ABSTRACT

The Lumpy skin disease (LSD) a notifiable, exotic, vector borne transboundary disease caused by LSD virus affects cattle and buffaloes. Disease is characterised by fever, oro-nasal, lachrymal secretions, enlarged lymph nodes, anorexia, dysgalactia, depression, disinclination to move. The disease is transmitted mechanically by blood sucking arthropod vectors, mainly during rainy season and summer which coincides with the peak vector density. LSD was reported from all 30 districts of Karnataka. Highest morbidity and CFR were recorded in Belgaum division. Vectors found on LSD suspected animals were; flies (46%), ticks (13%), flies and ticks (34%) and others population (7%). Viral DNA was isolated from vectors implicating their role in transmission. Both crossbred and native zebu cattle were susceptible. The incidence was more in 2 to 4 years old animals. Common communal points had only four per cent influence on the incidence of LSD. Incidence was more in pre-existing animals (87 %) than newly introduced ones (13%). Outbreaks were more in rainy and summer season. Decrease in milk yield in lactating animals and draught capacity in bullocks was noticed. Of 372 samples subjected for partial P32 gene-based PCR, 299 clinical samples and all 35 necropsy samples found positive, with an overall positivity rate of 89.78 %. Among the various clinical materials, Nasal /ocular / rectal swabs were preferred for the PCR detection of LSDV-DNA. Virus isolated using primary cell culture and cell lines, identified by PCR and Transmission electron microscopy. P32 gene sequences were submitted to GenBank. Phylogenetic analysis revealed isolates from different geographical regions having 100 % nucleotide homology. Dot blot assay was standardized for serological diagnosis of LSD, 137 sera samples subjected to dot blot assay and only nine animals' sera were negative with a sensitivity of 93.4 per cent, which were otherwise positive by PCR.

Key words: Karnataka, Lumpy Skin Disease, PCR,P32 gene, Transmission Electron Microscopy.

TS1-PP-29

Surgical management of metacarpal and metatarsal fractures - A study of eight goats

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ABSTRACT

Goats are agile creatures, if frightened, they may attempt to jump that might results in fractures or other injuries. Metacarpal and metatarsal bone fractures are most common fractures in goats. Totally 8 cases were presented with history of automobile accident and non-weight bearing lameness of affected limb. Clinical examinations revealed swelling at the affected bones, open wound and protruding fractured fragments were noticed in all goats. Based on the history and clinical examination, cases were diagnosed as metatarsal bone and metatarsal fractures. The animals with fractures were immobilized by external skeletal fixators using epoxy under sedation and local infiltration of 2 % lignocaine hydrochloride. seven animals showed gradual weight bearing on the affected limb on 3rd post operative day and one goat succumbed to death because of necrosis and toxaemia after a week. It is concluded that application of external fixation using epoxy for distal limb fracture with open wound could result in effective immobilization and early ambulation.

Key words: Metacarpal, Metatarsal, Goat, Epoxy, External fixation

TS1-PP-30

Incidence and management of esophageal obstruction - A clinical study of 11 cattle

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ABSTRACT

The study reports types, causes and clinical findings of oesophageal choke and different methods of foreign body retrieval eleven cattle. A total of 11 cattle suffering from oesophageal obstruction were presented over a period of two years. Out of these 11 animals, 6 were aged less than three years. Obstruction at the cranial cervical portion was more frequent (08 animals) than caudal cervical and thoracic region. Oesophageal obstruction was treated either conservatively or surgically. A conservative treatment in 6 animals was either manual retrieved (4 cases) or pushed into rumen (2 cases). Manual retrieval was better option for cranial cervical oesophageal obstructions. Surgical treatment i.e., Oesophagostomy was comparatively better option for mid to caudal cervical oesophageal obstruction (5cases). For cervical Oesophagostomy, standing method under sedation and local analgesia was a better method. 10 cattle were recovered uneventfully and of the one animal with oesophageal rupture, had complications of local cellulitis, infection and responded to treatment. In conclusion, early diagnosis, proper application of conservative or surgical interventions and post-operative follow up are the fundamental factors for successful outcome of oesophageal obstruction in cattle.

Key words: Choke, Cervical, Rupture, Cattle

TS1-PP-31

Surgical treatment of hernia in ruminants – A review of 31 cases

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ABSTRACT

This study was conducted on thirty-one clinical cases to determine the prevalence of external hernias in ruminants (6 sheep, 5 goat, and 20 cattle) for a period of 7 years. These animals had abdominal (cattle - 4, goat – 3, sheep - 2), umbilical (cattle -16), inguinal (sheep – 2, goat – 2) and scrotal (sheep - 2) hernias. The histories of the cases indicated that the hernias were noticed at 3 days to up to month before presentation to the veterinary dispensary. The four rams, two ewes, two buck, three doe and cattle were four males and sixteen females. The animals were placed on a dorsal position for umbilical, Dorso-lateral position for inguinal, scrotal and ventrolateral hernias. simple and small hernia (umbilical and scrotal hernia) are treated by suturing the edges of ring by absorbable suture (Herniorrhaphy), but in case of large hernia (traumatic ventral hernia) are treated with polypropylene mesh (Hernioplasty) under sedation using the mixture of inj Xylazine Hydrochloride @ 0.01 mg/kg, inj Butorphenol @ 0.02 mg per kg inj Ketamine @ 0.04 mg per kg IM along with local infiltration of 2 % lignocaine hydrochloride at the site of the incision or circular infiltration around the base of the swelling. In conclusion, this study described the clinical and surgical findings, which include the size of the hernial rings, the reducibility of the contents, the condition of the peritoneum, suture patterns and materials used. The present study confirmed that the umbilical hernia usually seen more in females.

Key words: Hernia, Herniorrhaphy, Hernioplasty, Ketamine

TS2-LP-01

Sustainable Poultry Production in India

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Introduction

Poultry is one of the most important and fastest-growing sectors of Animal agriculture sectors in India. The poultry sector majorly maintains the requirements of protein and nutrition. India today is one of the largest producers of eggs and broiler meat. The poultry industry in India has endured an exemplary transformation in structure and operation during the last two decades and modified into a mega-industry with the presence of a huge number of workers from a mere backward poultry farming that appears to be very fast. When we see the complete overview, the production of crops has been growing at a rate of 1.5-2% per annum whereas the production of eggs and broilers has been growing at a rate of 8-10% per annum. India is the world's 2nd largest egg producer and 4th largest producer of broilers. The Indian poultry market, comprising of broilers and eggs was worth INR 1,750 billion in 2018 and INR 2099 billion in 2022-23. The market is further projected to reach INR 4,340 billion by 2032, growing at a CAGR of 16.2% during 2019-2024.

India's poultry sector: big, growing and increasingly organized

India is the Second-largest egg producer in the world (after China) and the fifth-largest chicken producer in the world. In India, the per capita availability of eggs has gone up 103 eggs per annum in 2024 and the consumption of chicken meat increased from 400 grams per annum to 3.1 kg per annum in 2020-21. The adult population in most developed countries consumes over 240 eggs and 20 kg of chicken per annum. Human nutritionists recommend a minimum of 180 eggs and 10 kg chicken per annum, which means that the Indian poultry market is laden with opportunities for growth. The egg production in the country is growing at the rate (CAGR) 6.87% per annum.

Poultry is the most organized animal agriculture sector in India, worth €14.5 billion. Almost every farmer (mostly small) has been integrated along the value chain. Production of broiler meat is 5.2 million tons per annum during 2020-21. Demand for processed chicken meat has been growing by 15-20% per annum. Total layer production in India has gone up to reach 142.77 million eggs per annum during 2024., feed consumption during this period was 39.3 million tons, which includes corn and soya bean and pearl millet.

Eggs and chicken were classified as "agriculture products" a few years ago, but are considered as "food items" today. This is one of the signs that safe food has become a priority. Besides maintaining production efficiency, the producer has to concentrate on the nutritive values, adulterants and contaminants of his or her produce. The central Ministry of Food Processing Industries (MoFPI) and food inspection authorities at the local levels have started keeping track of eggs and chicken production in India for quality and nutrients.

Basic structure of Poultry Sector

Poultry sector in India is valued over Rs. 2,30,000 crores broadly divided into two sub-sectors – one with a highly organized commercial sector with about 80.49% of the total market share and the other being unorganized with about 19.50% of the total market share. The unorganized sector also referred to as backyard poultry plays a key role in supplementary income generation and family nutrition to the poorest of the poor. It is estimated that with a poultry population of 851 million, small and medium farmers are mostly engaged in contract farming system under larger integrators and there are around 30 million farmers engaged in backyard poultry as per NSSO 66th Round Survey. The needs of organized and unorganized sectors are very different. Discussions with various stakeholders reveal that poultry sector- especially commercial poultry sector- is flourishing in certain pockets, where amenable environment exists, along-with backward and forward linkages while the unorganized sector is very dispersed and micro-fragmented.

Organized sub-sector needs conducive environment to grow for which policy support & intervention is required mainly for disease surveillance, Drug residue and drug/ vaccine quality control, standardization & quality control of poultry feed, eggs & meat, Application of HACCP (Hazard Analysis and Critical Control Point) and Good Manufacturing Practices for compliance to WTO & CODEX norms and gradation, value addition, brand promotion & export boosting. Poultry exports reached ₹ 1,081 crore (approximately $130 million USD) in FY 2022-23, a 100% increase from the previous year, driven by increased demand and strategic partnerships. We aim for ₹ 1,200-1,400 crore (approximately $145-$170 million USD) this fiscal year through improved processing plant infrastructure, higher quality and hygiene standards (Halal, ISO), and stronger global distribution networks. Oman, Sri Lanka, Japan, and Qatar are leading importers. Expansion targets Southeast Asia and the Middle East, focusing on high-value products and using targeted marketing and trade show participation.

The above issues are broadly dealt with by a number of Ministries/ agencies like Export Inspection Council of India, Agricultural and Processed Food Products Export Development Authority (APEDA), Ministry of Food Processing Industries, Food Safety and Standards Authority of India (FSSAI), Bureau of Indian Standards (BIS) etc. Besides, National Institute of Animal Health under Animal Husbandry Department is dealing with quality control of vaccines and the 'The Prevention and Control of Infectious and Contagious Diseases in Animals Act, 2009' is the key regulation to control important livestock and poultry diseases in the country. Compartmentalization for disease control as per OIE Standards is an important issue being dealt with by Ministry of Fisheries, Animal Husbandry and Dairying, Govt. of India to facilitate smooth trade.

Unorganized sub-sector generates additional income and improvement of nutritional status among the poorest of the poor. However, until now there has been little support to this sector. Now however through one of the components 'Rural Backyard Poultry Development' under Centrally Sponsored Scheme 'Poultry Development' assistance is provided for to cover beneficiaries from BPL families. But this continues to be very little as compared to the demand.

A part of the unorganized sector is the **Transitional Small & Marginal sub-sector:** Due to Government initiatives for entrepreneurship development, small/ marginal units are now coming up. However, these can sustain only if they operate in a clustered manner.

Producing for the domestic market

Poultry production has three segments: Layers, broilers, and backyard or family production (both eggs and chicken). Some 70% of the layer birds are being raised in the states of Andhra Pradesh, Telangana, Tamil Nadu, Karnataka and Maharashtra in the south and Haryana in the north of India. Feed (65%) and chicks (25%) account for 90% of the broiler inputs and consolidation is being observed in the market. Smaller producers increasingly engage in 'contract farming'.

At one time, 30% of the eggs produced in India were produced in backyards. Improved varieties of 'Low technology input birds', which are dual purpose, *i.e.*, producing eggs and meat, are new being bred in India for the purpose of backyard/family production. The final food products, i.e., eggs and chicken are not exported in huge quantities as there is a huge gap in supply and demand within India. Between the start of the 21st century and 2050, the consumption of protein from animal sources in India is expected to increase by 94%.

Poultry production in India largely takes place in cage systems. During Poultry India 2019, the NBSO and Embassy invited experts to talk about housing systems and animal welfare. Attendants indicated that different housing systems require investments and training, which can be difficult to earn back in the current market.

Global production and Indian perspective

Global Poultry Meat Production is around 107 MMT; Trade/Exports are around 11 MMT i.e around 10% of total production. India, though ranks 5th in chicken meat production, is having only 3.3% share of the production and exports are negligible at only about 5.5 thousand tones.

Global Egg production is around 1387 billion eggs / 74 MMT; Trade around 10% i.e. 7 MMT. India, again even if it stands at 2nd position in egg production, only has about 6.3% share in the global production. Exports are again very negligible with about less than a billion eggs/

Major items exported from India are table eggs, egg powder, hatching eggs, SPF eggs, live birds, and poultry meat. However, India is way behind in exports at 32nd place as per APEDA data. India's share in World trade is around 0.23 percent.

The egg production in the country has increased from around 83 billion nos. in 2015-16 to around 144.77 billion in 2023-24 registering a growth of about 6.87%. The per capita availability of egg has increased from 61 in 2013-14 to 103 in 2023-24.

The poultry meat production in the country has increased to nearly 5.2 million tons during the year 2023-24 from 3.26 million tonnes during the year 2015-16 again at around 6% growth rate.

Growth Drivers and Emerging Trends

The commercialization of the Indian poultry industry over the past decades has involved sizeable investments in poultry breeding, hatching, rearing, and processing. Indian farmers have moved from rearing non-descript birds to rearing newly developed hybrids like shaver, Babcock, hyaline which ensure more rapid growth, good livability, excellent FCR, and high profits. Other factors that are

responsible for the rapid growth of the poultry sector are initiatives of private enterprises, fewer government interventions, and very considerable indigenous poultry genetics capabilities and support from the complementary veterinary health, poultry feed, poultry equipment, and poultry processing sectors. Apart from this, India is one of the few countries in the world that has put into place a sustained Specific Pathogen Free (SPF) egg production project. Some other factors are: –

i. In India, poultry sector growth may be attributed to many factors like rising incomes and a rapidly expanding middle class, together with the emergence of vertically integrated poultry producers that have reduced consumer prices by lowering production and marketing costs.

ii. Integrated production, market transition from live birds to chilled and frozen products, and policies that ensure supplies of competitively priced corn and soybean are keys to future poultry industry growth in India. Further, disease surveillance, monitoring and control will also decide the fate of this sector.

iii. Concurrently, India's unorganised and backyard poultry sector is also one of the potent tools for subsidiary income generation for many landless/ marginal farmers and also provides nutritional security to the rural poor.

iv. These achievements and growth rates are still being sustained despite the ingress of avian influenza which was a severe setback for the industry, showing the resilience of the subsector, perseverance of the private sector and timely intervention by the Government.

v. To assess the future trends, we have to review the past planning and present scenario to extrapolate the future. The externalities and variables are often unprecedented and sudden.

vi. Newer Challenges posed: Along-with challenges posed by emerging and re-emerging diseases, there are issues of animal welfare, consumer and NGO driven demands, AMR issues, environmental impact etc. which need to be addressed.

Challenges

1. A significant difference in the industry across various regions of India: – more than 60% of broilers are produced in these 5 states of India (Andhra Pradesh with 20%, Karnataka, Maharashtra, Punjab, and West Bengal) while more than 60% of eggs are produced in these 5 states of India (Andhra Pradesh, Haryana, Maharashtra, Punjab, and Tamil Nadu). This creates logistic and quality issues related to transport.

2. Competition from the international market: On opening up duty-free imports, lifting of trade barriers, etc.

3. Disease outbreaks: Fowl pox, Fowl cholera, Avian influenza, *E. coli* infections, etc.

4. Feed ingredients and other logistics cost: Small-scale producers are facing problems like high feed and transport costs, expensive vaccine costs, veterinary care services, and the non-availability of credit. It has been noticed that due to high capital investments some farmers have been switched from layer production to broiler production as output in broiler units can be fetched in six weeks.

5. Antibiotic misuse in poultry farms: It is leading to multi-drug resistance properties in bacteria (because of unsafe disposal of poultry litter).
6. Lack of insufficient biosecurity standards taken by poultry keepers.
7. Presence of Salmonella spp. and Cholesterol in poultry meat.
8. Noticeable price fluctuations.

Way forward

1. Going for regionalization and recognizing more compartments as per OIE guidelines for exports
2. Recent evaluation of Performance of Veterinary Services would further help us in improving sanitary aspects
3. The exercise with industry on Agri-Export Policy is going on and it is believed that it will help improve our trade position substantially.
4. India should look forward to increasing Scope for exports through value added products like whole egg powder, brined and pickled eggs, egg roll, egg cutlet, egg crepe and waffles, albumen flakes/ rings, yolk powder, cured and smoked chicken, chicken patties, nuggets, kababs, meat spreads, marinated breast fillet, hot-dogs, frankfurters etc.
5. Encourage brand development for certain indigenous poultry like Kadaknath or other birds with some specific attributes. Low cholesterol and Omega-3 rich designer eggs are already in vogue in private sector.
6. Intensify education and awareness about nutritive value of eggs and poultry through various platforms like World Egg Day etc.
7. Intensify skill development in the poultry sector and reduce the gap.
8. Develop Marketing Intelligence domestically and internationally in collaboration with ICAR and other Department/ agencies.
9. Online food delivery is booming, projected to grow at 25% CAGR over 5 years. Mobile app usage and online ordering are key drivers of this growth.
10. Businesses use analytics to understand consumer behavior and tailor products. Data reveals food preferences, dietary trends, and regional cuisine popularity.
11. Precision farming and IoT boost efficiency and reduce waste. This leads to better crop yields and more sustainable farming practices.
12. Blockchain enhances supply chain transparency and traceability, ensuring food quality and origin.
13. Automated systems are streamlining food processing, leading to faster times, lower costs, and improved quality.

Future Prospects

1. India's poultry industry is poised for continued growth, fueled by a dynamic interplay of economic factors, evolving consumer preferences, and cutting-edge technological advancements.
2. By addressing challenges and seizing opportunities, the industry is well-positioned for a prosperous future.
3. Ensuring its sustainability and success for years to come.

2030 Vision: A Thriving Poultry Ecosystem

1. By 2030, Indian poultry farms will leverage AI and IoT for optimal production and resource management.
2. The market will offer a wide array of specialized poultry products catering to diverse consumer preferences.
3. Small-scale farmers will benefit from technology and market access, driving rural economic growth.

TS2-LP-02

Optimization of poultry health - Way forward

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Poultry meat and eggs are now the leading global source of protein for humans and demand is predicted to increase more in the coming decades. The modern poultry industry aims at high production and better quality at a low cost. In the future several challenges and problems, in addition to the ones already existing, will face everybody involved in the production chain. These will include: strong global competition; changes in social, political and consumer perceptions in regard to food safety and animal welfare; increase of environmental protection issues; a steady increase in the cost of feed; the emergence of new and unforeseen diseases, and; new legislation that will serve to regulate the related issues.

Disease control is clearly crucial to the health, welfare and economics of modern poultry production. The emergence of new diseases and the re emergence of recognized diseases are familiar events in the history of poultry medicine. Some of these emerging diseases could have been present earlier but were not recognized because of low prevalence, mild signs and lesions, lack of diagnostic techniques, or misdiagnosis. In other situations, genetic changes in infectious agents could have rendered them more virulent or pathogenic. Similarly, genetic changes in the bird could have altered its susceptibility and resistance to disease. In addition, changes in environmental conditions or management could result in conditions that are favorable for an infectious agent to express pathogenic properties. Because of the global activities of the poultry industry, resulting in the continual movement of personnel, live birds, eggs, and poultry products across political borders, it is difficult to contain an emerging or re emerging disease to a country or a continent. Hence, it is necessary to maintain a vigilant attitude toward poultry health and to sustain capable diagnostic facilities. Optimization of disease preventive measures to reduce the disease risk in poultry production is essential. Current disease status, importance to flock health and profitability and efforts needed to control diseases are presented in the Table 1.

Breakthrough infections

Control of infectious diseases is essential for the production of healthy poultry flocks, and this is generally achieved by extensive vaccination programs in combination with good management practices, including biosecurity measures to reduce the risk of infection. The success of vaccination programs depends on the ability of the birds to mount a vigorous immune response after vaccination. Despite the widespread use of vaccines against several diseases, vaccination failures are occurring in recent years. *Breakthrough infection* is defined as the development of an infection with an organism resistant to prophylaxis. An infection of a completely vaccinated bird is called a vaccine breakthrough infection. Breakthrough infections can occur for a variety of reasons, including immunosuppression, vaccine failures and immune escape. In spite of vaccination and the presence of a satisfactory antibody level, it has been observed that in some instances breakthrough infections occur due to mutations that result in altered antigenicity, accompanied by failure of antigen recognition by neutralizing antibody. The emergence of new strains in the field has been suggested as one of the main causes of vaccination failure, resulting in new threats and greater losses to the poultry industry.

IBV has the ability to mutate or change its genetic makeup either by mutation or recombination. As a result, many serotypes/genetic varients have been identified world over. IBV strains vary significantly from country to country as well as from region to region. IBV varients such as nephropathogenic, QX strains and Indian varients are circulating in India. Currently, a combination of Massachusetts (mass) and nephropathogenic vaccine (attenuated and inactivated) are being used to control IB in India. Despite the wide use of vaccination the disease still occurs at high frequency.

Despite highly effective vaccines, Marek's disease (MD) causes great economic loss to the poultry industry annually, largely due to the continuous emergence of new MD virus (MDV) strains. The continuous evolution of MDV is the main factor leading to vaccine immunity failure. MD vaccines consist of viruses of three different serotypes: MDV-1 (CVI988), MDV-2 (SB1 and 301B/1) and MDV-3 (HVT FC126). After the emergence of vv and very virulent plus (vv+) MDV field strains, serotype 1 vaccine (CVI988) became the vaccine of choice worldwide because of superior protection and is now considered the "gold standard" of MD vaccines.

Although intensive vaccination programs have been implemented in India, genotype VII and XIII NDV outbreaks and sporadic cases occur, even in vaccinated farms. Current NDV vaccines consist of live and inactivated genotype I and/or II NDV (F1, B1, LaSota, R2B and ND Killed). These classical vaccines may prevent the clinical outbreaks but not the shedding of genotype VII/XIII viruses allowing build-up of infection which precipitate in the form of outbreak whenever the susceptible flock is available. Repeated outbreaks of virulent NDV among vaccinated chickens indicate the need to revise the NDV vaccination strategy. Furthermore, several underlying factors may have contributed to vaccination failure such as the presence of immunosuppressive diseases as well as poor cross immunity between the vaccines and field challenge virus strains. In addition, recent studies have shown that genotype-matched vaccines provide better protection against challenge with the virulent genotype VII and XIII NDV and significantly reduce virus shedding and transmission compared to the LaSota vaccine.

Immunosuppression increase the risk of Breakthrough infections. There are various factors, infectious and noninfectious, causing immunosuppression in chickens. Most common viral diseases that induce immunosuppression in chickens are Marek's disease virus, chicken anemia virus (CAV) and infectious bursal disease virus. MDV-induced immunosuppression affects both humoral and cellular immune responses. The interaction and coinfection of IBDV, CAV and MDV can cause more severe immunosuppression. A proper control of IBDV is a must to have proper humoral immune responses needed to control CAV and other pathogens including ND, IB etc. Environmental factors, including management errors and mycotoxins, can also result in immunosuppression.

Vaccine failure in young chicks may be due to the presence of maternal antibody which prevents adequate response to vaccination. These circulating antibodies in the young chicks may neutralize or remove the antigen before it can induce an immune response. Typically, virulent infectious agents are capable of breaking through maternal immunity earlier than modified live or killed vaccines. Vulnerability occurs between the time that young chicks wane their maternal antibody and before they develop their own active immune responses.

Gut Health

The gut not only absorbs nutrients; it is also an important part of the immune system. The gut barrier protects the host from toxins and microorganisms. However, if damaged, especially early in life, birds can have compromised growth and disease susceptibility throughout the production period," Gut health is an important component of bird health and productivity. Even subtle non-specific changes to gut health and physiology can have a significant bearing on flock health and performance. It is important for the clinician to have a very good understanding of normal gut morphology and physiology in order to detect mild pathological changes or altered intestinal contents. Coccidiosis in broilers, layer and breeders appears to be one of the principal destabilizing agents, causing the destruction of enterocytes and affecting the integrity of the intestinal mucosa and wall. The lesions that it causes, the inflammatory process, the reduced absorption and consequent excess of nutrients in the lumen, all contribute to the proliferation of certain groups of bacteria, in particular colonization by *Salmonella* spp, *Escherichia coli* and *Clostridium perfringens*. This situation clearly predisposes birds to intestinal dysbiosis and/or bacterial enteritis and in particular a process of necrotic enteritis. When the overgrowth of C. perfringens causes necrotic enteritis, this further aggravates the damage to the mucosa and intestinal functioning, resulting in worse feed conversion rates and performance, and can cause high mortality rates. The toxins produced by *C. perfringens* also damage the intestinal wall. In general, it occurs in broiler chickens of 2-6 weeks of age. In sub clinical forms, it is characterized by impaired digestion. Clinical forms lead to severe problems and increased flock mortality in a very short time. The occurrence of Necrotic enteritis is on the rise, one reason is the voluntary or legally required reduction of antibiotics in animal production.

Coccidiosis treatments for prevention are therefore essential for optimal intestinal health. Any method of disease control must always be accompanied by the most appropriate hygiene and management conditions. The use of vaccines has also been shown to be highly effective for the development of immunity to the parasite. Live Coccidia vaccines with multiple Eimeria species are authorized to use in India.

Foodborne and zoonotic diseases

Consumer perspectives on the quality and safety of poultry products are a continuous issue for the poultry industry and its strategic future. Many foodborne diseases can be transferred through the food chain. In the available literature, Salmonella serovars (*S typhimurium and S enteritidis*) and *Campylobacter spp*. are the poultry bacteria more often responsible for human foodborne diseases. In addition, public health concerns on the development of resistant bacteria due to the abuse of antibiotics as growth promoters and drugs are emerging public health challenges. Controlling zoonotic diseases and foodborne pathogens involves a deep understanding of how microbial pathogens invade and colonize, as well as the circumstances that encourage or stop growth for each strain of organism.

Antibiotic Resistance and Related Problems

Animal welfare and food safety are going to be the future challenges and will be the integral part of poultry industry as well as responsibility. The industry has accepted the responsibility and is very positive in implementing antibiotic free chicken production to reduce antibiotic resistance in humans before statutory ban. Use of AGPs and therapeutic antibiotics favors emergence of resistant bacteria in poultry. Resistant bacteria can get transferred to humans through food. Antibiotic residues in poultry products

pass on through food and lead to resistance in bacteria present in humans. Humans are also exposed through environment and direct contact. Soil and water from poultry farm waste having antibiotic residues and resistant bacteria entering into environment, direct contact at poultry farms, slaughter houses, wet market etc affect human being. Fortunately, alternatives to AGPs have become more refined with specific mode of action. Issues of gut health need to be taken care in absence of AGPs. Reduction in therapeutic antibiotics need to be tackle through quality chicks, quality feed, quality management, good biosecurity and targeted vaccination program. Implementation of animal welfare guidelines and production of antibiotic free chicken products will have drastic impact on the disease scenario.

Biosecurity

Poultry medicine focuses on prevention through biosecurity, vaccination, medication, and harmonizing the environment. Each disease control strategy requires a financial investment with an expectation of a financial return on investment. The function of a health program is not necessarily to eradicate or completely eliminate a disease, but to find a level that will optimize return on investment. Biosecurity encompasses procedures that reduce the probability of disease outbreaks and includes two components: a) bioexclusion prior to an outbreak (keeping pathogens out) and b) biocontainment after an outbreak (keeping pathogens from leaving an infected flock to prevent disease transmission). Biosecurity is critical from start to finish of a flock and should be in place on every farm. Farms with poor biosecurity are vulnerable to diseases, which have the potential to ruin an entire flock. In recent years, the number of backyard poultry has been on the rise in India. Biosecurity practices are highly variable among flocks. Pathogen spillover events between backyard chickens and wild birds are becoming more commonly reported. Backyard flocks are implicated in maintaining of two critically important RNA viruses, NDV and HPAIV. This is largely due to essential differences in the biosecurity of backyard flocks and commercial flocks. For instance, while the commercial industry practices high containment and mass immunization against NDV, only 3% to 10% of backyard flocks are immunized for common poultry pathogens. Backyard flocks are also often subject to little to no biosecurity regulations, where biosecurity protocols and vaccination serve as the essential management practices that mitigate the transfer of infectious agents into and from the flock.

Industry and the government coordination

India does not have national policy for control of most poultry diseases except for HPAI. There should be better coordination between industry and the government in surveillance to identify the prevailing pathogens and their variants for making available needy vaccines and upgrading existing vaccines. Without involvement of government, control of diseases like HPAI, LPAI, ILT, etc., seem impossible. In the context of poultry health and disease control, the government also put in place competent field and veterinary laboratory capacity for the diagnosis of poultry diseases. There is a strong need for close collaboration between the public and private sectors in achieving this important goal.

Table 1: Current disease status, importance to flock health and profitability and efforts needed to control diseases

Diseases	Status	Vaccine availability	Importance to flock health or profitability	Effort needed to control on farm
HPAI	Sporadic	Not authorized	High to very high	Significant
LPAI	Endemic	Killed	High to very high	Significant
IB	Endemic	Live, Killed	High	Significant
ND	Endemic	Live, Killed, rHVT	High	Significant
ILT	Endemic	Not authorized	Moderate to high	Significant
MD	Endemic	Serotype 2&3	Moderate to High	Significant
IBD	Endemic	Live, killed, IC, rHVT	Moderate to High	Moderate
Chicken Anemia	Endemic	Live, Killed	Moderate to high	Moderate
IBH	Endemic	Killed	Moderate	Moderate
AE	Endemic	Live, killed	Low	Low
Fowl Pox	Endemic	Live	Little	Little
EDS	Sporadic	Killed	Little	Little
APV	Not known	Not authorized	Moderate	Moderate
REO virus infection	Endemic	Live, Killed	Moderate	Moderate
Necrotic Enteritis	Endemic	None	Moderate to High	Moderate
Mycoplasmosis Significant (MG/MS)	Endemic		Live, Killed, rFowl Pox	High
Infectious Coryza	Endemic	Killed	Low to moderate	Little
Fowl Cholera	Endemic	Killed	Low to moderate	Little
E coli	Endemic	Not authorized	Moderate	Moderate
Salmonellosis	Endemic	Live, Killed	Moderate to high	Moderate
ORT	Not known	Not authorized	Low	Little
Coccidiosis	Endemic	Live	Moderate to High	Moderate

HPAI; Highly Pathogenic Avian Influenza; LPAI: Low Pathogenic Avian Influenza; IB:Infectious Bronchitis; ND: Newcastle Disease; ILT: Infectious Laryngotracheitis; MD: Marek's Disease; IBD: Infectious Bursal Disease; IBH: Inclusion Body Hepatitis; AE: Avian Encephalomyelitis; EDS: Egg Drop Syndrome; APV: Avian Pneumovirus; REO: Respiratory Enteric and Orphan virus infection; MG: Mycoplasma gallisepticum; MS: Mycoplasma synoviae; ORT: Ornithobacterium Rhinotracheale.

TS2-PP-01

Investigating environmental influences and spatiotemporal patterns of H5N1 Avian Influenza outbreaks in India using machine learning

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ABSTRACT

Avian Influenza (AI), caused by highly pathogenic strains of influenza viruses, represents a major threat to poultry and public health globally. This study provides a thorough analysis of the spatial and temporal patterns of HPAI outbreaks in India, using a multidisciplinary approach that combines geospatial analysis, machine learning modelling, remote sensing, and environmental risk factor evaluation. The resulting incidence map offers a clear visual representation, providing valuable insights into the distribution and concentration of HPAI outbreaks across the nation. The study reveals a peak in HPAI outbreaks during the winter and spring seasons. Key environmental factors, such as air temperature, enhanced vegetation index (EVI), leaf area index (LAI), potential evapotranspiration (PET), rainfall, specific humidity, and wind speed, are identified as significant predictors of HPAI risk. An ensemble method was employed, integrating high-performance random forest and classification tree models for HPAI risk assessment. The risk map generated, along with the estimated basic reproduction numbers (R_0), highlights that the southern and north-eastern regions of India are particularly vulnerable to HPAI. The findings offer a comprehensive perspective essential for effective surveillance, resource allocation planning, and policy development aimed at controlling the disease and protecting both avian and human populations from the threat of influenza outbreaks.

Key words: Avian Influenza, Machine Learning, $R_{0,}$ Environmental factors.

TS2-PP-02

Antimicrobial susceptibility testing and molecular detection of multidrug-resistant ESBL *E. coli* and *Klebsiella pneumoniae* in backyard poultry and associated environment

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ABSTRACT

The emergence of Extended-Spectrum Beta-Lactamase (ESBL)- *E. coli* and *Klebsiella* spp. in poultry can cause severe infections. A multistage random sampling was designed in two districts, four blocks covering 14 villages of Kolar and Mandya districts in Karnataka. A total of 168 samples comprised of cloacal swabs of poultry (n=79) and farm environment (soil and water) (n=89) were collected. ESBL *E. coli* and *Klebsiella pneumoniae* identified using standard bacteriological procedures. Antibiotic resistance was determined by disk diffusion and ThermoScientific Sensititre™ AST System using avian antibiotic panels as per CLSI (2024) breakpoints. Multiplex PCR was performed to detect *ESBL, Sul, Tet* and virulence genes (*TEM, SHV, OXA, CTX, AMPC*) in *E. coli* and *K. pneumoniae*. In poultry, ESBL *E. coli* and *ESBL K. pneumoniae* were found to be 27.8% (22/79) and 3.75% (3/79), respectively, while in farm environments, they were found to be 8.9% (8/89) and 16.9% (15/89), respectively. The phenotypic antibiogram of *E.coli* isolates (n=65) showed highest antibiotic resistance to Tetracycline 52.31% (34/65), followed by Ampicillin 27.69%(18/65), Nalidixic acid 26.15% (17/65), Amikacin 24.62% (16/65), Cefpodoxime 21.50%(14/65), and Enrofloxacin 20.00%(13/65) Trimethoprim- sulfamethoxazole16.92%(11/65), Cefotaxime, and Ceftriaxone 15.38% (10/65), Imipenem and Ceftazidime 10.77%(7/65), Aztreonam 7.69%(5/65), Amoxicillin-clavulanate 6.15%(4/65). MIC determination of poultry *E.coli* isolates (n=18) showed highest resistance to clindamycin (R>4ìg/ml) (n=17) followed by erythromycin (R>16ug/ml) (n=16), amoxycilin (R>16ug/ml) (n=9), tetracycline (R>8ug/ml) (n=9) and Trimethoprim/ Sulfamethoxazole (R>4/76ug/ml) (n=6). However, these isolates were sensitive to Ceftiofur, Enrofloxacin, Florfenicol, Chloramphenicol, Gentamicin, Spectinomycin, Streptomycin and Tylosin. *E. coli* (n=15) isolates from environment showed highest resistance to Tetracycline and Ampicillin at 53.33% (8/15) whereas *K. pneumoniae* (n=23) isolates from environment showed highest resistance to Ampicillin and Amoxicillin-clavulanate at 56.52% (13/23 each), followed by Cefoxitin 52.17% (12/23), Cefotaxime and Imipenem at 39.13% (9/23 each), Environmental isolates were sensitive to Amikacin, Cefpodoxime, and Enrofloxacin. In poultry, a multiplex PCR test revealed AMPC, TEM, SHV, and CTXM genes in 26 ESBL *E.coli* and four ESBL *K.pneumoniae* isolates, whereas in the environment, six ESBL *E. coli* and 18 ESBL *K. pneumoniae* isolates showed presence of these ARGs. These isolates also harboured other resistant and virulence genes such as *Sul, tet, stx1* and *stx2* in both poultry and in the environmental samples. The study has given significant understanding of the sharing of AMR phenotypes and ARGs among poultry and associated environment. Hence, strict hygienic and biosecurity measures should be in place to prevent the AMR transmission

Key words: AmpC, ESBL *E coli, Klebsiella*, poultry, one health

TS2-PP-03

Effect of crumble and mash form of broiler feed in Raja II coloured chicken

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ABSTRACT

PB1 male parental line day old chicks of Raja II coloured birds under AICRP on Poultry breeding, Veterinary College, Bengaluru were classified randomly into two groups with 285 chicks in one group and 345 in another group. The birds were reared under deep litter system in a common shed under similar managemental conditions. The broiler feed as per recommendations of ICAR-DPR in both crumble and mash form was obtained from Hygain Pvt. Ltd., Bengaluru and fed separately to two groups. Feed was given ad libitum. The body weight at day old and at 5th week was recorded for all the chicks. Total feed consumption, mortality rate till 5th week and causes of mortality were recorded. The body weight of PB1 birds fed with crumble feed at 5th week of age was 1489.24±14.15 g (133) in male birds and 1247.89±09.26 g (140) in female birds. Where those fed with mash feed had significantly lower body weights of 1330.41±10.47 g (158) in male and 1138.00±8.52 g (173) in female birds respectively. However, those with mash feed had better feed efficiency of 2.08 and chick survivability of 97.92% compared to those fed with crumble feed with feed efficiency of 2.21 and 95.79% respectively. Higher percent of mortality in Crumble fed birds was due to ascetics. Crumble form with uniform particles, better nutrient retention, lesser wastage may be advantageous. However, PB1 line may genetically prone for ascites when fed with densified feed which needs to be investigated.

Key words: Coloured Broiler, Crumble feed, Mash feed, Ascites, Mortality.

TS2-PP-04

Comparison of conventional PCR assay and SYBR Green Real-Time PCR assay for early detection of *Ornithobacterium rhinotracheale* from respiratory diseased poultry of Andhra Pradesh for sustainable production

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ABSTRACT

A total of 113 tracheal swabs, 79 nasal swabs, 104 oral swabs, 91 exudates of infraorbital sinuses, 52 heart blood swabs, 63 tracheal tissues, 63 liver tissues, 63 lung tissues, and 34 air sacs from 28 suspected poultry farms located in various districts of Andhra Pradesh and Screened by PCR and SYBR Green Real Time PCR by targeting*16S r RNA and rpoB*, 85.84, 47.11, 54.43, 30.76, 34.92, 47.61, 58.73, 75 and 47.05% respectively out of 20 positive farms. In the present study, the positive PCR *ORT* gene products (*16S r RNA and rpoB*) from representative farm samples of Andhra Pradesh were sequenced with forward primer and found 99.32-99.7% and 86.38- 98.05% homology with *O.rhinotracheale* strains of NCBI. Present OR835801 and OR835802 isolates showed nucleotide substitutions at different positions. The phylogenetic analysis revealed that our two strains were closely related to local Indian strains, Costa Rica and United Kingdom and German strains. It can be concluded that early detection of ORT in common respiratory infections of poultry by molecular based methods helpful for implementation of control strategies to reduce the economic losses in poultry industry. This study concluded that the 71.42% incidence of the respiratory pathogen *O. rhinotracheale* was observed in all over Andhra Pradesh. SYBR Green real time PCR test is more advantage than conventional PCR due to its rapid detection.

Key words: PCR, Phylogenetic analysis, Sequencing, SYBR Green Real-Time PCR

TS2-PP-05

Poultry information need assessment of multistakeholders and constraints faced by them in utilization of web module in Karnataka, India

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ABSTRACT

Information need assessment is a crucial component for implementation of any scientific managemental practice. Several digital tools and modules like Web modules are being utilised to deliver credible and timely information to the Multi-stakeholders. Web modules are best sources of information, but it is imperative to study the needs of poultry farmers about scientific poultry farming and also the constraints faced by farmers in utilization of web module. This study was conducted in four administrative divisions of Karnataka. One district from each administrative division was selected. Twenty five poultry farmers and 15 Veterinary officers from each district were selected making a final sample size of 160 and data was collected through interview schedule and questionnaire respectively. Information needs of poultry farmers and officers were assessed in different areas viz., Housing and management, Feed and Feeding management, Healthcare, *etc*,. Responses were taken on three point continuum i.e. 'most needed', 'needed' and 'least needed'. Constraints faced by Poultry farmers were assessed in 13 areas like Illiteracy / Poor educational status of farmers, Lack of Practical exposure etc. The study revealed that, information on Zoonotic disease and their preventive measures (91.00%) were perceived as most needed by poultry farmers followed by information on Vaccination (82.00%). Veterinary officers prioritized information on Balance ration feeding and its economical composition (83.00%) and disinfection of poultry shed (83.00%) as most needed by poultry farmers followed by Vaccination (77.00%). Non-availability of information (Dairy, Poultry, etc) in one source or platform (79.00%) was expressed as the major constraints faced by farmers whereas, majority of the veterinarians prioritized Illiteracy / Poor educational status of farmers (77.00%) and Lack of practical exposure(77.00%) as the major constraints faced by poultry farmers.This study suggests ways to policy makers, scientists and veterinarians to provide appropriate need based solutions through development of web modules, demonstrations and trainings.

Key Words: Information, Karnataka, Needs, Poultry farmers and Veterinary officers

TS2-PP-06

Evaluation of diets containing Rumen Digesta Meal (RDM) replacing maize on serum biochemical profile and nutrient digestibility in broilers

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ABSTRACT

The present study was conducted to evaluate the effect of feeding varying levels of Rumen Digesta Meal (RDM) on serum biochemical profile and nutrient digestibility in broilers. A feeding trial of six-week duration was undertaken in a completely randomized design with four dietary treatments *viz*., 0 (T_1), 20 (T_2), 30 (T_3) and 40 (T_4) per cent of RDM replacing maize. One hundred and fourty four day-old chicks were divided into four dietary treatments with three replicates each having 12 chicks. At the end of study period (6^{th} week), 2 birds per replicate and thus a total 6 birds per treatment were randomly selected for collection blood to study the serum biochemical profile. During the last 3 days of trial 2 birds from each replicate and all the four treatments were shifted to metabolic cages for faecal collection to estimate the digestibility of proximate nutrients. Data revealed increased levels of glucose ($P<0.05$), albumin ($P<0.01$) and decreased levels ($P<0.01$) of albumin and A/G ratio with increased levels of RDM from 0 to 40%. Further, the triglycerides were lowest ($P<0.05$) in T_2, while the total cholesterol ($P<0.05$) and LDL-C ($P<0.01$) was lowest in T_4. The SGPT and BUN levels were higher ($P<0.01$) in treatment groups compared to control with non-significant differences in SGOT, creatinine, calcium and phosphorous. The data on metabolism studies revealed decreased ($P<0.01$) digestibility of DM, OM, CP and EE and increased ($P<0.05$) digestibility of CF with increased levels of RDM from 0 to 40%. Further, the feed cost/kg gain (₹) was lowest ($P<0.01$) in T_2 compared to other treatment groups. It was concluded that maize could be replaced up to 20 per cent level with RDM in the diet of broilers economically without any adverse effects on health and nutrient digestibility.

Keywords: Broiler chicken, nutrient digestibility, rumen digesta meal, serum biochemical profile

TS2-PP-07

Histological changes in broiler tissues supplemented with a phytogenic feed additive/blend and antibiotic growth promoter in a confirmatory field study

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ABSTRACT

To overcome the subclinical infections and associated losses encountered due to intensive production conditions, subtherapeutic doses of antibiotics have been used as growth promoters (AGPs) in broiler production. But using AGPs has been linked with AMR surge. So, a study was conducted to explore the efficacy of a phytogenic feed additive /blend as an alternative to the antibiotic growth promoter in broilers and histological changes were recorded in various organs. The phytogenic feed additive/ blend tested in the present study was earlier evaluated and found to be a promising source. However, to ascertain its efficacy once again under field conditions, a second broiler study was conducted in the same commercial farm. Present experiment was conducted in a commercial broiler farm of a farmer at Santhur, Krishnagiri District, Tamil Nadu. A total of 600 numbers of day-old broilers were distributed to four treatments with three replicates of fifty chicks per replicate. The treatments included: basal diet; basal diet supplemented with 355g/ metric ton of feed grade chlortetracycline and basal diet supplemented with 0.25% or 0.5% phytogenic feed additive/blend. The experiment was conducted for six weeks after which representative birds from each treatment were subjected to histopathology analysis. The histology of spleen revealed marked lymphoid depletion in spleen follicles of birds fed antibiotic growth promoter, chlortetracycline. However, the birds supplemented with phytogenic blend showed reduced lymphoid depletion compared to birds fed with AGP. In liver, the hepatic cells showed increased degenerative changes in birds fed AGP. In duodenum, jejunum and ileum microscopic parameters were better in birds fed 0.5% phytogenic compared to other groups while birds fed AGP and 0.25% phytogenic did not show any significant differences. Overall results indicated that feeding the phytogenic is nontoxic to broilers.

Key words: Antimicrobial resistance, antibiotic growth promoters, broilers, phytogenics

TS2-PP-08

Isolation and identification of *Bacillus cereus* in convenience foods

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ABSTRACT

Convenience foods, easily available and increasingly favoured due to changing lifestyles, are often not commercially heat-sterilized, potentially allowing survival and growth of foodborne pathogens such as *Bacillus cereus*. This widely distributed pathogen is capable of causing emesis and diarrhoea, is found in various food products, and can form spores that allow survival in adverse conditions. This study investigated the isolation and identification of *Bacillus cereus* from convenience foods. A total of 120 samples were procured from market through simple random sampling, equally divided between ready-to-eat (RTE) and ready-to-use (RTU) categories. Isolation was performed following ISO 7932:2004 on *Bacillus cereus* selective agar supplemented with polymyxin and egg yolk, yielding characteristic fimbriated peacock blue colonies. On Gram staining all these isolates were Gram positive rods and spores were also seen. The overall prevalence of *Bacillus cereus* was 23.33% (28/120), with RTU foods showing higher contamination (28.33%) than RTE foods (18.33%). Biochemical test results showed that all *Bacillus cereus* isolates were indole (100%) and oxidase (100%) negative, while being positive for Voges-Proskauer (100%), catalase (100%), nitrate reduction (100%), citrate utilization (100%), and tyrosine decomposition (100%). The methyl red test yielded positive results in 57.1% of the isolates, and starch hydrolysis was observed in 89.2%. This study highlights the concerning level of *Bacillus cereus* contamination in convenience foods, emphasizing the need for improved processing standards, storage conditions, and stricter regulatory oversight to ensure food safety and prevent potential foodborne illnesses associated with these widely consumed products.

Key words: *Bacillus cereus*, biochemical test, foodborne pathogen, Gram staining

TS3-LP-01

Newer approaches in therapeutic management of pet diseases

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Diseases commonly encountered in pet animals have been treated with different treatment regimens with great success. However, in the recent day's response to conventional methods of treatment has not been yielding success in certain commonly encountered diseases in companion animals. Literature has indicated success with newer strategies of treatment and approaches. Some of these newer approaches which has shown success in small animal practice are:

1. Establishment of emergency and critical/intensive care unit
2. Use of alternate medical practices
3. Use of modern gadgets for therapeutic purpose
4. Utilization of therapeutic diets (both formulated and commercial diets)
5. Enteral feeding
6. Utilization of modern gadgets/diagnostic techniques for early detection of diseases
7. Advocation of newer regimens of treatment in refractory cases
8. Relocation of patient to different/friendly environment

1. Establishment of emergency and critical/intensive care unit

Veterinary emergency and critical care medicine is one of the fast-growing specialties in Veterinary Medicine. "Two" specialties joined as "One" emphasizes continuous care and partnership with other specialists. Certified Veterinarians from Colleges of Veterinary Emergency and Critical Care are termed CRITICALISTS, because they provide**,** Immediate Essential and Intensive care and management for these animals. Criticalists frequently manage multiple comorbidities.

Emergency and critical care clinicians face an important challenge. They must achieve a high level of broad interdisciplinary expertise while also requiring deep knowledge in the core areas of the specialty. The first and the most important step in critical care is TRIAGE.

Triage consists of preliminary evaluation of the patient which must be done quickly in around a minute. Second examination should be conducted to evaluate the various body systems and initiate appropriate procedures to treat the emergency.

Core Areas of Emergency and Critical Care Medicine Includes:

1. Pain management
2. Mechanical/positive pressure ventilation
3. Transfusion medicine
4. Coagulation disorders
5. Fluid and colloidal therapy,

6. CPR and cardiorespiratory disorders
7. Sepsis and antimicrobial use
8. Trauma management, and
9. Acute plant and chemical toxicities.

Management of critical illness and injury

Skills are frequently required for evaluation of the emergent and critically ill patient in the following areas:

Continual assessment, interpretation, and management of the patient's status, including vital signs. Acid–base, electrolyte, hematologic, cardiovascular, respiratory, renal, neurological, gastrointestinal, and nutritional status.Laboratory technical skills, point-of-care testing, and ultrasonography.

2. Some of the alternate medicine practices which have been used with great success are:

- Laser therapy
- Use of nutraceuticals
- Stem cell therapy
- Gene therapy
- Homoepathy
- Herbal medicaments
- Ayurvedic medicine usage
- Acupuncture
- Rekhi
- Magnet therapy
- Pranic healing
- Hydrotherapy
- Physiotherapy
- Massage therapy
- Spiritual healing, etc.,

Laser Therapy

The therapeutic effects of light are known since the 6th century B.C. Treatment of diseases utilizing phototherapy won the first of many Nobel Prizes awarded in this field in 1903. In 1960, the first laser was developed. **The first documentation of accelerated healing in veterinary medicine was done in 1967**. By the early 1970's, laser therapy was recognized as a physical therapy modality in Eastern Europe, the Soviet Union, and China. The first appearance of laser therapy in the United States wasn't until 1977.

The World Association for Photo-biomodulation Therapy (WALT) was formed in 1994 in Barcelona, Spain at the joint Congress of the International Laser Therapy Association (ILTA) and the International Society for Laser Application in Medicine (ISLAM) when these two international groups merged and WALT became the leading world body for promoting research, education and clinical applications in the field of photo-biomodulation with lasers and other light sources. Since receiving FDA approval in 2002, laser has gained widespread scientific and clinical evidence-based acceptance, accompanied by advances in the technology of the equipment utilized to deliver it. In India laser therapy has been put into practice for treatment of various conditions in companion animal practice since 2016.

Veterinary laser therapy is an innovative treatment that has gained popularity in recent years as veterinarians discover its benefits for pets. Used similarly to acupuncture, massage therapy, and other alternative therapies, laser treatment can be used in conjunction with, or instead of, medication to manage pain, inflammation, and wound healing.

Laser is an acronym of light amplification of stimulated emission of radiation (Laser). Laser when passed on cell or tissue alters physiology of cells and tissue by means of photons (light). Laser therapy lessens pain, relaxes muscle and improves circulation by altering the physiology of cells by means of light (photons). The effect of laser on mitochondria, cells and tissues is called photo-biomodulation. Low level laser therapy (LLLT) refers to use of light at a much lower level than those used for tissue ablation or photocoagulation."Laser"—an acronym for "light amplification of stimulated emission of radiation"—refers to a unit that emits focused, penetrating light beams in three forms and is the unique property of laser.

- **Monochromatic:** Light that is a single wavelength (as opposed to natural light, which is emitted as a range of wavelengths)
- **Coherent:** Photons (*i.e.*, tiny particles of light or electromagnetic radiation) that travel in the same phase and direction (tightly aligned)
- **Collimated:** Photons that travel in a single straight beam (parallel)
  Coherence and collimation give a laser penetrating power to a restricted area so that nearby tissues are unaffected.

Lasers are classified based on their wavelength and potential energy output, with four classes currently recognized:

- **Class 1** lasers, such as barcode scanners used in supermarkets, are used safely every day
- **Class 2** lasers, which include laser pointers and some therapeutic lasers, produce a beam in the visible spectrum (400–700 nanometers)
- **Class 3** lasers include the most commonly used therapeutic lasers
- **Class 4** lasers are currently, most commonly used for therapeutic purpose and includes surgical lasers used to cut and cauterize tissue during surgical procedures

Most commonly used therapeutic lasers in Veterinary Medicine are Class III (deliver energy from

1 to 500mW) and IV (delivers energy more than 500mW) lasers. One watt is one Joule of energy that is delivered per second and the laser dose is expressed as Joules/cm^2. Very many types of laser units are available for the small animal practitioner to be used for therapy as well as for surgery. Obviously one can select either a surgical or therapeutic laser unit or can have a choice of equipment which can be used both for treatment and surgery.

Benefits of Therapeutic Laser

Neo-vascularization

Angiogenesis

Collagen synthesis which enhances wound healing

Stimulation of nerve healing

Enhanced healing of tendons, cartilage and bones

Reduced swelling from injury

Modulation of degenerative tissue changes

Mitigation of CNS damage following traumatic brain injury and spinal cord injury

Therapeutic laser has been used to treat conditions like:

Superficial skin wounds/ Aural Hematoma/ pyo-traumatic dermatitis

Post surgical wounds

Gingivitis/periodontal disease/stomatitis (closed mouth)

Deep tissue and musculoskeletal conditions

Rhinitis/Sinusitis (closed mouth)

Abdominal disorders

Hematoma/aural hematoma

Tendon and ligament injury

Trigger points

Edema

Anal sacculitis/adenitis/anal fistula

Lick granuloma

Muscle injuries

Neurological conditions

Osteoarthritis/Degenerative joint disease

Pododermatitis/Atopic dermatitis/interdigital pyoderma

Otitis

Laser therapy is particularly useful for pets with limited medical treatment options, such as:

- Pets with liver disease who cannot take medications
- Cats, for whom only a few pain-control medications are approved

- Exotic pets for whom medication administration is difficult or impossible
- Older pets with diminished organ function

2. Nutraceuticals

This is a branch which has gained great importance in the management of many diseases and has been claimed to be very beneficial as the products used are not medicaments and the contents are nutrition material/s used in appropriate concentrations to derive therapeutic effect. The most commonly used materials are carnitine, Chondroitin sulphate, Q10, coenzymes, magnesium, copper, strontium, aminoglycans, manganese, vitamins, (Vit A, D, E, folate, nicotinamide *etc.*,) glucosamine, hyaluronic acid, polyunsaturated fatty acids, herbal/root extracts, egg membrane etc.,

3. Use of modern gadgets for therapeutic purpose: Use of endoscopes for removal of foreign body in GIT, Laparoscopy for abdominal surgeries, surgical laser for cutting tissues etc.,

4. Utilization of therapeutic diets (both formulated and commercial diets)

Various diets are available in dry, semisolid and liquid form in convenient packs. Diets available are Renal, Hepatic, Weight management, Gastrointestinal, Diabetic, Hypoallergic, Skin and Coat, Mobilty, Recovery, Urinary, Calculolytic, Convalascence etc.,

5. Enteral feeding

Supplemental Nutrition Options for Dogs and Cats help in the better management of disease treatment. There are two primary options for supplementation nutrition in dogs and cats. They include enteral and parenteral feedings. They include

Enteral (Feeding though the GIT)

Nasoenteric (nasoesopahgeal, nasogastric, Naso jejunal)

Esophageal tube

Gastric tube (surgical or endoscopic placed)

Jejunal tube (surgical)

Parenteral (Feeding IV)

Partial

Total

Nutritional support should be considered for any animal that has been anorexic or has had inadequate voluntary caloric intake for e” 3 days, has lost e” 10% of their body weight or has other signs of malnutrition (e.g. poor hair coat, muscle wasting, poor wound healing, hypoalbuminemia)

Nutritional support should be considered in patient with predisposing conditions such as vomiting, diarrhea or liver disease, prior to development of overt malnutrition3. Pre-emptive feeding tube placement is also recommended in patients where complete or partial anorexia can be expected (e.g. facial or jaw surgery, feline gastrointestinal lymphoma, etc.) and can often be done at the time of general anesthesia for initial therapeutic or diagnostic procedures.

Indications

Oral pain from dental disease or oral surgery

Side effects from chemotherapy

Pancreatitis

Kidney disease

Gastrointestinal disease

Megaesophagus

Enteral nutrition (EN) supports the functional integrity of the gut by maintaining tight junctions between the intraepithelial cells, stimulating blood flow, and inciting the release of trophic endogenous agents (agents that increase cell growth).

EN also maintains the structural integrity of the gastrointestinal tract by maintaining villous height and supporting the immune cells of the intestinal tract.

In addition, EN may decrease inflammatory cytokine production, modulate the inflammatory acute phase response, and decrease catabolism (protein breakdown) to preserve protein.

Types of feeding tube used in small animal veterinary practice

Nasogastric tube: This is a narrow tube and can be used for only a few days to give watery material.

Esophagostomy/pharyngostomy tube: This is a wider tube and can be used for days to a few weeks to give slightly thicker fluid and some liquid medications.

PEG (percutaneous gastrostomy tube): This is to be used for several months or permanently. If the PEG tube is to be permanent it must be replaced every 6-8 months. Gruel and most crushed medications can be given through a PEG tube.

Jejunostomy tube (J tube): This exits the right side of the abdomen and are usually only used in the hospital.

6. Utilization of modern gadgets/diagnostic techniques for early detection of diseases

Newer equipment and Biomarkers have been utilized for early detection of diseases. A biomarker has been defined a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention". Biomarkers include genetic variants, clinical images, physiological tests, and tissue specimen biopsies. Biomarkers in the conventional sense refers to substances measured in the blood. There are different kinds of markers namely:

Antecedent biomarkers

Screening biomarkers

Predictive biomarkers

Diagnostic biomarkers

Staging biomarkers

Pharmacodynamic/responsive biomarkers

Prognostic biomarkers

Biomarkers are different for different organs say Kidney (BUN, Creatinine, SDMA, Urinary enzymes etc.,) Heart (Troponins, BNP etc.,) Liver (SGPT, ALP, LDH, TP, Albumin, Globulin, Bile acids etc.,), Inflammation (C-reactive protein protein(CRP), etc., Each system/organ has specific biomarker which can be quantitated and can be used for early detection of disease and treatment can be initiated early which will help in favorable prognosis in a disease.

7. Advocation of newer regimens of treatment in refractory cases

For Example: Treatment of Babesiosis:

Imidocarb diproprionate: 5 to 6 mg/kg, IM or SC. 2 inj 15 days apart. (*B.canis*). *B.gibsoni* : less effective. *B.microti*: not effective

Atovaquone: 13mg/kg orally every 8 hrs for 10 days. Highly effective against *B.microti* in combination with azithromycin

Buparvaquone: 5mg/kg IM 2 doses with an interval of 48 hrs. *B.microti* in combination with azithromycin.

Azithromycin: 10mg/kg orally once daily for 10 days. *B.gibsoni* in combination with atovaquone.

Diminazene aceturate: 3.5 to 7 mg/kgIM as a single dose. *B.gibsoni*

Clindamycin: 12.5mg/kg orally every 12 hours. *B.gibsoni* in combination with Diminazene and imidocarb.

To mitigate or prevent adverse reactions of imidocarb atropine (0.05mg/kg) can be administered before or within 30 minutes of imidocarb administration.

Metronidazole, 15mg/kg PO BID + Clindamycin 25mg/kg PO BID + doxycycline 5mg/kg PO once dialy.: 30 to 90 days.

Doxy+Enrofloxacin+Metronidazole: claimed to be effective.

8. Relocation of patient to different/friendly environment.

This has been considered useful in treating allergic conditions, behavioral disorders, obesity etc.,

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Newer approaches in nutritional modulation for fostering companion animal health

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Introduction

In recent years, the field of pet health has witnessed a paradigm shift, where traditional veterinary practices are increasingly being complemented by a deeper understanding of the role nutrition plays in the well-being of animals. As pet owners become more informed and invested in the health of their companions, the demand for more effective, tailored, and scientifically-backed nutritional strategies is on the rise. This has led to the development of *newer approaches in nutritional modulation*, which focus not only on meeting basic dietary needs but also on enhancing health outcomes, preventing disease, and improving the overall quality of life for pets.

Historically, pet nutrition has largely revolved around providing balanced commercial diets that meet the fundamental nutritional requirements of pets. However, emerging research has expanded our understanding of how diet can influence various aspects of pet health beyond just growth and maintenance. Today, veterinarians and animal nutritionists are exploring specialized diets, functional foods, nutraceuticals, and even genetic-based nutritional interventions that target specific health conditions, from obesity and allergies to joint health and cognitive aging. One of the most significant advancements in pet nutrition is the growing recognition that, just like humans, pets have unique metabolic needs that can vary depending on factors such as breed, age, activity level, and underlying health conditions. This has led to the rise of personalized nutrition, where diet plans are specifically tailored to the individual animal's needs, considering both genetic predispositions and lifestyle factors. Additionally, the use of functional ingredients like probiotics, prebiotics, antioxidants, and omega-3 fatty acids has gained attention for their potential to modulate immune function, promote gut health, and reduce inflammation in pets. Alongside these targeted nutritional interventions, there is also a growing focus on the prevention of chronic diseases through proactive dietary management. With the increasing prevalence of conditions like obesity, diabetes, kidney disease, and arthritis in pets, nutrition is being recognized as a critical tool not only for treatment but also for prevention and long-term management.

As the field of pet nutrition continues to evolve, these newer approaches are expected to reshape the way we think about and implement dietary strategies for pets, offering exciting new opportunities for improving their health and longevity.

The evolution of pet nutrition

Pet nutrition has undergone a significant transformation over the past few decades. Early pet food formulas were primarily based on basic ingredients designed to meet the minimum nutritional needs. However, as we learn more about the physiological needs of animals, a more refined and holistic approach to pet nutrition has taken shape.

Historically, pet food was designed to keep pets alive and healthy, but modern pet diets now aim to enhance quality of life, prevent diseases, and even reverse certain health issues. Advances in understanding pet metabolism, microbiome health, and the role of functional foods have led to the development of new nutritional strategies. Here, we will look at some of the more recent approaches to nutritional modulation. The recent approaches include:

1. Nutrigenomics: Understanding the Interaction Between Nutrition and Genes
2. Microbiome Modulation: For the health benefits
3. Anti-Aging and Cognitive Health Diets
4. Alternative Protein Sources and Novel Diets
5. Functional Foods and Therapeutic Diets

Nutrigenomics: understanding the interaction between nutrition and genes

Nutrigenomics is the study of the relationship between an animal's genetic makeup and its response to nutrients. This emerging field is revolutionizing not only human nutrition but also pet nutrition by offering a more personalized approach to diet and health management. The integration of genomics with nutrition aims to understand how specific nutrients can influence gene expression, metabolic pathways, and disease susceptibility. By leveraging this knowledge, veterinarians and pet owners can design more tailored nutritional plans that optimize health, prevent diseases, and even extend the lifespan of pets.

Understanding nutrigenomics

At its core, nutrigenomics seeks to understand how genetic variations influence the way animals metabolize and utilize different nutrients. Every pet's genetic composition, whether it's a dog, cat, or other animal, plays a role in how they absorb, process, and respond to the foods they consume. Genes can affect how well pets digest nutrients, how efficiently their bodies utilize energy, and even their predisposition to certain conditions, such as obesity, diabetes, or cardiovascular disease.

Even by the year 2003, 263 feline and 451 canine genetic diseases had been described (Swanson et al., 2003). For monogenic diseases, molecular biological techniques can be used to find the genetic cause of a disease. This information can then be used to prevent or treat the disease. The first canine disease-causing gene was cloned and described in 1989 (Evans et al., 1989). Since then, at least 20 canine disease genes have been cloned and characterized (Swanson et al., 2003). Once DNA sequence data for a disease are known, mutation-based tests can be developed to test for diagnosis and carrier detection. Test results may be used to eliminate carriers from the breeding population to decrease or eliminate incidence of disease. Dogs and cats also are excellent animal models for human genetic and nutritional diseases.

Through nutrigenomics, researchers and veterinarians are discovering that what might be an ideal diet for one pet may not be suitable for another based on their genetic make-up. This has led to the development of a more individualized approach to pet nutrition, considering not just breed, size, or age but also the unique genetic makeup of each animal.

How nutrigenomics impacts pet nutrition

Personalized diet plans: Nutrigenomics allows for the creation of personalized diets based on a pet's genetic profile. By identifying specific genetic markers associated with metabolism, nutrient utilization, and disease risk, it is possible to formulate a diet that best supports the pet's health. Personalized nutrition is increasingly gaining attention in clinical settings, with healthcare professionals using genetic testing and other personalized approaches to manage chronic diseases and improve patient outcomes (Park et al., 2024). For example, dogs with certain genetic variations may require different levels of specific nutrients, like taurine for heart health, or omega-3 fatty acids for inflammation management. This personalized approach ensures that pets receive the right balance of nutrients tailored to their individual needs, which may help prevent chronic diseases and promote optimal growth and development. Personalized diets designed for pets with genetic susceptibility to metabolic diseases can include adjusted protein or fat content to promote healthier body weight and metabolic function. These diets can also be used to manage chronic conditions like diabetes or allergies, improving quality of life through targeted nutrition (Yang, 2019).

*Breed-specific nutritional needs***:** Certain breeds have unique genetic traits that influence their nutritional needs. For example, large dog breeds such as Great Danes or Saint Bernards may have a genetic predisposition to joint issues, requiring diets rich in joint-supporting nutrients like glucosamine and chondroitin (Dougherty et al., 2022). Similarly, smaller breeds like Chihuahuas or Dachshunds may be more prone to obesity, and their diets might need to be more calorie-controlled and rich in fiber to aid in weight management (Wilding, 2018). Nutrigenomics enables the creation of breed-specific diets that address these genetic predispositions, potentially enhancing a pet's health and longevity (Gaillard et al., 2019).

*Disease prevention and management***:** One of the most promising aspects of nutrigenomics is its potential for disease prevention. Genetic predispositions to diseases such as obesity, diabetes, cardiovascular disease, and even some cancers can be mitigated or managed through diet. For example, pets with a genetic predisposition to obesity may benefit from a high-protein, low-carbohydrate diet to help maintain a healthy weight. Similarly, pets at risk for kidney disease may require diets low in phosphorus and protein to ease kidney stress. Nutrigenomics can provide a deeper understanding of which nutrients may help prevent or manage these conditions based on the pet's genetic risk factors (Phungviwatnikul et al., 2021).

*Nutrient sensitivities and allergies***:** Pet allergies, particularly food-related allergies, are increasingly understood through genomic research. Genetic predispositions to allergies in both dogs and cats can be identified through the presence of specific genetic markers. Nutritional strategies, such as hypoallergenic diets, can be developed based on an animal's genetic profile. Studies have shown that genomic approaches, including gene-expression analysis, can identify immune response genes activated during allergic reactions, allowing for tailored nutritional interventions (Yamazaki et al., 2021). For example, elimination diets have been found to reduce the expression of inflammatory genes associated with food allergies in pets, helping manage symptoms more effectively.

*Improving longevity and aging***:** As pets age, they become more susceptible to various health issues, including cognitive decline, arthritis, and reduced immune function. Nutrigenomics can aid in understanding how certain nutrients may influence the aging process and help delay the onset of age-related diseases. For example, antioxidants like vitamins E and C, omega-3 fatty acids, and specific amino acids can help combat oxidative stress, which contributes to aging and degenerative diseases. By tailoring the diet to the pet's genetic profile, nutrigenomics may help improve their quality of life and increase their lifespan (Wang and Lin., 2024).

*Enhanced digestive health***:** Digestion is one of the key areas where nutrigenomics has a significant impact. Some pets have genetic variants that affect the function of their gastrointestinal tract, making them more prone to issues like inflammatory bowel disease (IBD) or food intolerances. Nutrigenomic research is uncovering which specific nutrients or food formulations can help support a healthy gut microbiome, improve digestion, and reduce gastrointestinal inflammation. For example, pets with genetic predispositions to IBD may benefit from diets rich in prebiotics, probiotics, and highly digestible ingredients (Wang and Lin., 2024).

Challenges and future of nutrigenomics in pet nutrition

While nutrigenomics holds great potential, there are challenges to be addressed. The field is still relatively new, and research is ongoing to better understand the complex relationship between genes and diet. Moreover, the availability of affordable and accessible genetic testing for pets remains a barrier for many pet owners. As research progresses and more genetic data is collected, the hope is that nutrigenomics will become a more common tool in pet nutrition, leading to more effective, individualized care. Nutrigenomics is a promising and innovative field that is transforming the way we approach pet nutrition. By integrating genetic knowledge with nutritional science, we can develop personalized diets that not only address the specific needs of individual pets but also help prevent and manage health conditions more effectively. As research continues and genetic testing becomes more accessible, nutrigenomics is poised to revolutionize the future of pet nutrition, ultimately improving the health, longevity, and quality of life for pets around the world.

Microbiome modulation

Microbial modulation for health benefits in dogs refers to the process of influencing or modifying the gut microbiota (the community of microorganisms, including bacteria, fungi, and viruses, living in the intestines) to enhance a dog's health and wellbeing. Just as in humans, the gut microbiota in dogs plays a critical role in digestion, immune function, and overall health.

The homeostatic balance of the intestinal microbiome is exceptionally beneficial to the host. A proper, healthy gut microbiome ensures a beneficial influence on the host's immune system, defense against pathogens, or supply of vitamins and nutrients. Gut dysbiosis has been defined as a disturbance to gut microbiota homeostasis with further changes in their functional composition and metabolic activities (DeGruttola et al., 2016). Dysbiosis might have serious health consequences, as was proven in dogs as well. The gut microbiome is altered in many gastrointestinal diseases such as diarrhea, chronic enteropathies, and inflammatory bowel disease (IBD) but also in obesity, pancreatic insufficiency, or heart diseases in humans and dogs.

A different composition of the gut microbiota is also related with behavioral disorders in dogs, including aggressive and phobic behavioral disorders. Canine behavioral disorders have become one of the most common concerns and challenging issues among dog owners. There is growing concern about dogs' emotionality and welfare, especially since pets are treated as family members and play very important social roles in modern societies. It is understood that that behavioral disorders in companion dogs may have serious consequences for the quality of life of both dogs and their owners. The gut–brain axis seems to be particularly interesting, especially since in many instances the standard treatment or behavioral therapies insufficiently improve animal behavior. Among the numerous factors contributing to canine behavioral disorders, the influence of gut-related mechanisms seems to be particularly interesting. The crucial mechanisms of the gut–brain axis include the homeostatic balance of the intestinal microbiome and crucial neurotransmitters along with gut metabolites (mainly SCFAs) regulated by the intestinal microbiome. Another mechanism suggested is the influence of the gut microbiome on inflammation and the hypothalamic–pituitary–adrenal (HPA) axis (Kielbik & Witkowska-Pi³aszewicz, 2024). Thus, the modification of the gut microbiome can potentially be a helpful tool for treating mental health disorders.

Strategies for manipulation of gut microbiota

There are various strategies to manipulate gut microbiota, such as dietary changes, the administration of prebiotics, probiotics, or postbiotics, or fecal microbiome transplantation (FMT) (Kielbik & Witkowska-Pi³aszewicz, 2024). The FMT method is based on transferring the fecal matter from a donor into the gastrointestinal tract of a recipient in order to modulate the gut microbiota. FMT is currently indicated for the treatment of debilitating gastrointestinal infections. Preclinical and clinical data suggest that FMT is a promising strategy to meliorate psychiatric disorder symptoms. Studies showed that transplanting the fecal microbiome from depressed humans to microbiota-depleted rats and mice can induce depressive-like and anxiety behaviors in recipients (Kielbik & Witkowska-Pi³aszewicz, 2024). FMT was also used to correct intestinal flora and intestinal barrier damage in rats with stress-induced depressive-like behavior. Animals in this study were exposed to different stressors (including social isolation, heat stress, and restraint stress) for 4 weeks. The FMT studies on dogs its application is summarized in Table.

Study	No. of dogs in study	Method used for FTM	Outcome	Reference
Dogs with acute hemorrhagic diarrhea syndrome	18	Endoscopic	No clinical benefit; however, increased abundance of SCFA-producing bacteria (beneficial for the organism) was observed	Gal *et al.*, 2021
Dogs with acutediarrhea	11	Rectal enema	Fecal consistency significantly improved in all dogs, with proper microbial (based on dysbiosis index)and metabolic profiles (in contrast to dogs treated with metronidazole)	Chaitman *et al.*, 2020
Dogs with inflammatory bowel diseases	16	Oral/ endoscopic	Clinical improvement in most of dogs	Minomoto *et al.*, 2015

Study	No. of dogs in study	Method used for FTM	Outcome	Reference
Dogs with inflammatory bowel diseases	9	rectal enema	improvement in canineinflammatory bowel disease activity index in all dogs	Niina *et al.*, 2021
Dogs with chronic enteropathies (FMT used asadd-on therapy)	41	rectal enema	Thirty-one dogs responded to treatment, resulting in improved fecal quality and/or activity level	Toresson *et al.*, 2023
Dogs with atopicdermatitis	12	Oral	Eleven dogs presented significantly decreased skin lesions and pruritusscores and beneficially changed gut microbiota	Sugita *et al.*, 2023

The observed improvements were related to the changes in microbiota composition, especially the increase in Fusobacterium (Niina et al., 2021). Although the FMT procedure has been tested as a novel therapeutic approach targeting specific canine disorders, further studies are needed to validate.

Nutritional modulations for anti-aging and cognitive health

Due to a difference in genetics, environmental factors, and nutrition, just like in people, dogs age at different rates. Brain aging in people and dogs share similar morphological changes including irreversible cortical atrophy, cerebral amyloid angiopathy, and ventricular enlargement. Due to severe and irreversible brain atrophy, some aging dogs develop cognitive dysfunction syndrome (CDS), which is equivalent to dementia or Alzheimer's disease (AD) in people. The risk factors and causes of CDS in dogs have not been fully investigated, but age, gender, oxidative stress, and deficiency of sex hormones appears to be associated with increased risk of accelerated brain aging and CDS in dogs. Both AD and CDS are incurable diseases at this moment, therefore more efforts should be focused on preventing or reducing brain atrophy and minimizing the risk. Since brain atrophy leads to irreversible cognitive decline and dementia, an optimal nutritional solution should be able to not only enhance cognitive function during aging but also reduce irreversible brain atrophy (Pan, 2021).

Healthy brain aging and CDS management

Many factors including genetics, environment, and nutrition may determine the different rates of brain aging observed in people and dogs. It is always better, compensating for the early cerebral metabolic change and mitigating known risk factors associated with brain aging and dementia may be effective in promoting successful brain aging, reducing brain atrophy, and minimizing the risk of dementia

Ketone bodies as an alternative energy source for the brain

Normal cerebral glucose metabolism is essential for cognitive function, unfortunately, cerebral glucose metabolism is impaired with age and in subjects with cognitive impairment (Bentourkia et al., 2000). Reduced cerebral glucose metabolism may partly contribute to the decline in brain functions associated with aging and cognitive impairment in AD subjects. Since reduced cerebral glucose metabolism occurs under the condition of normal blood glucose and appears to be caused by dysfunction of the insulin signaling pathways, further increasing blood glucose does not help to improve cerebral energy supply. However, increasing ketone body supply as an alternative energy source for the brain

appears to be able to enhance cognitive function in people with cognitive impairment (Avgerinos et al., 2020). In addition to glucose, the brains can also utilize ketone bodies as energy when blood ketone bodies are available. Cerebral metabolism of ketone bodies depends on the levels of ketone bodies in the blood and the number of monocarboxylic acid transporters 1 (MCT1) of the blood–brain barrier (BBB). MCT1 transport ketone bodies across the BBB into the brain. MCT1 are also present on glia, while monocarboxylic acid transporters 2 (MCT2) are exclusively found on neurons (Pan, 2021). When glucose supply from diets is adequate, carnitine palmitoyl transferase is inhibited by malonyl-CoA to support the storage of energy surplus as triglycerides. However, the ketogenic diets may not serve as a long-term solution for old people or animals because of the side effects.

Medium-chain triglycerides are composed of C6, C8, C10, and C12 saturated fatty acids. MCT have several unique properties compared with long-chain triglycerides. They do not require bile salts for digestion. Medium-chain fatty acids (MCFA) are absorbed more efficiently than long chain fatty acids (LCFA) and transported in the portal blood directly to the liver, while LCFA need to be incorporated into chylomicrons and transported through the lymphatic system. MCFA diffuse into the mitochondria independently of carnitine palmitoyl transferase and are rapidly converted into ketone bodies in the liver. Therefore, dietary medium chain triglycerides can increase blood ketone body levels regardless of the levels of dietary carbohydrates, fat, and proteins. Increased blood levels of ketone bodies can increase brain metabolism of ketone bodies as an alternative energy source to compensate for the deficits in cerebral glucose metabolism. This increases the energy supply to the brain and helps to maintain or improve brain functions. The medium chain triglycerides in diet can significantly improved spatial learning and memory, and visual-spatial attention in old dogs within one month after feeding (Pan, 2021).

Nutritional interventions targeting oxidative damage-related brain aging

Oxidative stress has been proposed as the main cause of aging, brain aging, and using exogenous antioxidants to reduce oxidative damage has been an active area of anti-aging research. Cotman et al. 2002, examined the effects of a test diet containing antioxidants and mitochondrial cofactors on cognitive function in aged dogs. The antioxidants included vitamin E, vitamin C, spinach flakes, tomato pomace, grape pomace, carrot granules, and citrus pulp, and mitochondrial cofactors (alpha-lipoic acid and L-carnitine) were added to the test diet to reduce reactive oxygen species (ROS) production by enhancing the function of aged mitochondria. The test diet significantly improved the ability of aged dogs to learn more difficult tasks compared with the aged dogs fed the control diet. Siwak-Tapp et al. 2008, reported a significant loss of neurons (about 30%) in the hilus of the hippocampus in old dogs compared with young dogs. A combination of exogenous antioxidants coming from fruits and vegetables and mitochondrial cofactors may improve cognitive function in old dogs, but were not able to reduce the irreversible neuron loss in old dogs.

In addition to antioxidants, other bioactives including S-adenosyl methionine and apoaequorin were tested in old dogs to enhance cognitive function. Oral S-adenosylmethionine were evaluated in old dogs with signs of cognitive dysfunction in a 2-month clinical study. Compared with the placebo dogs, SAMe-treated dogs showed significant improvement in both activity and awareness at the end of the study. In addition, the aggregate mental impairment score was reduced by more than 50% in 41.2%

of the SAMe-treated dogs and 15.8% of placebo dogs (Reme et al., 2008). Disturbance of intracellular calcium is associated with aging and may be linked to CDS in dog. Studies were conducted to investigate the effects of apoaequorin, a calcium buffering protein, on cognitive function in aged dogs. The apoaequorin-treated dogs showed significant improvement in the discrimination learning and the attention tasks (Milgram et al., 2015).

Nutritional interventions in blends of nutrients and bioactives

There are several studies on nutrient blends and bioactives designed to improve cognitive function in aging dogs and cats, particularly those with cognitive dysfunction syndrome (CDS). Blends containing ingredients like phosphatidylserine, Docosahexaenoic acid (DHA), antioxidants, and N-acetyl cysteine have shown significant improvements in learning, memory, and attention in both healthy and CDS-affected pets. Notably, the Brain Protection Blend (BPB), which includes antioxidants, B vitamins, and DHA/EPA, enhanced cognitive performance and slowed brain atrophy in healthy older cats and dogs. A clinical trial also demonstrated that a combination of medium chain triglyceride oil and BPB improved CDS symptoms in senior dogs. These findings suggest that targeted nutritional interventions can support healthy brain aging and help manage cognitive decline in pets (Pan, 2021).

Alternative protein sources and novel diets for pet health

The growing human population, increasing living standards, and urbanization are driving the global demand for protein sources, both for human and animal consumption. To meet this demand, efforts are focused on improving production efficiency and developing alternative, sustainable protein sources. These alternatives include proteins derived from biomass, such as leaf proteins from crops like sugar beet or grass, and proteins from organic waste converted by insects like black soldier fly larvae. Additionally, aquatic proteins from microalgae, duckweed, and seaweed are emerging as viable options, though they still face challenges in terms of costly and energy-intensive separation technologies. In the future, laboratory-cultured meat from muscle stem cells could replace conventional livestock. While these alternative proteins show promise, further development is needed to scale production and ensure safety and nutritional viability. Acceptance of these ingredients by pet owners may be challenging in some regions, but growing awareness of global food security issues may help facilitate their adoption in pet foods. (Bosch., 2016).

Functional foods and therapeutic diets

The canine pet care industry is growing as more households have dogs as primary companions, with owners focusing on providing proper care and nutrition. Canine health, like human health, is closely linked to diet and the gastrointestinal (GI) microbiome, which plays a key role in nutrient digestion and absorption. While traditional pet foods provide basic nutrients, there is increasing interest in functional foods that target the improvement of gut microbiome health through probiotics, prebiotics, synbiotic, and postbiotics, as well as essential nutrients like polyunsaturated fatty acids and phytonutrients. While studies have shown the positive effects of supplements on chronic enteropathies and allergies, research on the impact of functional foods on the GI microbiome and overall canine health is still limited. Further understanding of how functional foods influence the GI microbiome could provide valuable insights for enhancing overall canine health and resilience.

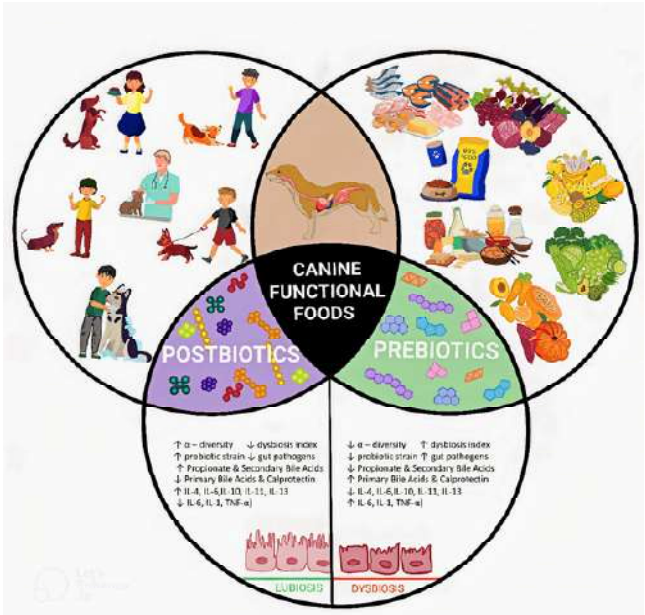

Fig 1: Schematic diagram of interaction between functional foods and diet with canine host's gastrointestinal microbiome and environment (Baritugo et al., 2023)

Probiotics

Recently, probiotic supplements for dogs have become popular because of their proven efficacy in restoring eubiosis in the GI microbiome of farm animals with compromised microbiota due to diseases and/or antibiotic/drug therapy (Lee et al., 2022). The ingestion of probiotics is seen as a direct approach to improving the canine gut microbiome and overall health since it directly introduces live microorganisms that have been selected because of their potential ability to provide health benefits to the host when taken regularly and in sufficient amounts. Potential probiotic strains should preferably be from the GI of target host (Kumar et al., 2017). Bacteria that are commonly found in canine gut microbiome are usually from Lactobacillus spp., Bifidobacterium spp., and Enterococcus spp. and most commercial probiotic products for canines contain similar strains.

Prebiotics and synbiotics

Prebiotics are indigestible materials that can selectively promote proliferation and activity of beneficial microbes, such as Lactobacillus and Bifidobacterium in the GI tract. On the other hand, synbiotics are combined blends of probiotics and prebiotics. This combination enhances their individual effects through synergistic activity. Commonly used prebiotics in canine diets are often in the form of complex and/or simple carbohydrates that provide dietary fibers such as lactulose, tagatose, mannanoligosaccharides (MOS), fructo-oligosaccharides (FOS), galacto-oligosaccharides, xylo-oligosaccharides, inulin, and polydextrose. Besides promotion of *in vivo* proliferation of beneficial bacteria, prebiotics such as MOS have been proven to be capable of binding with pathogenic *C. perfringens* and have immunostimulatory activity against GI pathogens (Spring et al., 2000). In addition, bifidogenic prebiotic, lactosucrose, can also decrease concentration of *C. perfringens* in the gut, along with reduction of fecal ammonia and fetid fecal odors (Terada et al., 2009). On the other hand, supplementation of prebiotics also promoted the production of postbiotics by probiotics strains in the

gut. For example, supplementation of Inulin, Polydextrose, Raftilose P95, Lactitol, and Pectin Classic CU201, increased production of postbiotics such as the short chain fatty acids lactic, propionic, acetic and butyric acid (Beloshapka et al., 2012).

Postbiotics

Postbiotics are defined as the preparation of non-viable probiotic or non-probiotic microorganisms, with or without their components, which can confer health benefits to canines when taken regularly (Ren et al. 2011). Postbiotics can directly or indirectly affect metabolism, insulin secretion, and insulin sensitivity. Postbiotics can be cell-free supernatants (CFSP) of strain cultures, which contain secreted metabolites, or they can be paraprobiotics or probiotics that have inactivated intact or ruptured cells of probiotics strains. Paraprobiotics include peptidoglycan-derived muropeptides, teichoic acids, cell surface associated proteins, surface-protruding molecules (fimbriae, flagella, pili), cell wall-bound surfactants, and exopolysaccharides.

*Short chain fatty acids***:** Postbiotics from the digestion of food (carbohydrates, fibers) by gut microbiome are SCFAs, such as acetate, butyrate, and propionate. These three acids are important in the maintenance of general intestinal homeostasis and target colon, neuroendocrine, and systemic energy availability. Acetate and propionate increase satiety and are used as substrates for hepatic gluconeogenesis. Butyrate is used as a source of energy for colonocytes, and modulation of the epigenetic balance levels of electrolytes in the colon improves GI motility and blood flow. Recently, a systematic review and meta-analysis of studies compared the levels of SCFAs between clinically healthy and sick canines (F´elix et al., 2022). In that study, the levels of SCFAs are generally higher in healthy canines as compared to canines afflicted with diseases such as inflammatory bowel disease (IBD). Thus, it has been concluded that that SCFAs can be used as marker of functionality because SCFAs concentration is directly affected by condition of canines (F´elix et al., 2022).

*Cell wall components***:** Peptidoglycan (PTDG) and teichoic acid (TEIA) are the major components of the cell wall and have been shown to have immunomodulatory functions. TEIA is divided into two groups: lipoteichoic (LTEIA) and wall-teichoic acid (WTEIA). LTEIA attaches to the bacterial membrane via glycolipids, whereas WTEIA forms covalent bonds with peptidoglycans. Peptidoglycans from Lactobacillus spp. prevent the release of inflammatory cytokines. In addition, peptidoglycan from *L. rhamnossus* improved the innate immune response in mice infected with pathogenic Streptococcus spp. LTEIA can also be an effective treatment for skin infections and prevention of bacterial and viral infections through the production of defensins and cathelicidin.

To date, the only cell wall component-related study used on canines is the supplementation of yeast (*Sacharomyces cerevisiae*) cell wall fraction (YCWF) and YCWF derived active mannoproteins fraction in the diets of adult and/or elderly dogs. In one study, YCWF improved the intestinal health of adult beagle dogs undergoing an abrupt dietary transition (Lin et al., 2020). In one study, YCWF was evaluated as a potential prebiotic when added to the diets of adult beagle dogs (Theodoro et al., 2019). In contrast, mannoproteins derived from YCWF were able to stimulate beneficial immune responses in adult and elderly canines (Kroll et al., 2020).

Polyunsaturated fatty acids: Polyunsaturated fatty acids (PUFAs) are crucial in canine diets for several reasons. They provide a high-energy source, delivering twice as much energy as carbohydrates and protein, and help in the absorption of fat-soluble vitamins. Supplementing omega-3 fatty acids, a type of PUFA, can reduce inflammation by decreasing the production of inflammatory mediators. PUFAs also play vital roles in the development of essential organ systems. For example, linoleic acid supports canine coat health by maintaining the skin's water barrier, while docosahexaenoic acid (DHA) is important for the brain, retina, and immune system development in both puppies and adult dogs. Canines require two types of essential PUFAs—omega-3 (O3FA) and omega-6 (O6FA)—as they cannot synthesize them. Deficiencies in omega-6 fatty acids like linoleic acid and arachidonic acid can lead to skin, coat, and reproductive issues, while omega-3 fatty acids like DHA, eicosapentaenoic acid (EPA), and alpha-linolenic acid (ALA) are critical for neurologic and visual health. While low concentrations of PUFAs have anti-inflammatory benefits, high concentrations can increase susceptibility to free radical oxidation, which may cause negative health effects (Baritugo et al., 2023).

Phytonutrients: Phytonutrients and phytochemicals are natural compounds exclusively present in plants. These are usually pigment that give dietary plants unique colors. While most phytonutrients are non-essential, their anti-inflammatory, antioxidant, and anti-carcinogenic roles have been evaluated for the promotion and maintenance of canine health and the prevention of chronic and aging-related diseases (Arshad et al., 2021). This section briefly defines the different kinds of phytonutrients.

Carotenoids: Carotenoids are fat-soluble pigments that are present in red, orange, and yellow vegetables and fruits. Over 600 different kinds have been identified, but only six are commonly found in commercially available canine and human dietary supplements and food: á- and â-carotene, lycopene, zeaxanthin, cryptoxanthin, and lutein. Furthermore, â-carotene, lycopene, canthaxanthin, and astaxanthin have been used as pigments in the commercial production of pet food including dog and cat foods (Dufoss´e et al., 2005). Carotenoids can be classified into two groups: carotenes (lycopene, á- and â-carotene) and xanthophylls (astaxanthin, â-cryptoxanthin, zeaxanthin, lutein).

Polyphenols: Polyphenols are a broad group of phytonutrients that can be divided into five sub-groups: (1) flavonoids, (2) stilbenes, (3) lignans, (4) phenolic acids, and (5) coumarins. Lignans are largely found in sesame and flax seeds, whereas small amounts are present in cereals, fruits, and vegetables. They are often prescribed to treat Cushing's disease in dogs (Fritsch et al., 2023). Stilbenes such as piceatannol and resveratrol are commonly found in berry fruits and black/red grapes, but they are toxic to dogs. However, daily supplementation with resveratrol (200 mg/kg) is considered safe for dogs.

Phytosterols: Phytosterols are plant-based steroids that have additional antidiabetic and anti-atherosclerotic activities, as well as the usual antioxidant and anti-inflammatory properties associated with phytonutrients. Phytosterols can be classified into plant sterols and stanols. Sterol groups included stigmasterol, campesterol, and â-sitosterol. The stanols group is composed of stigmastanol and campestanol. Phytosterols are found in oils, vegetables, fruits, nuts, seeds, and beans. Phytosterols play an important role in the reduction of high plasma triglyceride and cholesterol levels in hyperlipidemic dogs (Borin-Crivellenti et al., 2021).

These functional foods can help prevent or remediate some diseases and improve the overall health and well-being of canines. Some functional foods are regarded as medicine for specific diseases, such as prebiotics and probiotics for chronic enteropathies, obesity, metabolic disorders, and phytonutrients for high blood pressure, oxidation, and cellular damage. Recently, investigations into the effects of different formulations of probiotics and prebiotics in synbiotics for canine diseases have gained much attention because they directly affect the gut microbiome, which is responsible for most host functions.

Conclusion

In conclusion, the evolving field of nutritional modulation for pet health presents promising advancements aimed at optimizing well-being and longevity. The integration of *nutrigenomics* holds significant potential, allowing us to understand how genetics and nutrition interact to personalize pet diets for better health outcomes. Additionally, the modulation of the *microbiome* has emerged as a critical factor in maintaining digestive and immune health, with growing evidence supporting its role in disease prevention. Anti-aging and cognitive health diets further highlight the importance of targeted nutrition in enhancing the quality of life for aging pets, improving both longevity and mental acuity. The exploration of *alternative protein sources* and *novel diets* responds to the increasing demand for sustainable and specialized feeding options, ensuring pets with diverse dietary needs are adequately supported. Lastly, the rise of *functional foods and therapeutic diets* emphasizes the role of nutrition in managing chronic conditions and promoting overall health. Collectively, these newer approaches underscore the importance of a more individualized, science-based approach to pet nutrition, ultimately improving both the quality and longevity of their lives.

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Animal Husbandry: Animating the Agriculture Sector

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How and why does the term husbandry get associated with animals, but not with crops or other production systems? Domestication of plants, and more importantly animals marked a major and dramatic turning point for humans: the beginning of an agricultural way of life, resultantly a more permanent and stable civilization. The domesticated creatures also became integrated into the social and cultural spheres of human lives. All across civilisations and religions, domesticated animals came to symbolize order as opposed to the chaos of the untamed world.

Let us, therefore, give a serious thought to Animal Husbandry and understand how this has infused dynamism to the agriculture sector. Livestock food products are energy and protein rich as also sources of many of the essential nutrients. Livestock species and breeds are adapted to a wide range of environments, so they are ubiquitous. Obviously the sector has great potential to contribute significantly to the eradication of hunger and malnutrition all across the world, even in areas that are unsuitable for crop production. Globally, on an average, livestock products contribute 34 percent of protein and 17 percent of calorie intake of human diets, but this contribution is not equitably distributed among regions. The food systems worldwide, especially in the developing countries, motivated by the critical need to ensure food security, focus on providing low-cost calories for the majority of the populace. This often leads to inadequate attention to nutrition and healthy diets resulting in malnutrition which resultantly place a heavy burden on human health and well-being. Improved governance of, and more importantly increased role to, the livestock sector is part of the solution to attaining food and nutrition security to the vast multitudes of the poor and hungry; currently 800 million people are said to be victims of chronic hunger and another 2 billion vulnerable to malnutrition.

Globally more than a billion people depend on livestock value chains for their livelihoods. Small-scale livestock keepers and pastoralists represent a large part of the livestock producers. About 600 million of the world's poor keep livestock and are vulnerable to the vagaries of climate. Livestock for them are an asset for economic resilience and income which, even if small, flows on a regular basis.

The global demand for livestock products is expected to increase by up to 50 percent by 2050, creating further economic opportunities. However, the ability to take advantage of these opportunities is not equal. Small-scale producers have little bargaining power in either input or output markets and limited access to social protection schemes. Many smallholders are women, who often have less access to production resources, credit, knowledge and information and markets. The involvement of youth in farming is also decreasing. Pastoralists are often marginalized and not considered by national policies and programmes.

Increasing the productivity of livestock farming and its better integration with agriculture could be effective means to increase sustainability. Productivity gains and the resultant financial benefits should

be equitable without compromising upon human and animal health or environmental sustainability. The approach along the value chain should be holistic and inclusive, thus empowering the small livestock holder.

Against this background, is it not intriguing that in spite of being one of the fastest growing sectors of our economy at a compound annual growth rate (CAGR) of 8.2% over the past several years, at par with manufacturing and much higher than agriculture, lack of even a basic awareness and recognition have plagued the sector? No wonder the sector has generally remained low in political and governance priorities, ever struggling for public investment and affordable access to capital. However, from another perspective this public and governance apathy has spurred the sector and its stakeholders to develop a strong entrepreneurial and competitive environment. Let us demonstrate how.

"It is a capital mistake to theorize before one has data." The Animal Husbandry aka the Livestock sector has continued to maintain its steady, yet impressive, rate of growth, reveals the Basic Animal Husbandry Statistics (BAHS), an annual publication of the Department of Animal Husbandry and Dairying (DAHD), Government of India. BAHS, an outcome of the Integrated Sample Survey (ISS), is the most credible source of data and information on the sector as the production and other estimates are arrived at following a robust statistical methodology designed by the Indian Agricultural Statistics Research Institute of the Indian council of Agricultural Research (ICAR-IASR). The objective of BAHS, as we should understand, is to turn data into information and information into insight to guide sound policy and plans for the animal husbandry sector.

Let us summarise and dissect the salient features of the BAHS 2024 and while celebrating the incredible growth story of our animal husbandry, also introspect to flag the issues of concern which continue to hold us back from realising our true potential, the impressive milestones notwithstanding. Statistics, especially when they are of high integrity such as the BAHS, should form a sound foundation of future policy, plan and programme design and not be left to languish as an end in themselves. In fact, in my view, BAHS being a repository of reliable and timely data is an indispensable document for policy, planning and decision making.

Our livestock population, the largest in the world, during the year 2022-23 created an output valued at ₹ 17,25,064 crore; add another ₹ 3,83,069 crore contributed by fishery, including aquaculture, the total value of output of the Animal Husbandry and fishery sector is a whopping ₹ 21,08,133 crore. It amounts to a percentage share of 6.80 in the nation's Gross Value Added (GVA) i.e. 5.50 and 1.3 percent respectively for the Livestock and Fishery sectors. In terms of contribution to the GVA of the Agriculture sector, the share of Livestock is 30.23% while Fishery stands at 7.25%. At constant price, the compound annual growth rate (CAGR) registered by the sector during the past decade is above 8%.

Against this background, it would be pertinent to ask whether public investment, be it infusion of finance or infrastructure, policy ecosystem or governance priority are even remotely proportionate to the sector's contribution to the economy and nation building. After all, if the Green Revolution transformed a food deficit nation into a food secure nation, the White Revolution secured livelihoods and empowered rural producers, primarily women and the Blue Revolution has been ushering in prosperity through activities which till now were mere livelihoods. Therefore, it becomes imperative that the

political and governance agenda accord a rightful priority to the sector. The data and figures outlined in the BAHS 2024 would reaffirm this.

We have been the biggest producer of milk in the world for quite some time now. In the decade gone by i.e. between 2014-15 and 2023-24, our milk production grew by 63.5%, increasing from 146.31 million tonnes to 239.30 million tonnes, with a CAGR of 5.62%. This amounts to more than one fourth of the global production. Following us is the United States of America (USA), a distant second, with a production of 102.68 million tonnes, not even half of ours. The 27 countries of the European Union (EU) collectively produced 149.33 million tonnes last year, which is about 90 million tonnes less than our production. The per capita availability of milk has increased to 471 grams per day in 2023-24, significantly higher than the 2021 global average of 394 grams per day. Complacency would be a natural, but a dangerous one, response to this data, even though spectacular.

It is a strange paradox that the richness of unparalleled production gains rests upon the poverty of productivity. The average yield per cow per day, indigenous and non-descript, stands at an embarrassing 3.54 kilogram; the performance of exotic and cross breeds at 8.43 kilogram too is nothing to boast about. The average per day in the prominent milk producing regions of the developed world is an upward of 25 kilograms, with an added benefit of utilisation of the dry animal as beef. A significant number yields 50 kilograms and more. Dairy cattle and buffaloes in the country primarily consume crop residues and by-products; poor nutrition results in low yield and inferior quality. Effective interventions, scientific and economic, are required in both breed and feed.

45.32% of India's milk production is the contribution of the buffalo, an animal we have become indifferent to in our policies and interventions despite its milk being richer in fat and despite owning three fourth of its global population. Moreover, the buffalo remains a productive economic asset beyond its milch life; buffalo meat is one of our biggest exports amongst agriculture commodities. Let there be a concerted plan to nourish this treasure.

The egg production in the country during the year 2023-24 has been a humongous 142.77 billion putting India to the second position in the world after China. 84.59% i.e. 120.77 billion in numbers is the contribution of commercial poultry to this production, while backyard poultry produced 22.01 billion eggs constituting 15.41%. This is a clear indicator that poultry continues its journey towards vertical integration and strengthening its position as an organised industry within the generally unorganised agriculture sector. The growth rate registered over the previous year is 3.18%. Per capita availability of eggs now stands at 103 per annum; though considerable it is yet short of the National Institution of Nutrition, Hyderabad recommendation of 180 eggs per person per year. However, this should not cause concern as the recommendation of EAT-Lancet Commission, a body of world scientists that seeks to develop quantitative targets for healthy diets and sustainable food production, is a desirable intake of 90 eggs per person per year.

A glaring data that calls for response is that 64.37% of the total egg production is by five states only. Further, 53% egg production is by four southern states, their respective shares being Andhra Pradesh: 17.85, Tamil Nadu: 15.64, Telangana: 12.88, and Karnataka: 6.33. West Bengal with 11.37 percent is

the fifth state. There should be no hesitation in admitting that development of poultry in our country, despite commendable, demonstrates a skewed pattern, including regional imbalance. Why so? We need to identify the causes and address them. It is surely a case for expansion and tapping the potential of poultry in other parts of the country. After all, it is the fastest growing agricultural sub-sector, especially in developing countries. Further, poultry offers the most affordable source of animal protein.

Growing at 4.95% over the previous year, we produced 10.25 million tonnes of meat in the year 2023-24 ranking fifth in the world behind China, USA, Brazil and Russia. Poultry has been the major contributor to this production comprising 48.96% followed by buffalo meat at 18.09%, goat 15.50% and sheep 11.13%. Though bereft of regional imbalance as is the case of egg production, quite akin to eggs the meat production sector too shows lopsided development. 57.46% of the total production is the contribution of only five states viz., West Bengal: 12.62, UP: 12.29, Maharashtra: 11.28, Telangana: 10.85, and Andhra Pradesh: 10.42. Such stark variations in production patterns does raise serious questions that we need to answer, especially why the immense opportunities the livestock sector offers are going abegging in several parts of the country.

"Data is the new oil," says Clive Humby, a British mathematician and data scientist. It is valuable, like oil, but it cannot really be used if unrefined. BAHS has, as in each year, given us invaluable data collected, compiled and collated painstakingly. Let us now analyse and refine it for informed decision making.

We are either at the top or near the top in production of almost all the major agriculture and livestock commodities. But we owe this position to our sheer numbers rather than efficient production systems. In absolute terms we are huge, but low productivity plagues us; half the country's population is engaged in agriculture but contributes a meagre less than 16% to the national GDP. This simple fact itself gives a clear idea of how low our productivity is, and what a lost opportunity it amounts to.

The time is more than opportune to reorient our perspective of Animal Husbandry from being a primary livelihood activity to a viable business vocation; accord it a recognition as a prime engine of economic growth and prosperity, and not just a food production system. In any case we produce more than we need; so why should we carry the burden of low value food surpluses. It is important to differentiate between food and animal husbandry, and agriculture too. While food is one of the biggest items of household expenditure, the money flows more to value addition rather than livestock and agriculture. The primary producer generally stays marginalised. Agriculture and Animal Husbandry could do well through a paradigm shift in approach from production to value, from quantity to quality; a model already demonstrated effectively by the poultry and the shrimp farming sectors.

Isn't the performance of the Animal husbandry truly remarkable considering that it has always had to remain in the shadows of agriculture, and the latter has been showered with innumerable concessions and subsidies? This surely is a pointer that the support of subsidies may not necessarily spur growth or even long term financial security. More important is the effectiveness of the policy framework, the operational eco-system and space for the industry and sector to grow. Poultry has organised and integrated itself into an industry; and hence has grown from a primary farming activity into a business enterprise. Our unorganised and backyard poultry sector is one of the potent tools for subsidiary income generation

for many landless/ marginal farmers and also provides nutritional security to the rural poor. More importantly, this too finds integration into the larger production and supply chain; even the relatively sophisticated transition from live birds to chilled and frozen products. And in quite a few stand alone models, this backyard poultry is the source of supply of high value free range eggs and organically produced chicken.

So why not aim for global dominance in the entire gamut of the livestock industry or even the larger agriculture sector? As has been witnessed in poultry and the shrimp, it is quite doable considering the huge size advantage we have.

Rainbow revolution is an attractive name given to the concept and practice of integrated development of agriculture encompassing cereal crops, horticulture, dairy, poultry, aquaculture, meat production etc.; seeing the whole rather than a narrow focus on farm crops. It is a realisation that besides addressing the issue of meeting the rapidly growing consumption and demand of animal protein, it would result in a much greater contribution to enhanced farmer income. Future policies and strategies of agriculture must involve all livestock, poultry and fisheries activities as the real potential of growth exists here. But above all, allow the sector to develop inherent strength and resilience rather than always keeping it overly dependent upon government support.

Husbandry is "to husband", meaning thereby to use with care, to keep, to save, to make last, to conserve; in short a holistic and responsible management. In fact, most and perhaps all of industrial agriculture's manifest shortcomings and even failures are the result of an attempt to make the land and livestock produce more and more without husbandry; in fact husbandry is nothing else but sustainable management and development. We must ensure that Animal and Husbandry remain inseparable, always.

Portia, the rich and beautiful protagonist in Shakespeare's popular play The Merchant of Venice meaningfully says, *"Lorenzo, I commit into your hands / The husbandry and manage of my house."*

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Prospects of veterinary education in India

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Introduction

Veterinary education in India has a promising future driven by country's large livestock population and growing awareness about animal health and welfare. It is vital for the health and well-being of animals as well as humans. Thus, Veterinary professionals play a pivotal role in the country's economy, food security and safety, rural lively hood security, and optimisation of one health. Building day one competency and confidence among the students and to mould them accordingly, providing them with accessibility to the latest knowledge, enhancing their fine skills, and values is the need of the hour to produce competent and compassionate veterinarians. The veterinary colleges across the India are mandated to shoulder this responsibility through minimum standards of veterinary education regulations (MSVER) of VCI so as to have required workforce of suitably qualified professionals.

Current Scenario of Veterinary Education in India

The ever expanding livestock and dairy industries have increased the requirement of veterinarians for optimisation of animal health and productivity. Rising pet ownership has also increased the demand for small animal veterinary care professionals. Wildlife conservation and maintenance of zoological parks have enhanced the demands for skilled veterinarians. Indian healthcare market is expected to grow from 1,169.8 million dollars in 2021 to 1,856.3 million dollars in 2027, with a CAGR of over 7.7 %. Although, number of veterinary colleges and universities have significantly increased over the last decade, there is a still demand for more expansion. At present there are 59 Veterinary Colleges recognised by Veterinary Council of India and 20 more Veterinary Colleges are in the various stages of temporary registration across the country. The number of state Veterinary Universities are also increased significantly and present there are 17 state Veterinary Universities (SVU) in India.

Does Privatisation of Veterinary Education (19 PVC) is a Game changer?

Despite the prospects, the veterinary education in India is facing the challenges like

- ✪ limited resources and infrastructure
- ✪ shortage of qualified Veterinary professionals
- ✪ limited awareness about the Veterinary education and its importance

As per the report of the National Commission on Agriculture (1976), there is requirement of one veterinarian for every 5000 cattle heads, however at present there are only 36 thousand of sanctioned posts of veterinarians as against the actual requirement of about 65,000 Veterinarians. Which has created a gap of more than 45 per cent. Further, about 20 per cent of the sanctioned veterinarian posts approximately are vacant across the nation.

At present about 5000 professionals are graduated every year from 58 government Veterinary colleges/universities and 19 private veterinary colleges/universities. This creates the requirement of about 2500 additional graduates per year in next five years.

- In addition to producing the required number of graduates, there is also a need for focussing on improving the quality of education and infrastructure in Veterinary institutions. As many of the institutions in India face challenges like outdated infrastructure, lack of resources and scarcity of qualified faculty members.
- Many of the veterinary institutions lack modern facilities, equipments and technology making it difficult for the students to receive hands on training and practical exposure.
- There is a requirement of at least one NABL accredited disease investigation laboratory in each state in the next five years. Which ensures that Veterinary laboratories follow standardized procedures, reducing errors and ensuring accurate diagnosis.

Government initiatives and investments in Veterinary Research and Development.

Government of India has launched several initiatives to boost veterinary research and development. One noticeable example is National Animal Disease Control Programme (NADCP), that aims to control and eradicate the disease like FMD and Brucellosis and another significant investment is in Information Network for Animal Productivity and Health – A digital platform that provides real-time data on animal health and disease surveillance.

Indian government also introduced schemes like the Agriclinic and Agribusiness Centres (ACABC) scheme, which provides financial assistance to veterinarians to set up clinics and offer services to farmers. This initiative aims to improve access to veterinary care and promote entrepreneurship in the animal health sector. These initiatives and investments demonstrate the government's commitment to improving animal health and promoting the growth of the veterinary industry in India.

Current Scenario

At present the annual intake in each recognized veterinary college is 80 and some established erstwhile colleges are allowed to increase their annual intake to 100. Among the total number of students admitted (59 colleges x 80 students per college) to the total 59 colleges even If there is 10 % dropouts among the admitted students across the country then the total number of students graduating annually is only 4250. There is no data on the number of students graduating each year in various colleges across the country and there is a need to have national data base.

Admission of Girl students to veterinary institutions in India has seen a significant upward trend over the last decade which reflects broader societal changes and increased encouragement for women to pursue careers in fields traditionally dominated by men.

Challenges and Opportunities

Challenges

Inadequacy of qualified faculty in the veterinary institutions: - There is a shortage of qualified and experienced faculty in veterinary colleges and universities. Due to either of administrative & court

litigations in recruitments, inappropriate salaries, poor working conditions, want of opportunities for professional & career development.

- Especially in pre-clinical (Veterinary Anatomy and Biochemistry Disciplines) and Clinical disciplines (Veterinary Surgery and Medicine disciplines)
- **Infrastructure and resources:** Poor Civil structures, Equipments, instructional farms, teaching hospitals. Many Veterinary colleges lack modern infrastructure and resources, including equipment, libraries, and clinical facilities.
- **Poor research possibilities:** Apart from teaching there is inadequate research capabilities at the institutional level that discourages the young faculty and students to mould their future, so retaining the talent is really a challenge.
- **Curriculum dynamism with the rapid changes:** Instruction being more of theoretical and less of hands on training. The curriculum and syllabus of veterinary programs need to be revised to keep pace with the latest advancements in veterinary science. Although curriculum revision is happening through VCI, but the process is time consuming in culminating the MSVR on ground. This needs a simplification so as to catch and stand on par with Global standards.
- **Need for more practical training facilities:** Providing adequate clinical training to students is a challenge, particularly in colleges with limited clinical facilities.
- **Uneven distribution of Veterinary Colleges and universities:** While some states have a good number of Veterinary institutions, others have very few. This leads to a shortage of veterinarians in certain areas.
- **Accreditation and quality assurance:** Ensuring quality assurance and accreditation of Veterinary programs is essential to maintain standards.
- **New skills:** Towards Day One Competence the Veterinarians are to be well trained to address complex issues like One Health, Climate change, Food safety & Security, TADs, Zoonosis, AMU-AMR, Animal welfare etc. Several veterinarians worldwide have dedicated their efforts and expertise during the recent COVID-19 pandemic in addition to their time immemorial role in guarding the Animal health.
- **Rapidly changing Technology:** The diagnostic area is fast changing through several non-invasive diagnostics. Use of AI & Machine Learning are also being harnessed in Veterinary profession. So capacity building both at the Institution and individual levels are required.
- One Health: This is very unique approach to keep a check on Universal health in all angles. Here the Vets become the Torch bearers monitoring and mitigating the potential transmission of the virus between animals and humans.

Opportunities

- Growing demand for specialized veterinary services (*e.g.*, animal nutrition, wildlife medicine, pharmaceuticals), advancements in veterinary technology, increasing public awareness about animal health and welfare, potential for international collaborations, One Health approach integrating human, animal and environmental health.

Emerging Trends in Veterinary Sciences

Emerging trends in veterinary science are transforming the way veterinarians diagnose the cases and treat the ailing animals and prevent diseases occurrence in the animals. Here are some of the most significant trends:

Focus on preventive healthcare and disease management.

- **Disease Surveillance and Forecasting:** Monitoring and predicting disease outbreaks to enable timely interventions.
- **Epidemiology and Research:** Conducting research on disease patterns, risk factors, and prevention strategies.
- **Extension Services:** Providing training and services to farmers, veterinarians and other stakeholders to promote preventive healthcare.

  Integration of technology in diagnostics and treatment (e.g., telemedicine, AI).

- **Artificial Intelligence (AI):** Being used in veterinary medicine to analyse radiographic images, ultrasounds, and reading of pathology slides. AI-driven telemedicine platforms also facilitate remote consultations and monitoring.
- **Veterinary Telehealth:** Becoming increasingly popular in veterinary care, enabling remote consultations, diagnostics, and follow-up care. AI and machine learning algorithms enhanced the Telehealth services, providing veterinarians with valuable pre-consultation data.

Growing importance of animal welfare and ethical considerations: Animal welfare and ethical considerations are gaining significant importance in India, driven by growing awareness and concerns about animal rights and well-being.

Research on emerging, Re-emerging infectious diseases and zoonotic threats: Research on emerging diseases caused by Avian influenza, Swine flu and Nipah viruses, re-emerging infectious diseases like Rabies, Brucellosis and Leptospirosis and zoonotic threats by Antimicrobial resistance, Vector borne diseases and Prion diseases is crucial for preventing and controlling outbreaks.

Specialization in various fields like Veterinary surgery, Veterinary radiology, Veterinary pathology, Veterinary microbiology, Veterinary ophthalmology and Assisted Reproductive Technology (ART) is need of the hour to keep face with growing demands for specialized veterinarians.

Career Prospects for Veterinary Graduates

Private practice:

1. Companion Animal Practice: Work in clinics, hospitals, or private practices, providing medical care to pets.
2. Large Animal Practice: Work on farms, ranches, or in equine medicine, providing medical care to livestock and horses.
3. Exotic Animal Practice: Work with zoos, aquariums, or wildlife rehabilitation centres, providing medical care to exotic animals.

Government Veterinary services: Department of Animal husbandry and Veterinary Services and public health sectors.

Research and development: Working in government, university, or private research institutes, carrying out research on animal health and disease.

Academic Institutions

1. **Universities and Colleges:** Teaching, Research and Extension at Colleges Universities, and shaping the next generation of veterinarians.
2. **Continued Veterinary Education:** Providing Continued Veterinary Education programs for veterinarians, veterinary technicians and other animal health professionals.
3. **Pharmaceutical and animal health companies:** Working in the development, testing and marketing of Veterinary Pharmaceuticals.

Pharmaceutical and animal health companies: Working in the development, testing, and marketing of Veterinary Pharmaceuticals.

Wildlife conservation organizations: Working with government agencies, non-profit organizations or private companies, conserving and managing wildlife populations. Working in the zoological parks and wild life sanctuaries.

Food safety and inspection agencies: career opportunities as a food safety inspector, veterinary food safety specialist, meat and poultry inspectors, foodborne disease investigator and risk analysis specialist.

Entrepreneurship (Veterinary clinics, Animal shelters).

1. By starting a private veterinary clinic to provide personalized care to clients and their pets
2. By speciality clinics: Such as a veterinary dental or surgical clinic, can cater to a specific need in the market and attract clients seeking specialized care.
3. By mobile clinics: To provide convenient and accessible veterinary care to clients in remote or underserved areas.
4. Telemedicine: To expand our reach and to provide convenient care to clients remotely.

Government Initiatives and Support

- Schemes for infrastructure development in Veterinary Colleges.
- Scholarships and fellowships for Veterinary students.
- Funding for research projects and disease control programs.
- Initiatives to promote animal health and welfare.
- Collaboration with international organizations.
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The Way Forward

- Continuous veterinary curriculum revision and modernization: Essential to ensure that Veterinary graduates are equipped with the latest knowledge, skills and competencies to address the evolving needs of the animal health industry.
- Emphasis on practical training and clinical skills: Essential for preparing competent and confident veterinarians.
- Strengthening research and development in veterinary science: Crucial for advancing animal health, welfare, and productivity.
- Promoting collaboration between academia, industry and government.

1. By establishing partnerships between academia, industry, and government to facilitate knowledge sharing.
2. By creating Joint Research Initiatives: To bring together experts from different sectors to tackle complex animal health challenges.
3. By developing Industry-Academia Exchange Programs: To enable professionals to work in different sectors, fostering collaboration and knowledge transfer.
4. By organizing conferences and workshops: To bring together stakeholders from different sectors to share knowledge, ideas, and best practices.
5. By fostering communication and networking: Encourage communication and networking between stakeholders from different sectors can help build relationships and facilitate collaboration.
6. Raising awareness about the importance of veterinary education: Important for promoting the value of veterinary professionals and the impact they have on animal health, welfare, and society.

Conclusion

- ✪ **Headline:** Investment in Animal Health is Investment in Our Future
- ✪ **Summary:** Reiterate the importance of veterinary education and its contribution to society.
- ✪ **Call to Action:** Encourage students to take up a career in veterinary science.
- ✪ The Prospects of veterinary education in India is dazzling, with an increased demand for veterinarians to safe guard Education, Research, Extension.
- ✪ Indian veterinary sector is projected to grow at a CAGR (Compound Annual Growth Rate) of 7.5% between 2020 and 2025, driven by factors such as increasing awareness of animal welfare, rising demand for dairy and meat products, and the growing pet care industry.
- ✪ It high time to adapt to the changing landscape for a better top notch veterinary education in India

- ✪ **Focus on One Health:** Veterinary education will increasingly focus on the One Health approach, which recognizes the interconnectedness of human, animal, and environmental health. This will lead to more emphasis on topics such as zoonotic diseases, food safety, and public health.
- ✪ Increased use of technology: Technology is playing an increasingly important role in veterinary medicine, and veterinary education will need to keep up with the latest advances. This could include the use of virtual reality and augmented reality for training students, as well as the use of telemedicine to provide veterinary care to animals in remote areas.

Measures in Place

- Indian Veterinary Research Institute (IVRI) has established a National Centre for One Health, which is working to develop and implement One Health-based approaches to veterinary education and research.
- Veterinary Council of India (VCI) has updated its curriculum to include more emphasis on topics such as zoonotic diseases, food safety, and public health
- Many veterinary colleges in India are now offering specialized programs in areas such as companion animal medicine, equine medicine, and food animal medicine, wild life veterinary medicine.
- Several SVUs have initiated innovative centres, programs etc.
- Strengthening the Veterinary Council of India (VCI) and State Veterinary Councils (SVCs)
- Increase the funding for veterinary education
- Update the veterinary curriculum
- Improve the quality of veterinary faculty
- Increase the number of veterinary internship and externship programs
- Promote continuing veterinary medical education (CVME)

Veterinary Education Mission 2025-30 Under AHIDF & or NLM

- ➢ Central Veterinary, Animal & Fisheries Sciences University - CVAFSU
- ➢ Regional / National Veterinary colleges - 6
- ➢ Regional / National Dairy Technology Colleges -2
- ➢ Regional / National Fisheries College – 1
- ➢ Pashu Vignyan Kendras (PVK) - 9
- ➢ Remount Veterinary Corps (RVC) can plan for Army Veterinary College (AVC) - 1
- ➢ Faculty Recharge Centre under VCI wherein faculty will be brought periodically to upgrade their skills towards better instruction to students.
- ➢ Need for a Indian Veterinary, Animal & Fisheries Research Council (IVAFRI)

Recommendations of WOAH Virtual workshop of Veterinary Education Establishments (VEEs) in India, 21 April 2021

A) Veterinary Council of India

1. To communicate & collaborate with VEEs of the Region and Country level
2. To consult WOAH experts during curricula revision

B) Veterinary Education Establishments

1. WOAH guidelines in teaching
2. Preparedness for teaching during emerging pandemic situations based on lessons learnt during Covid-19 pandemics
3. GADVASU to share experiences of Twinning with other VEEs

C) Veterinary Services

1. Enhance communications with VEEs & VSBs regarding development of sector specific skills development
2. Preparedness in rendering services during pandemic situations based on lessons learnt in Covid-19 pandemics
3. Organise workshops for Vets & Paraprofessionals on AMU-AMR

TS4-LP-03

Veterinary Profession in the Wake of Changing Global Scenario

Prof. R.N. Sreenivas Gowda
Former Vice Chancellor, Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar

Animal Husbandry is making a significant contribution to the national economy and socio-economic development in the country. In rural India where over 15-20% families are landless and about 80% of the land holders belong to the category of small and marginal farmers, livestock is the main source of livelihood. In the absence of fertile lands and assured irrigation which are controlled by a small population of rich farmers and lack of employment in the industrial and service sectors, most of the rural families belonging to socio-economically weaker sections of the society maintain different species of livestock to supplement their income. While the land owners prefer cattle and buffaloes, the landless prefer to own sheep, goat and poultry. With the policy of the State Animal Husbandry Department to extend free breeding, vaccination and veterinary services and permit free grazing on community lands, the farmers were encouraged to expand their herd size without any major financial burden. This has probably been the reason for the presence of the world's largest livestock population in India. India ranks first in cattle and buffalo population, second in goat, third in sheep and seventh in Poultry.

Livestock and agriculture sector contribute 30% of gross domestic product. Over 70% are dependent in these sectors for livelihood. Advanced technologies of health, management, disease control and production of livestock including poultry has ranked India the First milk producer, second largest egg producer and 4th largest broiler producer in the world scenario. Poultry sector has shown 20% annual growth rate, 1200 billion mega poultry industry is at a takeoff stage to enter into the international market. Indian poultry market consisting broilers and eggs was worth INR1,750 Billion (2018) The market is further projected to reach INR4,340 Billions by 2024.

- Significant increase in production of milk, meat eggs and wool were made by the combined effects of veterinarians and livestock owners.
- Our country is a global leader in milk production growing at an annual rate of about 6.5%, the estimated milk output of 188 million tons in 2018-19, was worth Rs 6,54,000 crore – more than the combined value of wheat and paddy.
- Egg production is growing at a staggering 8%, crossing the 100 billion number and touching 104 billion in the fiscal year gone by. At an average rate of Rs 4, the 100 billion-plus egg production would be worth over Rs 40,000 crore annually, with the roughly 4 million tons of poultry meat at Rs 75/kg adding another Rs 30,000 crore.
- Fish production has consistently growing at roughly 7% i.e. at 13.7 million tones and is next to China. Similarly, Marine products are also the single largest agricultural export commodity
- Infectious diseases were contained by use of biologicals & Veterinary Techniques.

- Productivity was enhanced through cross breeding and better management by veterinarians
- Improved antibiotics, anthelminthics, quality vaccines and diagnostic kits led to reduction in the number of outbreaks of infectious diseases are invented and checked by veterinarians.

Animal husbandry is an important sector, which can meet three demands

- Gainful employment to millions of people (Marginal and landless persons)
- Providing adequate animal protein to children, mother and other people
- Production of organic manure to fertile soil

It is estimated that by the end of 2030 we need 150 metric tones of milk, 4-5 metric ton of egg, 12-14mt of fish.

Animal Husbandry- Pivotal role

- Sustainable development through application of technologies
- Vigil in control and prevention of various diseases
- Neglecting the health of animals not only leads to loss in production but also superior germplasm.

Veterinary science covers all veterinary activates including **animal production & health** coverage. It is core discipline that performs essential **public health** functions and directly influences human health in following ways.

1. Professional knowledge and experience is used to respond to infectious disease outbreaks and intoxication from animal and environmental reservoirs including products of animal origin
2. Health care services and health research for both human and animals have common activities.
3. Veterinary science emphasizes preventive, economic and population aspects of animal health and production, as they relate to human health and well-being.
4. In the forthcoming decades, there is an urgent need to expand the links between human and animal medicine. For eg.,At least one half of the 1700 agents known to infect humans have animal or insect vector or reservoir and may emerge infections either.

Veterinary science contributes to human health by promoting the health of the animals, which provide necessary income, food, transport, draught power and the raw materials for clothing through out the world. By promoting animal health, the quality and quantity of animal products is enhanced. This is especially important in developing countries where food of animal origin help to improve the nutritional status of mal nourished people by providing high quality protein and micronutrients. The use of manure as fertilizer and fuel increases crop production especially in small scale farms.

Equitable distribution of food within family, community and nation will contribute to health equity, One of the global health targets of **HEALTH FOR ALL IN THE 21ST CENTURY** which emphasizes: "One World One Health".

- Making available safe food
- Safe drinking water
- Adequate sanitation
- Adequate shelter in sufficient quantity & quality to every person
- Activity in promoting human health
- High quality food, especially for children & women

Role of Veterinarians In Food Production Chain:

- A change in the focus from individual animal to herds and populations and system based controls (eg. Hazard analysis critical control point (HACCP)
- Increased responsibility of participants at all points in the food production chain to certify the quality of all phases of production and the final products
- Development and implementation of new technologies for food and feed production, preservation and commercialization, and related problems of toxic residues and improved standard of hygiene.
- Implementing and ensuring compliance with the requirements of international agreements and convention (eg. WTO agreement on application of sanitary and phyto-sanitary measures) and national regulation, both to allow access to international market and to guarantee the internal market by certification of product.

Core domain of Veterinary Profession is production and protection of animals through diagnosis, surveillance, epidemiology, control, prevention and elimination of zoonosis.

- Food production
- Management of health aspects of lab animal facility & diagnosis facility.
- Biomedical research, health education & extension
- Production & control of biological products and medical devices.

Interaction Between Human and Animals

- Changing the incidence of animal related hazards (eg. those associated with zoo tourism)
- Role of companion animals and human well being
- New requirement connected with increasing urban and periurban population
- Biomedical applications (eg. Xenotransplantation)

Role of Veterinarians in Environmental Pollutants

Researchers in recent years have drawn attention to the fact that environmental estrogens and other potential hormone disrupting compounds are widespread and persistent in the environment; they are likely to be present in drinking water, plastics, household products and food packaging and in the human food chain. To date, some 60 chemicals have been identified as endocrine disrupters (i.e. exogenous

agents that interfere with various aspects of natural hormone physiology). Octylphenol (OP) is one of several compounds found in the environment that possesses estrogen mimicking action in vivo. The potential reproductive and health hazards by such environmental chemicals have generated concern among the scientific community, policy makers and the general public. There are those who claim that declining human male fertility may be due to global pollution with synthetic chemicals, which have very weak estrogenic and or androgenic potency. There have also been suggestions that, during the last 20 years puberty and human menopause are occurring earlier in humans and endocrine disturbing compounds may be influencing the timing of adult reproductive transition. Using sheep as their animal model, workers in Scotland found that administration of environmental estrogenic chemical (OP) would inhibit foetal follicle stimulating hormone secretion. This provide one explanation of how such chemicals may adversely affect adult reproductive potential

Natural and Man Made Disasters

- ✪ Increasing demand for Veterinary services to respond to non epidemic emergencies such as weather related problems (eg Drought, famines, floods, hurricanes), earth quakes, industrial and nuclear accidents and to epidemics.

Today's veterinarians are the only doctors educated to protect the health of both animals and people. They work hard to address the health and welfare needs of every species of animal. Veterinarians also play critical roles in environmental protection, research, food safety, and public health.

Veterinarians can take significant role in public health:

- ➢ Investigation epidemiology and contro
- ➢ l of non-zoonotic, communicable diseases.
- ➢ Social behaviour and mental aspects of human-animal relationships, setting up of animal welfare standards.
- ➢ Epidemiology and prevention of non-infectious diseases.
- ➢ Leadership management & administration of public health and environmental agencies including Government, private and academic institutions.
- ➢ Risk analysis, health economics, cost benefit, cost analysis, effective new analysis & other methods to evaluate health care.
- ➢ Social context of delivery of veterinary services, especially to human in rural areas who have been traditionally under served by veterinary services who have great potential in preventing infection & zoonotic diseases.

Zoonotic Diseases

- ➢ Patterns of zoonotic disease will change. During the past few years many zoonotic diseases have occurred as newly recognized (Emerging) or previously recognized(Reemerging) diseases., There are many reasons for the increased occurrence of zoonotic disease including alteration of environment, establishment of human settlements in formerly uninhabited areas, a greater demand

for animal protein , intensification of animal production, acceleration of trade in live animals, animal products and other food stuffs.

- The classical example is the present situation of CoVid 19
- E. coli infection was confined to North America until mid 1990s , now found throughout the world, similarly Salmonellas via eggs have spread enormously world wide since detected in the U.K. BSE has also spread rapidly from U.K to number of countries since 1980s and now threatens to become endemic in certain European countries
- Porcine reproductive and respiratory syndrome which spread through out Europe in the early 1990s and even in Canada, Mexico and the U.S.A.
- Cold water vibriosis was confined to fish of the Norwegian island of Hitra for some years, but in 1993 it spread to Canada and USA.
- One of the more dramatic development Cyclosporiasis, a coccidium found in migratory birds in central America caused a outbreak of human disease in USA.
- Avian Influenza, which was dominant has now surfaced up and a threat to human life.

Challenges toward the Year 2030

Reinvigorating animal agricultural research is essential to sustainably address the global challenge of food security. The demand for food from animal agriculture is anticipated to nearly double by 2030. Increased demand is due, in part, to a predicted increase in world population from 7.2 billion to between 9 and 10 billion people in 2050 (United Nations, 2013). The increase in population puts additional pressure on the availability of land, water, and energy needed for animal and crop agriculture. During this period, it is also anticipated that there will be significant growth in per capita animal meat consumption related to increasing urbanization and income in developing countries. Global environmental challenges, including global climate change, and the growing threat of disease transmission to and from agricultural animals add further challenges to sustainably meeting the demand for animal agriculture in 2050. Even in a stable world, the animal agricultural research enterprise would be significantly challenged to help rectify the current unequal distribution of animal calories and the need to integrate social science research so as to better understand and respond to changing consumer preferences.

GLOBALIZATION OF TRADE

Globalization of trade has facilitated the spread of food borne infections and diseases, such as BSE in cattle & Bird Flu in poultry. Accordingly, food and livestock feed need to be closely monitored during production, as well as during handling, processing and distribution. It is not enough blame outbreaks on condition during production, if product control at later stages is substandard. Similarly, the whole chain of responsibilities must be transparent from beginning to end.

Leadership is needed to achieve this, because a disease outbreak in one country cannot be seen as merely a local disaster. It must be perceived as a Global problem. The classic example is recent spread of Bird Flu in South East Asia and some parts of Europe. No country is sufficiently isolated or protected to ensure the population-human and animal- is safe. It is vital for the control and maintenance of the health to have “forward defenses to prevent and control food borne infections and diseases. This process demands an International partnership capable of guaranteeing food quality and food safety programme that are integrated with strategies for public health and sanitary control.

Increasing National and International trade in animals and animal products has led to emergence and reemergence of zoonotic diseases may be the consequence of new patterns in food trade or in some cases.

Global Trends in Veterinary Care

The veterinary industry is undergoing significant changes, primarily driven by advancements in technology, a growing focus on preventative care, increased pet owner expectations, and a shift towards specialized veterinary services like telemedicine, with key trends including: greater use of diagnostic tools, personalized medicine, alternative therapies, a "One Health" approach, and increased emphasis on client education and communication; all aimed at providing more comprehensive and tailored care for animals.

Key changes in the veterinary industry:

Technological advancements:

Telemedicine: Remote consultations with veterinarians becoming increasingly common.

Advanced diagnostics: Availability of sophisticated imaging techniques like MRI and CT scans for improved diagnosis.

Genetic testing: Wider use of genetic testing to identify potential health risks in pets.

Artificial intelligence (AI): AI tools for analyzing medical data and assisting with diagnoses.

Remote monitoring devices: Devices to track vital signs and behavior in pets at home.

HIV/ AIDS EPIDEMIC

The HIV/AIDS epidemic has also caused an additional challenge to Veterinary Profession in developing countries. More than 90% of the estimated 36 million people living with AIDS live in developing countries. The impact of epidemics in these countries has been greatest in rural areas and has spread to rural areas, where it has impaired food production, including animal husbandry. One of the major challenges for the study group is to propose measures that would ensure a wider understanding of the concepts of the Veterinary Profession. This would require a major cultural change among the health professionals especially Veterinarians, many of whom have little or no background in public health. Ultimately these changes will have to achieved by modifying the curricula at both the professional and the post graduate levels.

CONCLUSION

The veterinarian has to gear up to tackle emerging issues in control of human diseases. Besides meeting the demand for animal products, production of safe food is another task. The role of veterinarians in building healthy minds of the country is commendable in guarding animals against zoonotic diseases. Veterinarians play a vital role in society by protecting the health of animals and people, and by contributing to the environment. Therefore, veterinary profession is a noble profession. Let us keep the light of this profession to glow brightly in future through you fellow veterinarians.

Brief of Brooke Hospital for Animals

The Brooke is an international charity that protects and improves the lives of horses, donkeys and mules, which gives people in the "Global South" or "world's most fragile states" the opportunity to work their way out of poverty for better livelihoods and resilience.

Vision: is of a world in which working horses, donkeys and mules are free from suffering and have a life worth living.

Mission: is to achieve immediate and lasting positive change in the lives of working horses, donkeys, and mules and the communities that depend on them.

In India, Brooke has been working since 2000 to improve the lives of vulnerable working equids and communities in some of the country's most challenging areas.

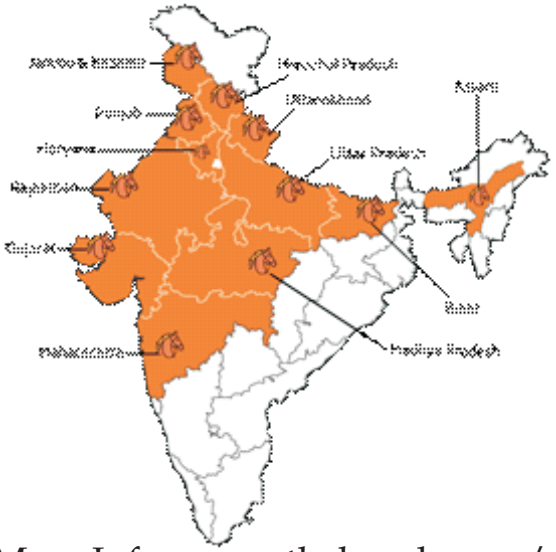
Our Reach

Through its multi-disciplinary teams, BI runs 36 Equine Welfare Projects (EWPs) across 12 States of India and works in approximately 1,778 brick kilns.

Direct Reach: is approximately 2,08,321 working equids and its **Indirect Reach** is approximately 550080.

BI actively incorporates the One Health framework by addressing zoonotic diseases, promoting hygiene, and encouraging sustainable health practices in rural communities where people and working equines live in close proximity.

BI has entered into 37 Memoranda of Understanding (MoUs) with notable institutions, including veterinary universities and civil society organizations (CSOs).



More Info: www.thebrooke.org/our-work/india

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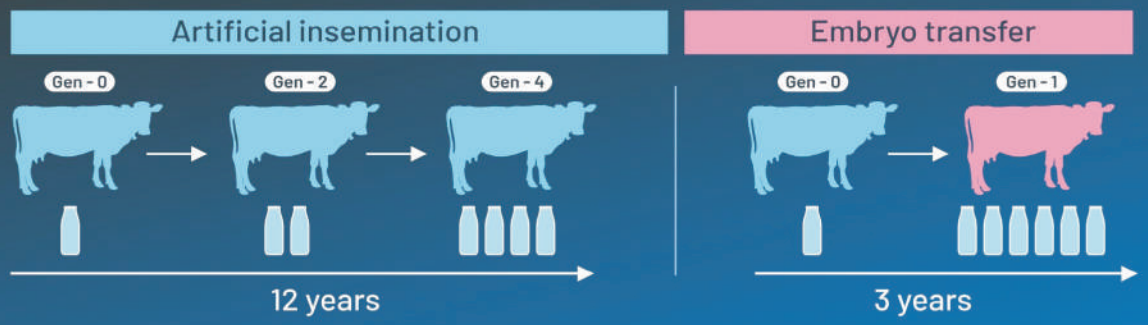

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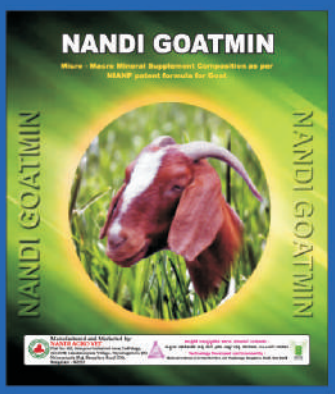

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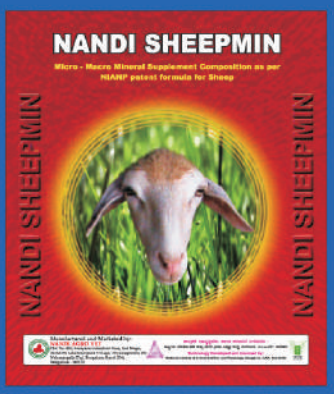

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ನರಡಿ ರೋಗ ಲಸಿಕೆ
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ವೈರಾಣು ಲಸಿಕೆಗಳು

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ಕುರಿ ಸಿಡುಬು ಲಸಿಕೆ
ರೇಬಿಸ್ /ಹುಚ್ಚು ನಾಯಿ ರೋಗ ಲಸಿಕೆ
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ಕುಕ್ಕುಟ ಲಸಿಕೆಗಳು

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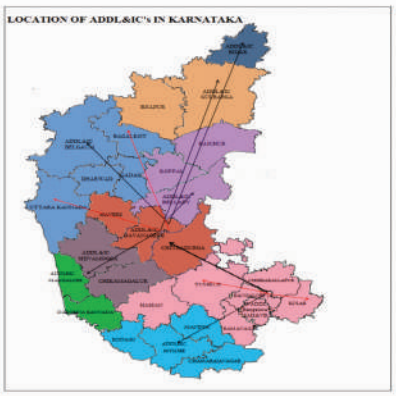
ಸಾಲ್ಮೋನೆಲ್ಲ ಪುಲ್ಲೋರಂ ಪ್ಲೇನ್ ಪ್ರತಿಜನಕ
ಸಾಲ್ಮೋನೆಲ್ಲ ಪುಲ್ಲೋರಂ ಬಣ್ಣದ ಪ್ರತಿಜನಕ
ಬ್ರುಸೆಲ್ಲಾ ಅಬಾರ್ಟಸ್ ಪ್ಲೇನ್ ಪ್ರತಿಜನಕ
ಬ್ರುಸೆಲ್ಲಾ ಅಬಾರ್ಟಸ್ ರೋಜ್ ಬೆಂಗಾಲ್ ಪ್ಲೇಟ್ ಪರೀಕ್ಷಾ ಪ್ರತಿಜನಕ
ಬ್ರುಸೆಲ್ಲಾ ಅಬಾರ್ಟಸ್ ಮಿಲ್ಕ್ ರಿಂಗ್ ಪರೀಕ್ಷಾ ಪ್ರತಿಜನಕ
ಮೈಕೋ ಪ್ಲಾಸ್ಮಾ ಬಣ್ಣದ ಪ್ರತಿಜನಕ

ಪ್ರಾದೇಶಿಕ ಸಂಶೋಧನಾ ಕೇಂದ್ರಗಳು



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ಬೀದರ
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ವಿಜಯಪುರ
ಧಾರವಾಡ

ರೋಗ ತನಿಖಾ ಸೌಲಭ್ಯಗಳು

ಕರ್ನಾಟಕ ಪಶು ವೈದ್ಯಕೀಯ ಮತ್ತು ಮೀನುಗಾರಿಕೆ ವಿಶ್ವವಿದ್ಯಾಲಯ
ಪಶು ಆರೋಗ್ಯ ಮತ್ತು ಜೈವಿಕ ಸಂಸ್ಥೆ, ಬೆಂಗಳೂರು
ಪ್ರಾದೇಶಿಕ ಪಶು ರೋಗ ತನಿಖಾ ಪ್ರಯೋಗಾಲಯ, ಬೀದರ

ಲಭ್ಯವಿರುವ ರೋಗ ತನಿಖಾ ಸೌಲಭ್ಯಗಳು :

1. ಜಾನುವಾರುಗಳ ರೋಗ ಪರೀಕ್ಷೆ	DISEASE INVESTIGATION
2. ಸಗಣಿ ಪರೀಕ್ಷೆ ಉಐಐಎ	DUNG EXAMINATION
3. ಮೂತ್ರ ಪರೀಕ್ಷೆ	URINALYSIS
4. ರಕ್ತ ಪರೀಕ್ಷೆ	HAEMATOLOGY
5. ಚರ್ಮ ಪರೀಕ್ಷೆ	SKIN SCRAPINGS
6. ಮೂಗಿನ ಗೊರ್ಜೆ ಪರೀಕ್ಷೆ	NASAL DISCHARGE TEST
7. ಪರೋಪ ಜೀವಿಗಳ ಪರೀಕ್ಷೆ	HAEMO PROTOZOAN PARASITES
8. ರಕ್ತದ ಜೀವ ರಸಾಯನ ಪರೀಕ್ಷೆ	BIOCHEMICAL TESTS (Calcium, Phosphorous, Magnesium, Liver & Kidney Function tests)
9. ಆಹಾರ ಪರೀಕ್ಷೆ	FEED ANALYSIS (Protein, Minerals, Total ash, Aflatoxin, Ochrotoxin)
10. ಕ್ಷಯ ಮತ್ತು ಜೋನ್ಸ್ ಕಾಯಿಲೆಗಳ ಪರೀಕ್ಷೆ	TB & JD TESTS
11. ಕಂದು ರೋಗ ಪರೀಕ್ಷೆ	BRUCELLA TESTS
12. ಲೆಪ್ಟೋಸ್ಪೈರಾ ರೋಗ ಪರೀಕ್ಷೆ	LEPTOSPIRA TEST
13. ಪಶು ಮತ್ತು ಕೋಳಿ ಮರಣೋತ್ತರ ರೋಗ ಪರೀಕ್ಷೆ	ANIMAL & POULTRY POSTMORTEM
14. ಹಿಸ್ಟೊ ಪ್ಯಾಥಾಲಜಿ	HISTOPATHOLOGY

ಜಾನುವಾರು ಲಸಿಕೆ ವೇಳಾಪಟ್ಟಿ

ಬ್ಯಾಕ್ಟೀರಿಯಲ್ ಲಸಿಕೆಗಳು

ರೋಗ	ಲಸಿಕೆಯನ್ನು ಹಾಕಿಸಬೇಕಾದ ತಿಂಗಳು	ಯಾವ ಜ್ಯಾತಿಗಳಿಗೆ ಲಸಿಕೆಯನ್ನು ಹಾಕಿಸಬೇಕು	ಯಾವ ವಯಸ್ಸಿಗೆ ಲಸಿಕೆಯನ್ನು ಹಾಕಿಸಬೇಕು
ಚಪ್ಪೆ ರೋಗ	ಏಪ್ರಿಲ್	ಜಾನುವಾರುಗಳಿಗೆ, ಕುರಿ ಮತ್ತು ಮೇಕೆಗಳಿಗೆ	ಆರು ತಿಂಗಳಿಗೆ ಮೊದಲ ಡೋಸ್, ಒಂದು ತಿಂಗಳ ನಂತರ ಎರಡನೆಯ ಡೋಸ್ ಹಾಗೂ ಪ್ರತಿ ವರ್ಷಕೊಮ್ಮೆ
ಗಳಲೆ ರೋಗ/ ಗಂಟಲು ಬೇನೆ	ಮೇ ಮತ್ತು ನವೆಂಬರ್	ಜಾನುವಾರುಗಳಿಗೆ, ಕುರಿ, ಮೇಕೆಗಳಿಗೆ ಮತ್ತು ಮೊಲಗಳಿಗೆ	ಆರು ತಿಂಗಳಿಗೆ ಮೊದಲ ಡೋಸ್ ನಂತರ ವರ್ಷಕ್ಕೆ ಎರಡು ಬಾರಿ
ಕರಳು ಬೇನೆ	ಜೂನ್ ಮತ್ತು ಡಿಸೆಂಬರ್	ಕುರಿ ಮತ್ತು ಮೇಕೆಗಳಿಗೆ	ಮೂರು ತಿಂಗಳಿಗೆ ಮೊದಲ ಡೋಸ್ ನಂತರ ವರ್ಷಕ್ಕೆ ಎರಡು ಬಾರಿ
ನೆರಡಿ ರೋಗ	ಜನವರಿ	ಜಾನುವಾರುಗಳಿಗೆ, ಕುರಿ, ಮೇಕೆ ಮತ್ತು ಹಂದಿಗಳಿಗೆ	ಆರು ತಿಂಗಳು ಮೇಲ್ಪಟ್ಟು ಜಾನುವಾರುಗಳಿಗೆ ಮತ್ತು ಮೂರು ತಿಂಗಳು ಮೇಲ್ಪಟ್ಟು ಕುರಿ, ಮೇಕೆ ಮತ್ತು ಹಂದಿಗಳಿಗೆ ವರ್ಷಕ್ಕೆ ಒಂದು ಬಾರಿ

ವೈರಲ್ ಲಸಿಕೆಗಳು

ರೋಗ	ಲಸಿಕೆಯನ್ನು ಹಾಕಿಸಬೇಕಾದ ತಿಂಗಳು	ಯಾವ ಜ್ಯಾತಿಗಳಿಗೆ ಲಸಿಕೆಯನ್ನು ಹಾಕಿಸಬೇಕು	ಯಾವ ವಯಸ್ಸಿಗೆ ಲಸಿಕೆಯನ್ನು ಹಾಕಿಸಬೇಕು
ಪಿ ಪಿ ಆರ್	ಜೂನ್	ಕುರಿ ಮತ್ತು ಮೇಕೆಗಳಿಗೆ	ಮೂರು ತಿಂಗಳಿಗೆ ಮೊದಲ ಡೋಸ್ ಮತ್ತು ಪ್ರತಿ ವರ್ಷಕ್ಕೆ ಒಂದು ಬಾರಿ
ಸಿಡುಬು ರೋಗ	ಆಕ್ಟೋಬರ್	ಕುರಿ ಮತ್ತು ಮೇಕೆಗಳಿಗೆ	ಮೂರು ತಿಂಗಳಿಗೆ ಮೊದಲ ಡೋಸ್ ಮತ್ತು ಪ್ರತಿ ವರ್ಷಕ್ಕೆ ಒಂದು ಬಾರಿ
ನೀಲಿ ನಾಲಗೆ ರೋಗ	ಅವಶ್ಯಕತೆಗನುಸಾರ ರೋಗೋದ್ರೇಕ ಸಂದರ್ಭಗಳಲ್ಲಿ	ಕುರಿಗಳಿಗೆ	ಎರಡು ತಿಂಗಳಿಗೆ ಮೊದಲ ಡೋಸ್ ಮತ್ತು ಪ್ರತಿ ವರ್ಷಕ್ಕೆ ಒಂದು ಬಾರಿ
ಕಾಲು ಬಾಯಿ ಜ್ವರ	ಫೆಬ್ರವರಿ- ಮಾರ್ಚ್ ಮತ್ತು ಆಗಸ್ಟ್ - ಸೆಪ್ಟೆಂಬರ್	ಜಾನುವಾರುಗಳಿಗೆ ಮತ್ತು ಹಂದಿಗಳಿಗೆ	ಮೂರು ತಿಂಗಳಿಗೆ ಮೊದಲ ಡೋಸ್, ಒಂದು ತಿಂಗಳ ನಂತರ ಎರಡನೆಯ ಡೋಸ್ ಹಾಗೂ ಪ್ರತಿ ಆರು ತಿಂಗಳಿಗೊಮ್ಮೆ

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Proximate Principles of Different Meat

	Moisture g.	Protein g.	Fat g.	Minerals g.	Energy Kcal	calcium m.g.	Phos m.g.
Chicken	72.2	25.9	0.6	1.3	109	25	245
Beef (Muscle)	74.3	22.1	2.6	1	114	10	190
Goat (Lean)	74.2	21.4	3.3	1.1	118	12	193
Mutton (Muscle)	71.7	20	7	1.3	194	150	150
Pork (Muscle)	72	21	6	1	114	30	200

. All Values are per 100gms of edible portion

. Source : Nutritive Value of Indian Foods, National Institute of Nutrition

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SPECIFICATIONS		BIO-A-PRO
Moisture	Max.	8.0 - 10.0%
Crude Protein	Min.	45.0%
Crude Fat	Min.	6.0 - 7.0%
Total Ash	Max.	32 - 35.0%
Crude Fibre	Max.	2.0%
Calcium	Min.	9.0 - 10.0%
Phosphorous	Min.	4.5 - 5.0%
Sand & Silica	Max.	2.5 - 3.0%
Lysine	Min.	2.0%
Methionine	Min.	0.6%
Pepsin Digestibility	Min.	85.0%
ME Value		2000 - 2200Kcal/Kg

Manufactured at our most sophisticated automatic plant at Kanchipuram (Tamil Nadu).

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