The Blue Cross Book

For the advancement of the veterinary profession

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From Editor's Desk

Animal health and productivity is dependent on disease diagnosis, prevention, proper treatment and also on control and monitoring. Regular surveillance and research to limit the pathogenicity of deadly microorganisms will help in assuring livestock and poultry farms run in healthy atmosphere resulting in high productivity and profitability.

Emphasis must be given to periodically monitor through sero surveillance against many bacterial and viral diseases. Metagenomics – a new concept in microbiological analysis of samples will add value in identifying culturable and non-cultureable organisms. High alert and strong communication system of professionals play vital role to eliminate threat of such emerging and re-emerging diseases of zoonatic importance.

All healthy livestock should be productive and fertile at the doorstep of farmers. When fertility is reduced, new advances and hormonal approaches have given promise to induce both ovulation and conception. Correct use of hormones under regular monitoring by expert is safe and sure approach to make the animals pregnant, which in term will lead to productivity.

Negative energy balance in dairy animals, if not identified and corrected at early stage, will lead to metabolic diseases like ketosis. A cow side test for identification of such condition will definitely be beneficial to livestock owners. Post partum infectious and non infectious complications always succeed during negative energy balance through reduced immune status.

Marketable dairy products must be safe for human consumption. Milk and milk products of superior quality and high nutrient content are preferred by the consumers. Country should prosper in dairy sector with "zero adulteration program" and should set best example of leadership in the world as is available for milk quantity. The consumer safety is also to be extended to poultry and fishery products.

Veterinary clinician is exposed to variety of clinical and surgical cases daily and it is possible to treat ailing animals with different approaches. Communication of clinical experiences will help to provide technical tips to all professionals. Technical discussion on clinical cases is prerequisite for every field veterinarian for updating new concepts and simplified ways suggested by their colleagues through practical experiences.

On behalf of entire editorial team, we wish very warm and hearty wishes to all veterinarians and readers of "The Blue Cross Book". May ensuing season be healthy and conducive to our livestock and poultry growth progress.

Dr. Yash Goyal
Managing Director,
MSD Animal Health

Dear Veterinarians,

This gives me immense pleasure to release the 37th issue of the Blue Cross Book journal, a biannual technical publication from MSD-AH. The publication has an uninterrupted long journey from the year 1993 till date with the support of scientific and technical Veterinary Professionals with their contributions.

To fulfill our vision of "Science for Healthier animals", we will continue to publish this journal for the benefit of Veterinarians working in the field. It is beneficial for them to read the current happenings in the field of health and productivity of livestock sector, published in the form of research and clinical articles shared by Veterinary professionals of colleges and research institutes.

There is a shift of understanding in the minds of farmers that is driving them to invest on small and medium dairy farms with a steady income rather than running backyard livestock. Young entrepreneurs in farming community have started establishing scientifically run dairy and small ruminant farms. The role of veterinarian also moved from only treatment to productivity enhancement of livestock. Programs like calf a year, clean milk production are gaining focus in dairy sector which is a positive sign for the success of industry.

Commercial poultry industry is well advanced in health and productivity compared to dairy sector. However, it is still suffering with emerging and re-emerging diseases affecting its economic growth. MSD-AH is continuously working for developing suitable preventive measures in the form of advanced biologicals with the help of its own diagnostic and research laboratories around the world.

MSD-AH would like to request the Veterinary Professionals working in Universities and Institutes for more and more contributions in the form of articles to be shared for publication of this journal for the benefit of veterinarians.

Best wishes
MSD-AH team

QUALITY PROTEIN FOR A HEALTHY WORLD

BY 2050 IT IS ESTIMATED THERE WILL BE AN EXTRA 2 BILLION PEOPLE IN THE WORLD. TO FEED THEM, WE WILL NEED TO HELP ANIMAL PRODUCERS BECOME MORE EFFICIENT AND MORE SUSTAINABLE.

Animal diseases still cost farmers a significant proportion of their meat, fish and dairy yield. Preventing disease-related costs will be crucial if we are to meet the demand for protein, created by rising standards of living and population growth. In addition, the land and water available for agriculture will only decrease. So not only will our animals have to be healthier, they will have to be reared more efficiently too.

Our portfolio is already focused on helping farmers keep their livestock productive. Targeted intervention with vaccines, therapeutics and performance technologies ensures that animals reach their full weight in good health.

Our global reach also means few companies are better placed to limit production losses from epidemics. To tackle foot-and-mouth disease for example, Merck Animal Health has the resources, including antigen banks managed on behalf of governments, to better prevent and manage outbreaks across international borders.

Review Articles

Research Articles

Clinical Articles

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Emerging and Re-emerging Viral Zoonoses: A threat to Mankind and Vice-versa

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Abstract:

The increase in emergence of viral zoonotic diseases has been associated with new challenges in animal and public health sectors. The extensive distribution of affected animal species and their interaction with humans causes implications in terms of food security and public health risks. New episodes of emerging viral zoonoses involve unique strategies pertaining to risk assessment and management based on fundamental research and traditional approaches. Emphasis should be placed to strengthen the response and preparedness competence considering the importance of public health implications created by the emerging and re-emerging zoonotic viral agents with respect to International health regulations.

Keywords: Virus, Hazard, Animals, Zoonosis, Prevention, Control

Introduction

Zoonotic diseases have gained increasing attention worldwide in the recent years. Zoonoses are among the most frequent and dreaded risk to which mankind is exposed. Human beings have always had contact with animals, relying on them for food, transport, draft-power, labour and companionship. Thus, animals play a significant role in the socio-economic development of country. In such a scenario, emerging viral zoonotic diseases such as Influenza, Ebola Haemorrhagic Fever, and Nipah viral infections have highlighted the need for a better understanding of animal diseases in terms of their epidemiology, mechanisms of transmission to the human population, diagnosis, prevention and control. The World Health Organization (WHO) in 1959 defined Zoonoses as "Diseases and infections that are naturally transmitted between vertebrate animals and man". The impact of zoonotic diseases in animals are tremendous like acute or chronic debilitating illness, Impairment of productivity, mortality, reduced reproductivity, loss of man-hours, monetary/financial loss (for diagnosis, treatment, surveillance and control) with adverse effect on morale of personnel, and loss of export and foreign exchange.

The newly emerging zoonotic diseases pose a significant challenge to food security as well as human and animal health. In order to strengthen the surveillance system considering the significance of emerging and re-emerging viral zoonotic diseases, preparedness and capacity building programmes should be promoted and identify possible economic tools and frameworks to assess the impact of zoonoses and interventions (Martin *et al.,* 2015).

Transmission of zoonotic viral diseases

Zoonotic viral agents can be transmitted to the

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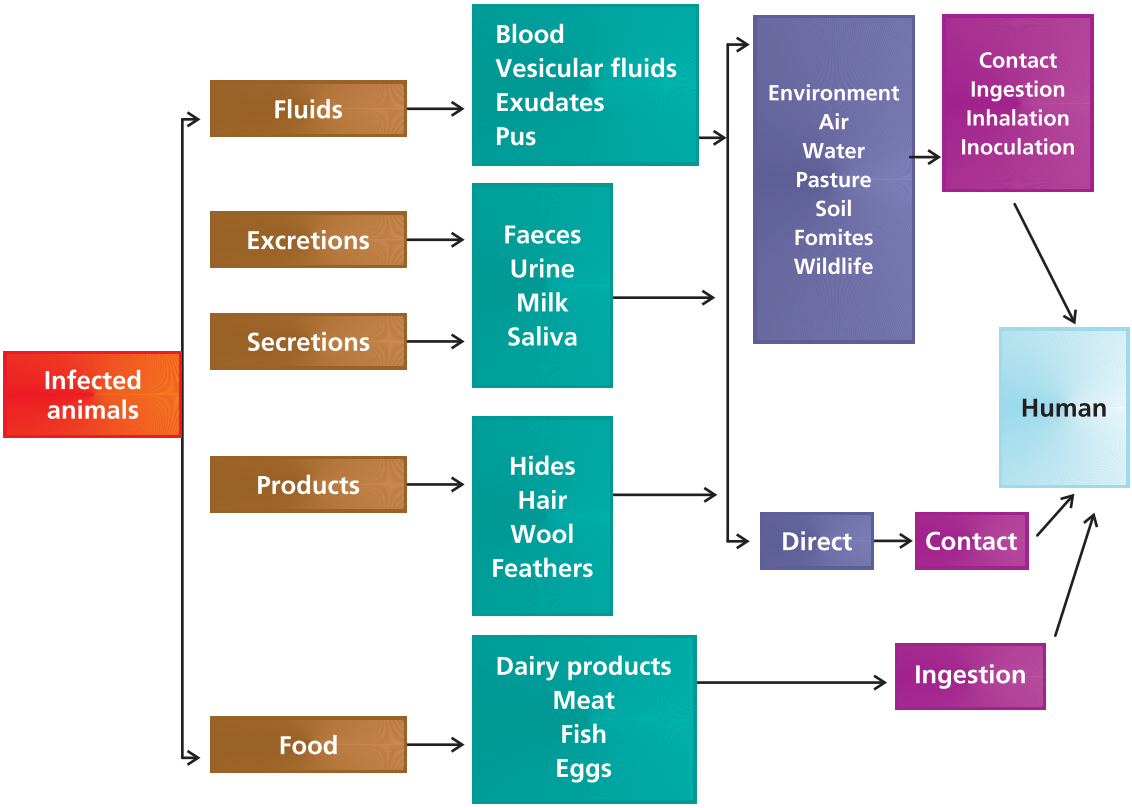
hosts through different modes and sources. The figure depicts the transmission of infectious viral agents from infected animals to the human population.



Mode of transmission of infectious viral agents in animals

1. Rabies

Rabies is caused by *Lyssavirus,* one of the seven genera that form the family *Rhabdoviridae,* within the order *Mononegavirales*. Rabies transmitted by dogs, is responsible for the loss of over 1.8 million disability adjusted life years (DALYs) every year, with direct and indirect economic costs (animal tests and vaccination with livestock losses) amounting to $ 5.5 billion per year (Gemechu, 2017). Besides, costs associated with the risk of human mortality, global cost for canine rabies amounted to $120 billion. Transmission of Rabies occurs through bite of infected animals, exposure to infected saliva and rarely through organ transplants. Rabies virus (RABV) migrates along peripheral nerves towards the CNS at about 50-100 mm per day. The incubation period (IP) or eclipse phase varies from 2 weeks to 6 years (average: 2 to 3 months) according to the amount of viral inoculum and the inoculation site. Bites on the head, face, neck and hands, particularly together with bleeding, offer the highest risk and are generally associated with a shorter incubation period.

Clinical signs of rabies in animals include sudden

behavioural changes and progressive paralysis leading to death. In some cases, animals may die rapidly without demonstrating significant clinical signs. Treatment includes management of animal bite wound with passive and active immunization. Passive immunization includes immunization of Rabies immunoglobulins (RIG), available as ERIG (Equine Rabies Immunoglobulin, 40IU/kg body wt) and HRIG (Human Rabies Immunoglobulin, 20IU/kg body wt). Active immunization include vaccination (Essen Regimen) of exposed individuals following the five-dose regimen to be administered on days 0, 3, 7, 14 and 28 into the deltoid muscle (WHO, 2014).

Prevention and control measures of Rabies include the following strategies. In countries where the disease is endemic, measures are implemented to address and reduce the risk of infection in susceptible populations (wildlife, stray and domestic animals) and create a buffer between the animal source of the disease and humans. Surveillance and reporting of suspected cases of rabies in animals, Vaccination programs for domestic animals, Research on disease dynamics, Vaccines and effective delivery mechanisms for target populations, Wildlife rabies control programs including vaccination (trap/vaccinate/release or delivery of oral vaccines) and Population control and vaccination programs for stray animal populations are the essential steps.

2. Crimean Congo Haemorrhagic Fever

Crimean Congo hemorrhagic fever (CCHF) is one of the severe forms of hemorrhagic fever endemic in Africa, Asia, Eastern Europe and the Middle East. The geographic range of CCHF virus is the most extensive among the tick-borne viruses that affect human health. Since its discovery in 1967, nearly 140 outbreaks involving more than 5,000 cases have been reported all over the world. A total of 52 countries have been recognized as endemic or potentially endemic regions, reporting substantial number of cases every year (Appannanavar and Mishra, 2011).

The CCHF virus is a member of the *Nairovirus* genus under family *Bunyaviridae*. Humans are infected by bite or by crushing an infected tick of the Hyalomma spp., against bare skin. The infection can also be acquired by percutaneous and permucosal route by contact with animal blood or tissues and drinking unpasteurized milk. The CCHF virus circulates in an enzootic 'tick-vertebrate-tick' cycle. The general approach in treatment of patients with CCHF viral infection depends on the severity of the clinical manifestation and is attempted by managing fluid and electrolyte imbalances. According to World Health Organization (WHO), ribavirin is the anti-viral medication of choice for CCHF and the recommended initial dose is 30 mg/kg followed by 15 mg/kg for four days and then 7.5 mg/kg for six days for a total of 10 days. At the community level, care should be taken to prevent human contact with livestock and minimize the tick burden in these vertebrate hosts.

3. Ebola Haemorrhagic Fever

Ebola was first recognized in 1976 when 2 epidemics occurred almost simultaneously in Zaire and Sudan. Since then, more than 20 outbreaks have been occurred, mostly in Equatorial Africa. The disease has a case-fatality rate of 78 per cent. The recent outbreak, which began in December 2013 is the largest ever, was first detected in March 2014, when cases were recognized in southern Guinea, Liberia, Sierra Leone, and Nigeria. The disease is a zoonosis caused by *Ebola virus* of the family *Filoviridae*. Fruit bats of the family *Pteropodidae* are believed to be the natural reservoirs. The incubation period of Ebola is generally 1 to 2 weeks but can range from 2 to 21 days. Human contact with

infected fruit bats or monkeys/apes and the consumption of their raw meat leads to wildlife-human transmission of the virus. Initial clinical symptoms are nonspecific with sudden onset of fever, chills, myalgia, and malaise. This is followed by flu-like symptoms (nasal discharge, cough, and shortness of breath); gastrointestinal symptoms (diarrhoea, nausea, vomiting, and abdominal pain); and, finally, hemorrhagic symptoms in the most severe cases. No anti-viral therapy is currently available. Supportive therapy should be provided to maintain renal function, fluid and electrolyte balance, oxygen status and blood pressure with provision to avoid secondary infections.

4. Nipah Viral Infections

Nipah viral infection is relatively a newly discovered disease of swine and humans, associated with infection of novel *Paramyxo-virus, Nipah virus* (NiV). This disease emerged in Malaysia in 1998 and 1999. It was linked to severe encephalitis among people occupationally exposed to infected pigs in Malaysia and Singapore. Fruit bats of the genus *Pteropus* appear to be reservoirs of the virus. In South-East Asia Region, the disease has been reported in India in the year 2001 and 2007 and most recently in 2013 from Bangladesh.

Infected bats shed virus in their excretion and secretion such as saliva, urine, semen and excreta but they are symptomless carriers. The NiV is highly contagious among pigs, and spread by coughing. Direct contact with infected pigs was identified as the predominant mode of transmission in humans. The incubation period is 4-8 days. In animals, typical clinical symptoms are observed in pigs, where respiratory symptoms dominate. Symptoms of NiV infection in humans are similar to that of influenza such as fever and muscle pain. In some cases, inflammation of the brain occurs, leading to disorientation or coma. Encephalitis may present as acute or late onset. There are currently no vaccines or therapeutics approved for combating human NiV infections (Geisbert *et al.,* 2014).

5. Influenza

Influenza is caused by Influenza virus of the family *Orthomyxoviridae.* The virus is associated with genetic reassortments resulting in emergence of new strains, which poses a significant impact in human and animal health perspective. Over the past decades, there have been multiple instances of Influenza pandemics causing millions of death worldwide. The most recent pandemic occurs in 2009, which is associated with a novel Influenza A H1N1 subtype containing reassorted segments of swine, avian and human influenza virus. Infections in humans may cause disease ranging from mild upper respiratory infection (fever and cough) to rapid progression to severe pneumonia, acute respiratory distress syndrome, shock and even death. Complications of

Influenza with zoonotic implications	Aetiology	Subtypes	Source of infection	Transmission	Incubation period
Swine Influenza	Influenza A virus	H1N1 and H3N2	Infected pigs/ Infected humans	Direct or indirect contact with infected pigs	24-72 hours
Avian influenza	Influenza A virus	H5N1, H7N7, H7N9, H9N2	Infected animals or contaminated environments	Direct or indirect contact with infected live or dead poultry	2 to 5 days and ranging up to 17 days

infection include severe pneumonia, hypoxemic respiratory failure, multi-organ dysfunction, septic shock, and secondary bacterial and fungal infections. The influenza subtypes of zoonotic importance are listed in the table. Antiviral drugs, notably neuraminidase inhibitors (Oseltamivir, Zanamivir), can reduce the duration of viral replication and improve prospects of survival.

6. Hendra virus infection

Hendra virus (HeV) is a member of the family *Paramyxoviridae* and was first isolated in 1994 during an outbreak of respiratory and neurologic disease in horses and humans in Hendra, a suburb of Brisbane, Australia. The natural reservoir for Hendra virus has been identified as the flying fox (Genus *Pteropus*). Transmission of Hendra virus to humans can occur after exposure to body fluids and tissues or excretions of horses infected with Hendra virus. Horses may be infected after exposure to virus in the urine of infected flying foxes. After an incubation of 9-16 days, infection with Hendra virus can lead to respiratory illness with severe flu-like signs and symptoms. In some cases, illness may progress to encephalitis. Anti-viral drug ribavirin has been shown to be effective against the viruses *in vitro*, but the clinical usefulness of this drug is uncertain. The occurrence of the disease in humans has been associated with infection of an intermediate species such as horses. Early recognition of the disease in the intermediate animal host is probably the most crucial means of limiting future human cases.

Conclusion

Zoonotic diseases are distinct in their host range and transmission pattern. Rapid detection and control of zoonotic diseases require unique strategies and approaches. Building up relationships within one health agenda and interactions between medical and veterinary health agencies is pivotal for a worldwide strategy to expand interdisciplinary collaborations and communications in all aspects of health care for humans, animals and the environment. Fundamental research in terms of epidemiology, transmission of emerging viral diseases to human population with diagnosis and treatment is required for implementing successful control strategy. Strengthening of diseases surveillance systems, diagnostic techniques, response procedures, multisectoral reporting and awareness in community level will significantly increase the likelihood of successful disease prevention and control.

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Metagenomics: A Step ahead in Microbial Study

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Abstract :

Metagenomics is an expanding field within microbiology that provides access to the genomes of the microbial community including the non-culturable microorganisms in any given environment. Genomic DNA is extracted directly from the samples without the isolation of microorganisms to study genomic or genetic material of microbial community. There are two main approaches for studying microbial communities: viz. 1) culture-based approaches and 2) culture-independent methods. In the culture-based, samples are inoculated in culture media, the colony forming units (CFUs) are counted and further analyses are performed in order to characterize those CFUs. Metagenomics has changed the approach of microbiologists to particular microorganisms to redefine the concept of a genome and gene discovery. The field of microbiology was previously relied on diverse methods of analysis, but now metagenomics can provide the tools to balance the abundance of knowledge attained from culturing with an understanding of the uncultured majority of microbial life and determine ecological/biogeochemical role of microbes in unique habitats. Metagenomic analysis offers a new tool to identify microorganisms present in foods and their evolution depending of environmental conditions.

Key words: Metagenomics, DNA, Genome, CFUs.

Introduction :

The pool of genomes recovered from the bacterial community of environment is often referred to as metagenome. Metagenomics term was coined by Handelsman for the genomic analysis of microorganisms of given environment by the direct extraction of the DNA from microorganisms. Metagenomics studies are mainly intended for assessing the coding potential of microorganisms and quantifying the relative abundance of species to estimate the unknown sequence information for which no species, or only distant relatives, have yet been described (Handelsman, 2004).

Metagenomics is designed to access the physiology and genetics of uncultured organisms for the genomic analysis of the microbial population. It is rapidly evolving field within microbiology to access the entire microbial community in the environment. Its ability to reveal the hidden diversity of microscopic life offers a powerful lens for viewing the microbial world that has the potential to revolutionize understanding of the entire living world (Eisen, 2007). It has been estimated that 99% of the microbes are non-culturable by available techniques and these uncultured microbes are untapped reservoir of biomolecules such as enzymes, drugs as well as metabolic capabilities. Moreover, large microbial populations are also present in/on animals and humans. Hence, new cultivation-independent methods to study the function and diversity of microorganisms in nature are needed.

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Since most of the microorganisms seem to be unculturable, this approach is rather limited in order to describe the taxonomic structure of microbial communities. In fact, new strategies have shown that only about 1% of the microorganisms are culturable (Schloss and Handelsman, 2003). In other words, culture-based approaches are selected for culturable microorganisms while ignoring non-culturable ones, leading to incomplete community diversity assessments of microbes.

In culture-independent methods, DNA is extracted and sequenced directly from environmental samples and communities are analyzed by comparing the sequence-composition of the sample. Metagenomics use the DNA sequencing techniques to study the genome of microbial community through the extraction of DNA directly from environmental samples. In addition to the information about taxonomic diversity (who is there), Metagenomics gives insight into the physiology of the organisms present in the environment (what they are doing), through studying their genes (Tringe and Rubin, 2008)

History of Metagenomics:

Early metagenomic studies have revealed that there are probably large groups of microorganisms in many environments those cannot be cultured and sequenced. These early studies focused on 16S ribosomal RNA sequences, which are relatively short, often conserved within a species, and generally different between species. Many 16S rRNA sequences have been found, which do not belong to any known cultured species, indicating that there are numerous non-isolated organisms. The study on rRNA genes, taken directly from the environment revealed that cultivation based methods find 1% of the bacterial species in a sample (Hugenholz *et al.*, 1998).

Early work in the field of metagenomics was conducted by Lane and his colleagues, who used the PCR to explore the diversity of r-RNA sequences and propose the idea of cloning DNA directly from environmental samples (Lane *et al.*, 1985). First 16S rRNA gene (40-kbp) has identified by Healy and his coworker from an archaeon, which had never been cultured. They referred the idea that collection of genes sequenced from the environment could be analyzed in a way analogous to the study of a single genome (Healy *et al.*, 1995).

Early shotgun metagenomic sequencing was done by Craig Venter. He collected the samples from various places. These samples are sequenced using shotgun sequencing to identify new genomes. The pilot project, conducted in the sargasso sea found DNA from nearly 2000 different species, including 148 types of bacteria, never before seen (Venter *et al.*, 2004).

First metagenomic studies was conducted by using high-throughput sequencing used massively parallel to 454 pyrosequencing (Poinaret al., 2006).

First approach is to identify genes based upon homology with genes that are publicly available in sequence databases, usually by simple BLAST searches. This approach is implemented in the program MEGAN (Husonet al., 2011).

There is no much information available about the microbes of gastrointestinal tract due to very less cultivation character. Therefore, a detailed study of microbial diversity and functionality has been attempted by using 16S metagenomics to evaluate the microbial population (Li *et al.*, 2012).

Approaches to study the metagenomics:

Initially, the term metagenomics was only used for sequence and functional based analysis of the microbial genome of environmental sample, but currently it is widely applied to studies

performing PCR amplification of certain tagged genes of interest. The former can be referred to as "shotgun metagenomics", and the latter as "marker gene amplification metagenomics" or "amplicon based metagenomics". Shotgun metagenomics and amplicon metagenomics are culture-independent methods of evaluation of microbial population.

Targeted metagenomics or Amplicon metagenomics:

Targeted metagenomics are phylogenetic surveys based on the diversity of a single gene (phylogenetic marker) and they help in answering to "which microorganisms are there". In this approach, a phylogenetic marker gene (e. g. 16S rRNA gene for studying bacteria, 18S rRNA gene for eukaryotes, internal transcribed spacer (ITS) gene for fungi is amplified and sequenced to classify them into taxonomic group (Thomas *et al.*, 2012). The 16S rRNA gene is considered to be a well-suited marker for targeted metagenomics to phylogenetic surveys that aim to study the bacterial community, as this gene shows enough polymorphism to enable us to differentiate between different taxonomic groups, so similarities between sequences coming from related taxa can be identified (Klinworth *et al.*, 2012).

Most popular genomic region for studying bacterial diversity is the gene encoding the RNA for the ribosomal small subunit, typically known as 16S. The gene includes conserved and variable region, which makes it well suited for PCR amplification and sequencing (Pace *et al.*, 1991). Primers that will universally anneal to the bacterial 16S regions are used in PCR to amplify the diverse fragments of the gene found in the different organism of a given DNA sample. Primers can also be designed so that they bind to the conserved regions on both sides of a variable region, generating amplicons of the polymorphic regions, which can be taxonomically classified according to their sequence. This is a common method used to identify and compare bacteria present within a given sample. This sequencing is a well-established method for studying phylogeny and taxonomy of samples from complex microbiomes.

For fungal diversity, Internal transcribed spacer (ITS) and ribosomal small subunit (SSU) region are commonly used for surveys. SSU is the more general term for the gene that is called 16S in bacteria, although it is typically called 18S in eukaryotes, as it has a larger molecular. ITS locus is commonly used as the fungal "species barcode" region because it always contains sufficient level of variation for species differentiation.

Shotgun Metagenomics:

Shotgun metagenomics sequencing is a relatively new environmental sequencing approach used to examine thousands of organisms in parallel and comprehensively to study community biodiversity and their function. In shotgun metagenomics, the total genomic DNA of an environmental sample is fragmented and sequenced using next generation sequencing technologies. The shotgun approach looks for the potential functions in the community and thus, it answers to "what the microorganisms could potentially do". This method can lead to the discovery of new enzymes, function-phylogeny links or evolutionary profiles of microbial communities (Thomas *et al.*, 2012).

Shotgun metagenomics has capacity to sequence majority of available genome within environmental sample and create a community biodiversity profile that can be further associated with functional analysis of known and unknown organisms lineages. It has evolved to address the question of who is present in an environmental community, what they are doing and how these microorganisms interact to sustain a balanced ecological niche. It detects new members and

new genes and resolves complex taxonomies as well as generates extensive gene inventories and genomes. Collection of DNA from an environment is largely uncontrolled. The most abundant organisms in an environmental sample are most highly represented in the resulting sequence data. On the other hand, the random nature of shotgun sequencing ensures that many of these organisms, which would otherwise go unnoticed using traditional culturing techniques, will be represented by at least some small sequence segments (Tyson *et al.*, 2004).

Shotgun sequencing is used to sequence many cultured microorganisms and, randomly shears DNA sequences, many short sequences and reconstructs them into a consensus sequence. Shotgun sequencing reveals genes present in environmental samples. Historically, clone libraries were used to facilitate this sequencing. However, with advances in high throughput sequencing technologies, the cloning step is no longer necessary and greater yields of sequencing data can be obtained without labour - intensive step. Most often, metagenomics shotgun sequencing is used to understand the functional potential of communities and provides information about both, which organisms are present and what metabolic processes are possible in the community (Nicola *et al.*, 2013).

Methodology of metagenomics :

It consists of several steps as under

Collection and processing of samples

Sample collected represents the environment under the study because the biological diversity will be different in different environments. The samples contain many different types of microorganisms, the cells of which can be broken using chemical or physical methods. Nucleic acid extract from gram negative, gram positive, fungi and viruses is collected. DNA extraction method ensures that all type of organism is lysed and DNA is extracted. Once the DNA from the cells is free, it must be separated from the rest of the sample. The DNA extracted should be representative of all cells present in the sample and is used for subsequent library production and sequencing (Delmont *et al.*, 2011).

Metagenomic Libraries Construction:

The metagenomic library is constructed to study the diversity and function of the metagenome. Total DNA content (metagenome) is extracted and purified. DNA fragments (inserts) of the appropriate size are then cloned into a cloning vector and transformed into a host cell, which results in thousands of cells, each carrying a DNA in fragment from the metagenome. All cells together build up the metagenomic library.

Sequencing in metagenomics:

Metagenomic sequencing has gradually shifted from classical Sanger sequencing technology to next-generation sequencing (NGS). The next-generation sequencing enables researcher to study biological system at greater depth. Complex genomic research demands the information beyond the capacity of traditional DNA sequencing technologies. All of these aspects will improve assembly outcomes for shotgun data. Since the first launch of NSG Platform in 2005, newer sequencing technologies have been developed rapidly and continuously. The recent development of sequencing has enabled us to assess much deeper layer of microbial community by generating gigabases of nucleotide sequence at lower cost. The common NGS are as follows;

Roche 454 sequencing:

The first NSG platform released Gs20 in 2005, uses a sequencing by synthesis on microbeads in picotitre plate. It is generated just 20 Mb per run with an average read length 100bp. Platform

based on pyrosequencing principle in which nucleotide triphosphate are flowed across the plate in a specific sequence and each base incorporation is marked by the release of pyrophosphate.

Illumina sequencing

Illumina's sequencing is most successful and widely adopted next-generation sequencing technology worldwide and 90 percent data of total NSG is generated by Illumina sequencing technology. The technology was introduced in the year 2006 and was quickly attracted by many researchers of high throughput data generation in cost effective manner.

Applied biosystem SOLiD

This sequencing technology was introduced in 2007 and has not become popular among scientific community because of low reads length and high cost.

Ion Torrent Sequencing

Ion torrent made personal genome machine (PGM) for next-generation sequencing. It differs from all other technique, in the manner in which base incorporation is detected. When a base is added to a growing DNA strand, a proton is released. The ion proton platform currently produced highest output upto 50 million reads per run.

Table 01: Comparison between sequencing technology

Sr. no.	Sequencing	Size of reads	Year
1	454 pyrosequencing	400 bp	2005
2	Illumina sequencing	400-700bp	2006
3	Applied Biosystem SOLiD	25-75 bp	2007
4	Ion Torrent	400 bp	2012

(Schuster 2007)

Illumina's sequencing technology is only platform that offers a short-insert paired- end capability for high resolution genome sequencing, as well as long-insert paired-end reads for efficient sequencing assembly. The combination of short and long reads increases the ability to fully characterize any genome. Metagenomic studies are useful for identifying the microbial species present in samples. They commonly involve sequencing the 16S RNA gene for taxonomic classification. Illumine demonstrated the protocol for 16S metagenomic sequencing library preparation targeted the V3 and V4 variables regions of the 16S RNA gene. It involve tailed PCR approach that generate ready-to- pool amplicon libraries. The libraries can then be pooled and run in illumine sequencing platform, which enables researcher to generate massive amount of sequence data in very short time.

Bioinformatics

The generated data will be analyzed through the various steps given bellow:-

Sequence pre-filtering:

The first step of metagenomic data analysis requires the execution of certain pre-filtering steps, including the removal of redundant, low-quality sequences and sequences of probable eukaryotic origin (Balzer *et al.*, 2013).

Assembly:

Inference of complete protein sequences from metagenomic data sets can provide a more accurate picture of the functional and metabolic potential of the microbial community. Genomic assembly is the reconstruction of genome and

genes from smaller DNA segments called reads, generate by sequencing (Reich *et al*., 1984). If the research aims at recovering the genome of uncultured for subsequent characterization rather than a functional description of the community, then assembly of short read fragments will be performed to obtain longer genomic contigs. Programs, such as Celera assembler, were designed to be used to assemble for single genome, whereas Meta velvet assembler has been optimized for the shorter reads.

Gene prediction and annotation:

Accurate and fast *de novo* gene finders are available that can predict protein coding genes from either reads or assembled contigs. Metagenomic analyses use two approaches in the annotation of coding regions in the assembled contigs (Kunin *et al*., 2008). The first approach is to identify genes based upon homology with genes that are already publicly available in sequence databases, usually by simple BLAST searches and implemented in the program MEGAN (Huson *et al.,* 2011). The second, ab initio, uses intrinsic features of the sequence to predict coding regions based upon gene training sets from related organisms. This is the approach taken by programs such as Gene Mark (Zhu *et al.*, 2010). The main advantage of *abinitio* prediction is that it enables the detection of coding regions that lack homologs in the sequence databases. However, it is most accurate, when there are large regions of contiguous genomic DNA available for comparison.

Binning:

Binning is representing a best effort to identify reads or contigs with certain group of organisms designated as operational taxonomic units (OTUs). Methods such as BLAST are used to rapidly search for phylogenetic markers or otherwise similar sequences in existing public databases. In order to connect community composition and function in metagenomes, sequences must be binned. It is the process of grouping reads or contigs and assigning them to operational taxonomic units (OTUs) and associating a particular sequence with an organism (Kunin *et al.*, 2008).

Analysis:

There are two types of analysis used in metagenomic data viz. 1) function-driven screening for an expressed trait and 2) sequence-driven screening for DNA sequences of interest. Function-driven analysis used to know "what the genes do" by expressing a desired trait or useful activity followed by biochemical characterization in host cell. Sequence-driven analysis used to identify "what genes are there" by using conserved DNA sequences of genomes. (Handelsman *et al*., 1998)

Applications of metagenomics:

Metagenomics is one of the fastest developing research areas. It is a modern analytical method of genome of microbial community. There it is used to solve various problems like diagnosis of various diseases, medicine, study of microbial community in healthy and disease condition of animals and discovery of novel biomolecules. Metagenomics offers potential solutions to some of the most complex medical, environmental, agricultural and economic challenges of today. Biotechnological potential of uncultivated bacteria might be accessible by directly cloning DNA sequences retrieved from the environment.

Animal health:

The metagenomics study will be used to improve the health status of animals by the study of their normal microflora of various organs of body in the normal and healthy condition.

1. **Diagnosis of infectious diseases.**

Metagenomic sequencing shows promise as a sensitive and rapid method to diagnose infection by comparing genetic material of sample of infected sample to a database of thousands of bacteria, viruses, and other pathogens. Metagenomics used to identifying the causative agents of infection disease, which are non-cultivable or less cultivable.

2. **Study of reproductive tract microbial diversity**

The microbial community of the reproductive tract is studied by metagenomics to obtain the information about the reproductive health of the animals. The cattle are affected by several diseases related to the genital tract caused by various pathogens like *Streptococcus, E. coli, Bacteroids, Prevolta, Mycoplasma* and *Fusobacterium*. Pyrosequencing of the 16S rRNA gene allowed the detection of some pathogenic bacteria associated with uterine infection and also the other opportunistic microbes, which have never been detected or associated with uterine health so far. Metagenomics has been used to identify and characterize microbial communities of reproductive tract. This information can also relate the microbial population in certain conditions of disease and in normal healthy animals.

3. **Study of gut microbial diversity**

Rumen microbial ecosystem harbor microbial diversity and is a home of complex microbes consisting of bacteria, fungi, archea, phage and protozoa. A greater depth of sequencing might produce useful and extensive coverage of the microbial diversity, allowing us not only to identify the prevalent member of community but also rare community members that could be associated with feeding practices (Shanks *et al.*, 2011). This ecosystem is responsible for degradation of lignocellulose by interactive mode of symbiosis and mutualism. These microbes are involved in supplying the energy and also influence many more factors as fiber degradability; immunity to host, regulation of nitrogen metabolism. Metagenomics has enabled us to study the complex structure and function of rumen microbiome through the construction of a catalogue of rumen microbes. (Li *et al.*, 2012)

4. **Study of emerging and reemerging infectious diseases:**

A disease that newly appears in the herd and nearby population will be identified to control the disease as early as possible and also studies established disease that has rapid spread of incidence or an expansion of geographic ranging with introduction in new host and area with the huge population. Metagenomics is used to identify the emerging and reemerging infectious agent of disease in the population.

Human health:

Human Microbiome initiative was started with primary goals to determine, if there is a core human microbiome, to understand the changes in the human microbiome that can be correlated with human health. The relationship between the human body and the microbial communities will lead to new methods for diagnosing, treating and preventing diseases (Nelson *et al.*, 2010). The metagenomics will be used to improve the health status and control the various disease conditions of the individuals through the study of their normal microflora of various organs of body in the normal and healthy condition.

Study of novel Gene and enzymes

Microorganisms are responsible for sustaining

life on earth but "how they do so" is still poorly understood. Until the advent of metagenomics tools, which allow the investigation of microorganisms that cannot be cultured in the laboratory, we were unable to study the entire genetic makeup from particular environments, thereby losing a fruitful source of microbial biodiversity and functional novelties.

Microbial communities mainly archae as harbour an excellent repertoire of novel genes. The impact of metagenomics is witnessed in the development of enzymes and pharmaceuticals. Metagenomics has revolutionized microbiology by paving the way for cultivation–independent assessment and exploitation of microbial community present in complex ecosystem. Metagenomics comprising construction and screening of metagenomic DNA libraries has proven to be a powerful tool to isolate new enzyme and drugs of industrial use (Simon and Daniel, 2010).

Virome analysis:

Many viruses, particularly RNA or Single stranded DNA viruses, exhibit extreme evolutionary dynamics. It is also used to study viral genome variability to monitor the viral population and their genetic changes. They have very high mutation rates which lead to the production of more number of genetic variants and high degree of genetic diversity in the host (MacLean et al., 2009). NGS opens up new roads to study the viral diversity. It will tremendously increase our knowledge in virus evolution, selection pathway, pathogenesis and diagnosis (Barzon *et al.*, 2011).

Conclusion:

- Metagenomics has changed the way of approach of microbiologists to particular microorganisms to redefine the concept of a genome and gene discovery.
- The field of microbiology previously relied on diverse methods of analysis, now metagenomics can provide the tools to balance the abundance of knowledge attained from culturing with an understanding of the uncultured majority of microbial life and determine ecological/ biogeochemical role of microbes in unique habitats.
- This is a culture independent analysis of a mixture of microbial genomes for phenotypic and genotypic screening of microbial community. Functional screening has identified new biomolecules, enzymes and antibiotics.
- Biotechnological potential of uncultivated bacteria might be accessible by directly cloning DNA sequences from the environment.

Metagenomic analysis offers a new tool to identify microorganisms present in foods and their evolution depending of environmental conditions.

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Quality assessment of *Kalakand* prepared and sold in Semi Urban City

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Abstract:

An experiment was conducted for Quality assessment of *kalakand* prepared and sold in Parbhani city (MS). A total of 3 *Kalakand* production units were selected and given codes viz. A, B and C. The samples were collected for physicochemical and microbial analysis from each production units. A total of 6 samples were collected from each of units from raw milk, *kalakand*, swab samples from utensils and hands of personnel. Physicochemical quality assessment of raw milk used for *kalakand* production was done with the help of pH, Clot on boiling test (COB), Titrable Acidity (TA) and specific gravity. The raw milk used for *kalakand* production in all 3 production units was found to be of fair quality. A significant difference was observed in microbial quality of raw milk amongst all 3 units in relation to total viable counts (TVC). Production unit A and B were found to be at par with each other in relation to *S. auerus* and *E.coli* count. A total of 2 Clostridial spp. Isolation were obtained from raw milk sample of unit A. A non significant difference of TVC counts of *kalakand* was seen amongst all units (A, B and C). Hands of personnel, kadai, stirrer and tray were assessed as sources of microbial contamination in all 3 *kalakand* production units. All 4 sources of contamination differ significantly amongst each other in all units. It was evident that all 4 sources viz. hand, kadai, stirrer and tray were at par with each other when compared amongst all production units (A, B and C). It was interesting to know that a non-significant difference exist between *E.coli* counts of all the sources of all the production units. The percent prevalence of S. aureus and *E.coli* amongst different sources revealed that in raw milk *E.coli* (44.44 percent) and S. aureus (33.33 percent) were present. The percent prevalence of S. aureus in *kalakand* was 16.66 and *E.coli* 5.55 percent. The highest prevalence of S. aureus (27.77 percent) was recorded in swab samples of hands of personnel. Hands of personnel, stirrer and tray were identified as sources of microbial contamination in *kalakand* processing.

Key words: *Kalakand*, S. aureus, *E.coli* count, *Clostridial spp*.

Introduction:

Kalakand (*sweet meat*) is a popular Indian sweet made out of solidified, sweetened milk. It's origin is Bruj area of western Uttar Pradesh. The term *Kalakand* is derived from Arabic language means sweet (Goyal and Goyal, 2011). For manufacturing of good quality milk products, it is essential to have milk of very high microbiological & chemical qualities, quality raw milk decreases major quality control problems at processing level. In indigenous milk production, surfaces of utensils can be a source of contamination (Shanmugam *et al.*, 2011). The

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HACCP system is widely used in dairy industry for control of hazards in food chain. The system is based upon 7 principles like identification of potential hazard, identification of CCP, target levels and tolerances, establishment of monitoring system, corrective action, verification and documentation (Sherikar *et al.*, 2011).

Quality control of milk and milk products consists of compositional and bacteriological quality. Physicochemical properties of milk like acidity, pH, and specific gravity gives an idea about compositional qualities of milk. Microbial quality of milk and their products is maintained by examination of samples at frequent interval. This helps in identification of CCP. The microbial quality of milk & milk products is estimated by direct and indirect methods, both the methods are being used in dairy industry. The total viable counts (TVC) and differential count (DC) are one of the direct methods of estimating microbial quality (Paturkar *et al.*, 2011).

Keeping this facts in view the present study was planned with objectives to study Physico-chemical and microbial quality assessment of raw milk and *Kalakand*, identification and assessment of sources of microbial contamination during processing, isolation and identification of *S.aureus*, *E.coli* and *Clostridial spp*. from raw milk and *Kalakand* and to study of shelf life of *Kalakand* in relation to microbial quality.

Materials and Methods:

A total of three kalakand production units from Parbhani city were randomly selected for collection of samples. Samples were collected from each *kalakand* production unit consisting of raw milk, utensils, personnel and *kalakand*. A total quality of 100-150 ml. of raw milk was collected aseptically in sterile glass bottles. Swabs were collected from utensils consisting of Kadai, stirrer and tray. Swab samples of hands of personnel engaged in *kalakand* production were also collected. Swab samples were collected from Hands of workers, Kadai, Stirrer and Tray before the start of *Kalakand* production by following methods of (Morris and Wells, 1970). The swabs were immediately placed in a screw cap test tube containing 10 ml of sterile maintenance medium (0.85 percent saline and 1 percent peptone). A quantity of 100-150 gm *kalakand* samples was collected in sterile polyethylene saechets. All the samples consisting of raw milk, swab samples and *kalakand* were transported at 4^{0}C on ice to laboratory.

To assess the physical and chemical changes in raw milk and *kalakand* samples following tests were carried out. The pH value of milk and *kalakand* was determined by pH indicator strips described in Sherikar *et al*. (2011). Titrable acidity (TA) determined by using 0.1 N NaoH as per the method described by Association of Official Analytical Chemists (AOAC,1997). Clot on boiling test of milk samples was done as per procedure described by Sherikar *et al*. (2011). Specific gravity of milk samples was determined by using lactometer according to the method described by Association of Official Analytical Chemists (AOAC, 1997). All the samples were subjected for estimation of total viable count (TVC) and differential count (DC). In the differential count the samples were analyzed for the presence of *S. aureus*, *E.coli* and *Clostridial* spp. Total viable count (TVC) was calculated as per the method described by AOAC (1997).

Selective media were used for isolation of *S. aureus*, *E.coli* and *clostridial Spp.* Isolation of S. aureus, *E.coli* and Clostridia was done as per the method described by Bacteriological Analytical Manual (BAM, 1998). Yeast and mould isolation

from the *kalakand* sample was done as per method described by Association of Official Analytical Chemists (AOAC, 1997). The bacterial isolates obtained were further identified by using various staining reactions and biochemical tests. All the isolates were characterized by biochemical test by using standard method described by Agrawal *et. al.* (2003). Shelf life studies of *kalakand* was done by storing *kalakand* at room temperature (37^{0}C) and refrigeration temp (4^{0}C) for 15 days. Total viable count (TVC), yeast and mould counts were observed at an interval of 48 hrs. for 15 days at both the temp. A data were analyzed by using Generalized Linear Model with the help of SYSTAT® software VERSION 7.0.

Results and Discussion:

A total of 3 *kalakand* production units from Parbhani city were selected to study hazard analysis of *kakakand* production process to identify critical control point (CCP). Raw milk, *kalakand* and swab samples of utensils and hands of personnel were collected.

Buffalo milk was used at all 3 *kalakand* production units. The platform tests consisting of pH, clot on boiling (COB), titrable acidity (TA) and specific gravity were conducted for evaluation of raw milk (Table 1). The pH values ranged from 5.917 $\pm$ 0.139 to 6.217 $\pm$ 0.139 in all the production units. The differences in pH values amongst production units were non significant (P>0.05). All the raw milk samples were negative for COB. The TA values were ranged from 0.167 $\pm$ 0.114 to 0.363 $\pm$ 0.114. The differences of TA amongst all the production units were non-significant (P>0.05). The specific gravity of raw milk amongst all production units differ non-significantly (p>0.05) ranging from 1.018 $\pm$ 0.002 to 1.023 $\pm$ 0.002.

Table 1: Physicochemical quality assessment of raw milk used for Kalakand production

Sr. No.	Properties	Production unit (Mean ± SE)		
		A	B	C
1	pH	6.217 ± 0.139^{NS}	5.917 ± 0.139^{NS}	5.917 ±0.139^{NS}
2	Clot on Boiling (COB)	Negative	Negative	Negative
3	Titrable acidity (TA)	0.167 ± 0.114^{NS}	0.206 ±0.114^{NS}	0.363± 0.114^{NS}
4	Specific gravity	1.023 ± 0.002^{NS}	1.023 ± 0.002^{NS}	1.018 ± 0.002^{NS}

NS- Non Significant (P>0.05)

The physicochemical properties of milk give an idea about compositional quality, in present study low pH, high TA and low specific gravity were recorded in all three production units. These parameters indicate that raw milk used in all production units was of fair quality in relation to compositional quality. All the raw milk samples were negative for COB test indicating that the raw milk can be further processed in *kalakand* production as the milk was having heat stability (Sherikar *et. al.*, 2011).

Total viable count (TVC) and differential count (DC) of raw milk were estimated for assessment of microbial quality (Table 2). The TVC value differs significantly amongst all 3 production units. The reason for different TVC values may be

due to different sources of milk and hygiene condition at each production unit. The DC values of S. aureus & *E.coli* amongst production units A and B were at par with each other than unit C. These counts indicate hygienic condition of production units. A total of 2 isolates of clostridia spp. were obtained from production unit A. Whereas none from units B and C. The microbial quality based upon TVC values of raw milk in production unit C (5.087 ± 0.879) and B (9.700 ± 0.879) can be classified as good whereas that of unit A (11.212 ± 0.879) as fair as per BIS standards of raw milk (IS – 1479 PART III -1997). However presence of *S. aureus* and *E.coli* in all units in addition to *clostridia spp.* (unit A) indicate contamination during handling and storage of raw milk.

Table 2 : Microbial quality assessment of raw milk

Sr. No.	Parameter	Production unit (Mean ± SE)		
		A	B	C
1	Total Viable Count (TVC) (logcfu/ml)*	11.212a±0.879	9.700b ± 0.879	5.087c ± 0.879
2	Differential Count(DC a) *S. aureus* (logcfu/ml)	7.450a ± 0.686	7.450a ± 0.686	3.717b ± 0.686
	b) *E.coli* (logcfu/ml)	4.890a ± 0.813	4.723a ± 0.813	1.390c ± 0.813
	c) *Clostridial Spp.*	2/6	0/6	0/6

(Same and different superscripts show non-significant and significant (P<0.01) difference from each other, respectively.)

In present study, the results of physicochemical quality assessment of *kalakand* are shown in Table 3. The pH value of different *kalakand* production units 3.917 ± 0.0239 to 5.583 ± 0.0239. a highly significant (p< 0.01) effect of variation due to production units was observed upon pH values of *kalakand*. All the *kalakand* samples tested showed TA value in the range of 0.134 ± 0.076 to 0.365 ± 0.076. No difference of TA value amongst all 3 production units, existed. Suresh and Jha (1994) reported higher levels of titrable acidity of *kalakand* amongst market samples.

Table 3: Physicochemical quality assessment of Kalakand

Sr. No.	Parameter	Production unit (Mean ± SE)		
		A	B	C
1	pH	3.917^{a} ± 0.239	5.500^{b} ± 0.239	5.583^{b} ± 0.239
2	Titrable acidity(TA)	0.365^{NS} ± 0.076	0.134^{NS} ± 0.076	0.246^{NS} ± 0.076

(NS- Non Significant (P>0.05), Different Superscripts show Significant (P<0.01) difference from each other.)

The microbial quality assessment of *kalakand* produced from all 3 units was done by estimating TVC and DC (Table 4). The TVC values recorded were 2.950 ± 0.454 (unit A); 1.585 ± 0.454 (unit B) and 1.677 ± 0.454 (unit C). The comparison of TVC values amongst different production units revealed non significant (P>0.05) effect of production unit upon TVC values. The ISI has not specified TVC counts for *kalakand*. Presence of bacterial load in milk products indicates contamination by handlers, equipment, environment and packaging materials. Earlier Suresh and Jha (1994) used TVC values to study microbial quality assessment of *kalakand* sold in market. The TVC values of 29.5 x 103 were recorded during the study. Magdum *et al.* (1988) also reported plate counts of 1836 to 4160/gm in *kalakand* sold in Bangalore city.

A highly significant ($p < 0.01$) DC values of *S. aureus* were reordered amongst all three units (A, B and C). The values recorded were 2.372 ± 0.395 (unit A); 0.468 ± 0.395 (unit B) and 0.867 ± 0.395 (unit C). The comparisons of mean DC values amongst group indicate that the units B and C were at par with each other whereas unit A values differ significantly (Table 4). The *E-coli* counts of different units recorded were 0.240 ± 0.133 (unit A), 0.045 ± 0.133 (unit B) and 0.270 ± 0.133 (unit C)

Table 4: Microbial quality assessment of Kalakand

Sr. No.	Parameter	Production unit (Mean ± SE)		
		A	B	C
1	Total Viable Count (TVC) (logcfu/gm)	2.950^{NS} ± 0.454	1.585^{NS} ± 0.454	1.677^{NS} ±0.454
2	Differential Count (DC) *S. aureus* Count (logcfu/gm	2.372^{a} ± 0.395	0.468^{b} ± 0.395	0.867^{b} ± 0.395
	E.coli Count (logcfu/gm)	0.240^{NS} ± 0.133	0.045^{NS} ± 0.133	0.270^{NS} ± 0.133
	Clostridial Spp.	0/6	0/6	0/6

(NS- Non Significant (P>0.05), Different Superscript show Significant (P<0.01) difference from each other.)

An attempt was made to isolate *clostridial spp.* from all *kalakand* samples (18) collected from all production units. However, no *clostridial spp.* was isolated during the study period.

S. aureus is an important organism from public health point of view due to its ability to produce enterotoxins. Enteric pathogens like *E.coli* are responsible for gastrointestinal disturbances. The *clostridial spp*. are being used as indicator of quality processing of the product Sherikar *et al*. (2011). Earlier many workers reported S. aureus and *E.coli* in *kalakand* from market while studying its microbial quality. Suresh and Jha (1994) reported coliform counts of 6.66 x 10-2 in

market made *kalakand* samples. A coliform count of 228/gm in *kalakand* sold in Banglore city was reported by Magdum et al. (1988). *S. aureus* counts of 7x 106 cfu/gm. in Pedha from retail shop was reported by Bandekar *et al.* (1998). Similar observations were recorded in present study.

Kalakand production process at different units in Parbhani comprises of milk, hands of personnel, utensils like Kadai and stirrer and tray were identified as sources of co The TVC values of all sources of contamination i.e. hands of personnel, kadai, stirrer and tray were calculated (Table 5). All the 4 sources differ significantly ($p < 0.05$) in all 3 production units A, B and C in relation to TVC values. Thereby indicating that personnel hygiene and utensils contribute significantly in microbial quality of *kalakand*.

The differential counts of various source of contamination in relation to *S. aureus* and *E.coli* were calculated (Table 5). A critical observation indicate that the differences in differential counts of S. aureus and *E.coli* in production unit A were non-significant. It is interesting to note that in production units B and C all the 4 sources contributed significantly ($p<0.05$) in relation to *S. aureus* count whereas, non-significant differences in *E.coli* count were observed from all sources in production units B and C. It clearly indicate that hygiene levels maintain in all 3 production units were similar which is reflected in *E.coli* counts whereas *S. aureus* counts from all 4 sources in units B and C indicate levels of personnel hygiene. In production of indigenous milk product utensils and handlers of product during processing are important from microbial quality point of view. Sherikar *et al*. (2011). The observations in present study are in agreement with earlier work.

The highest percentage of bacteria found in raw milk consisting of 44.4 percent positivity for *E.coli* and 33.33 percent positivity for *S. aureus*. The kadai and stirrer were found to be negative for indicator organisms. This may be due to heat treatment of product during processing. The hands of personnel contributed significantly in contamination of *S. aureus* (27.77 percent) and *E.coli* (5.55 percent). A practice of smearing of trays used for setting of *kalakand* might have contributed in contamination of *S. aureus* (11.11 percent) and *E.coli* (5.55 percent). The finished product i.e. *kalakand* showed positivity of 16.66 percent for *S. aureus* and 5.5 percent for *E.coli*.

Table 5: Microbial quality assessment of Sources of contamination in relation to Total Viable Count (TVC).

Sr. No.	Production unit	Sources			
		TVC(cfu/cm2)			
		Hand	Kadai	Stirrer	Tray
1	A	$4.298^{a} \pm 0.368$	$3.405^{b} \pm 0.368$	$1.768^{c} \pm 0.368$	$2.313^{d} \pm 0.368$
2	B	$6.523^{a} \pm 0.510$	$6.420^{b} \pm 0.510$	$3.540^{c} \pm 0.510$	$3.555^{d} \pm 0.510$
3	C	$6.025^{a} \pm 0.537$	$3.268^{b} \pm 0.537$	$2.632^{c} \pm 0.537$	$1.587^{d} \pm 0.537$

(Different Superscripts show significant ($P<0.05$) difference from each other.)

It is evident from analysis of percent prevalence of indicator organism in production process of *kalakand* that the raw milk contributes significantly in appearance of *S. aureus* and *E.coli* in food chain. However, heat treatment during production process might have resulted into their elimination. Maintenance of hygiene by handlers during process has appeared as an important source of contamination. Also, a practice of setting of product in trays might have exposed the product for environmental contamination. Sherikar *et al.* (2011). While describing hygienic aspect of indigenous dairy product clearly insisted that good quality raw material, greater hygienic practices and post-production contamination are an important parameters from public health point of view. Earlier Sohal *et al*. (1993) reported that heat during production of *Khoa*, *E.coli* were eliminated from all sources whereas *S. aureus* was recovered. Around 31.66 percent isolation of *E.coli* from handlers and *kalakand* during processing were observed by Chakraborty *et al*. (2005). The highest percentage (70 percent) of Staphylococcal coagulase positive strain, isolation from personnel involved in *kalakand*

Table 6: Percent prevalence of *S. aureus* and *E. coli* from different sources of contamination of kalakand.

Sr. No.	Sources	Total No. of Samples analyzed	Total No. of positive samples		Percent positive samples	
			S. aureus	*E. coli*	*S. aureus*	*E. coli*
1	Milk	18	6	8	33.33	44.44
2	Kalakand	18	3	1	16.66	5.55
3	Hand	18	5	1	27.77	5.55
4	Kadai	18	0	0	0	0
5	Stirrer	18	1	0	5.55	0
6	Tray	18	2	1	11.11	5.55
Total		108	17	11	94.42	61.09

production was observed by Chakaborty *et al.* (2004). Observations in present study are on similar lines. Quality assessment of production process of *kalakand* in present study indicate that handlers and trays can be used as control point (CP) in maintenance of hygiene and production quality.

Kalakand is a condensed indigenous milk product involving heat treatment. Shelf life of *kalakanad* dependent upon its microbial quality and hygiene during storage. The microbial quality assessment of *kalakand* was done by estimating TVC, yeast and mould counts at room temp. at the interval of 2 days upto 16 days. The results are depicted in Table 9 and Fig. 8 (a & b) The TVC counts rose significantly ($p < 0.01$) from 4th day of storage till end of the study (16th day) in all 3 production units. The yeast and mould counts were observed from 4th day of storage in units B and C whereas, in unit A on 6th day of storage.

A highly significant ($p < 0.01$) increased levels of

yeast and mould counts were observed from 4th day of storage in unit C till end of the experiment (16th day). The yeast and mould counts showed significant ($p < 0.05$) rise in production unit B. A critical observation of Table 9 indicate that at room temp. microbial quality of *kalakand* starts detoriating from 4th day of storage. Magdum & Anankrishanan (1989) also reported similar observations in relation to *kalakand*. Gaikwad and Hembade (2011) reported mould growth on 5th day of storage in condensed buffalo milk product at room temp. The observations in present study are on similar lines.

In preparation of *Kalakand* various hygienic aspects are to be taken into consideration. The raw milk used should be of high bacteriological quality, moulds are able to grow in sweetened condensed milk due to their sugar tolerance. During sterilization few micro-organisms like clostridium spp. can withstand the temprature. Handlers, equipment, environment and packaging materials contribute significantly in hygiene of *kalakand*. Post production contamination and storage life are an important factor in maintenance of quality of *kalakand* (Shanmugam *et al.*, 2011).

E.coli are being used as an indicator organism for faecal contamination, milk handlers, infected animals and environment as sources of contamination. Though *S. aureus* originate from human handlers due to their presence of skin, wounds of handlers and udder of milch animals. Yeast and mould in indigenous milk products also contribute significantly in their contamination (Ghodekar *et al.*, 1980).

Shelf life of *kalakand* is dependant upon post product handling and maintenance of temperature in addition to packaging materials. The products are handled in trays and packaging materials used is polythene bags (Magdum and Anantkrishnan, 1989). Studied shelf life of kalakand upto 21 days in relation to bacteriological quality in polythene packed samples, satisfactorily storage of *kalakand* between 22 to 30°C.

Conclusion:

It was concluded that raw milk used in *kalakand* production in Parbhani city is of fair quality in relation to physicochemical characters, the product is of fair quality in relation to physicochemical characters, hands of personnel, *kadai*, stirrer and tray were identified as sources of contamination during *kalakand* production.

Handlers and trays are identified as critical points (CP) in *kalakand* production process. The *kalakand* can be stored in polythene bags for 2 days at room temperature, and for 8 days at refrigerated temperature (4°C) in packed condition polythene bags.

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Effect of Oestrus Synchronisation with Double $PGF_{2\alpha}$ Regimen and Early Pregnancy Diagnosis by Transrectal Ultrasonography in Malabari Goats (Capra hircus)

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Abstract :

Twenty goats were administered with two injections of 10 mg Dinoprost (2 ml Lutalyse®) at 11 days apart for the synchronisation of oestrus. A total of 25 per cent (5/20) animals exhibited oestrus within 24 h of treatment, whereas 45 (9/20) and 30 (6/20) per cent of goats showed heat signs by 48 and 72 h, respectively. Oestrus was observed in all the treated does (100% response) and the conception rate was 70 per cent (14/20) when subjected to natural service with fertile bucks. On transrectal ultrasonography, fluid filled embryonic vesicle (7.4±0.59 mm diameter) was visualized as early as 18th day of service whereas, the embryo proper (0.88±0.02mm length) and its heart beat could be detected from day 24 onwards. Protocol with double $PGF_{2\alpha}$ injection was found to be an effective method of oestrus synchronisation at low cost and transrectal ultrasonography might be a reliable method for pregnancy diagnosis as early as day 18 of service in Malabari does.

Key words: Malabari does, early pregnancy, embryonic vesicle, dinoprost tromethamine.

Introduction

Oestrus synchronisation is one of the techniques by which the does can be bred at a fixed time and kidding period is predictable that helps the farmers for proper reproductive management of the herd depending on the availability of feed and veterinary services. Malabari goats are known for high prolificacy and are reared mainly for both milk and meat production. They show cyclic activity throughout the year and hence, efficient and cost effective methods of oestrus synchronisation in goat population become very important for optimising their production. $PGF_{2\alpha}$ and its analogues induces the premature lysis of the corpus luteum (CL), when administered between day 5 and15 of oestrous cycle, which results in the initiation of next oestrus (Greyling and Van Niekirk, 1986).

Reliable early pregnancy diagnosis with Real time B-mode ultrasonography was found to be the most reliable and non-invasive method in all domestic animals (Ott *et al.,* 1981). The present study was designed to address reproductive issues for efficient management in Malabari breed.

Materials and methods

A total of 20 multiparous, apparently healthy Malabari does, aged between two to five years, weighing 25 to 30 Kg, maintained at Goat farm under College of Veterinary and Animal

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Table 1. Reproductive performance of Malabari goats treated with double $PGF_{2\alpha}$ protocol

Oestrus proper after treatment	Oestrus response (no. and %)	Breeding and conception	
		Animals bred	Animals conceived
24	05 (25 %)	00	00
48	09 (45%)	12	08 (66.67%)
72	06 (30 %)	06	04 (66.67%)
Total	**20**	**18**	**12 (66.67%)**

Sciences, Pookode, Wayanad were selected for the present study. The goats were maintained under semi-intensive housing system with identical conditions of feeding and management. The does were injected on day 0 with a natural prostaglandin, Dinoprost tromethamine @10 mg (2.0 ml Lutalyse) by IM route and the treatment was repeated after 11 days (Day 12) (Mobini *et al.,* 2002). The goats were subjected for heat detection 48 h after the injection at 12 hours interval by teaser bucks. The goats which were showing signs of oestrus and receptive for mounting were subjected for natural service by fertile bucks at 24 hours interval till 72 h of the oestrus. The does were kept in separate compartments following natural service and were not allowed for mating thereafter. The day of service was recorded and considered as day 0 of pregnancy.

All the naturally bred Malabari does were subjected to transrectal ultrasonography using real-time B-mode ultrasonographic machine (ESOATE 128 XP/10, Italy) connected with linear array transducer (5.0-7.5 MHZ frequency) commencing from day15 post-mating to day 40.

Results and discussion

All the does subjected to oestrus synchronisation protocol exhibited oestrus signs like vaginal discharge, bleating, redness of vagina, Flehmen reaction and submission for mounting and copulation (Table 1). The goats came to oestrus within 49.2±4.07 h (range 24 to 72 h) after the second administration of $PGF_{2\alpha}$. The duration of oestrus was ranged from 30 to 48h with a mean duration of 36.8±3.2h.The oestrus response to oestrus synchronisation protocol was 100 per cent, which was in agreement with Hussain *et al.* (2013) who conducted studies in dwarf Goats.

In the present study, 18 goats were bred, of which 12 conceived (66.67%). Similar observations were made by Riaz *et al.* (2012) as they recorded higher pregnancy rate in Beetal and Dwarf goats (78%).

The pregnancy detection was carried out from day 15 of breeding using ultrasonography (table 2) and the embryonic vesicle was imaged as anechoic fluid filled structure by day 18 in four does (33.33%) and by day 21, the embryonic vesicle could be visualized in all does subjected for breeding. The mean diameter of the gestational sac was 7.40±0.59 mm and 10.70±0.77 mm on day 18 and 21, respectively.

Panicker *et al.* (2015) detected pregnancy by transrectal ultrasonography on days 19, but on day 18 by Martinez *et al.,* (1998). The varying results might be due to the breed differences.

The embryo appeared as an echogenic structure within the anechoic gestational sac by day 21

Table 2. Detection of pregnancy in pregnant Malabari goats using transrectal scanning

Days of gestation	Embryonic feature detected (no and %)		
	Embryonic vesicle	Embryo proper	Foetal Heart beat
15	0	0	0
18	4 (33.33%)	0	0
21	12 (100%)	5 (41.7%)	0
24	12 (100%)	12 (100%)	6 (50.0 %)
27	12 (100%)	12 (100%)	12 (100%)

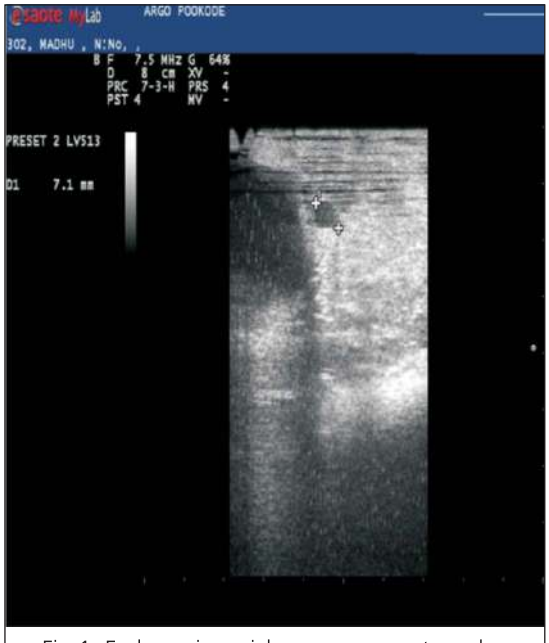

Fig.1: Embryonic vesicle measurement on day 18 post-service

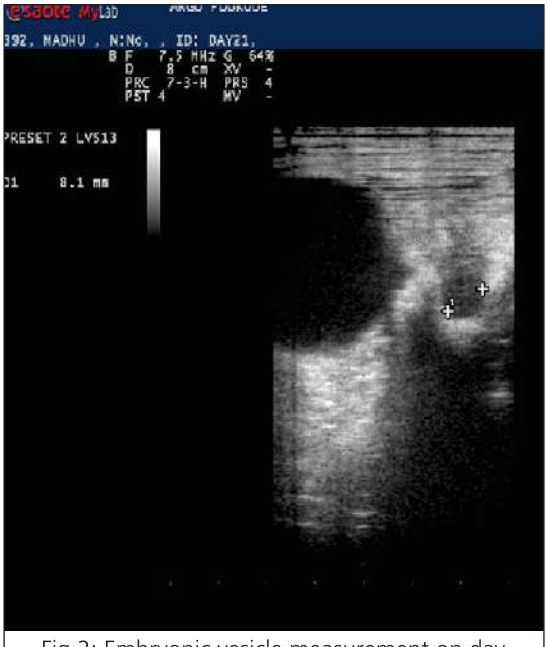

Fig.2: Embryonic vesicle measurement on day 21 post-service

post service in 5 goats (41.7%) and by day 24, it was visualized in all the pregnant (100 %) does (Table. 2; fig. 2). The foetal heart beat was detected on day 24 in six goats (6/12, 50%) and by day 27, it was evident in all the pregnant does of study. Suguna *et al.* (2008) and Karen *et al.* (2009) also observed foetal heart beat as early day 22 and day 24, respectively. Due to the variations in observations and possible early embryonic losses due to manipulations, pregnancy examinations by day 32-34 was recommended in goats to avoid chances of false positive diagnosis (Gonzales-Bulnes *et al.*, 2010).

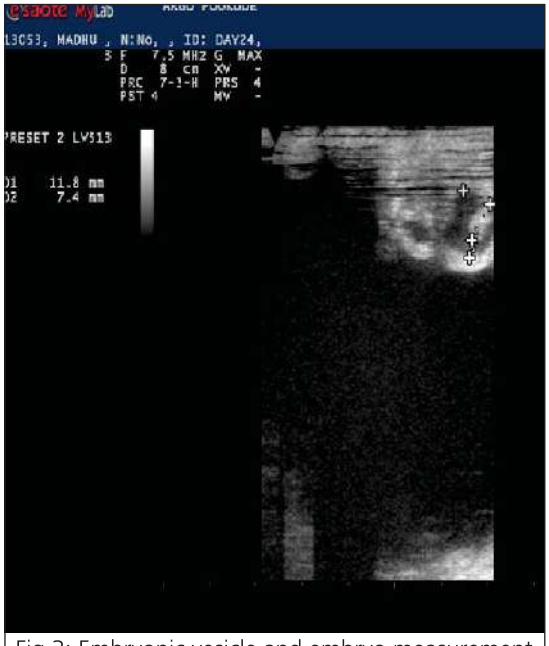

Fig.3: Embryonic vesicle and embryo measurement on Day 24post-service

Conclusion

Double injection regimen with $PGF_{2\alpha}$ was found to be a promising method of oestrus synchronisation in goats which could provide good oestrus response. Moreover, early pregnancy detection in Malabari goats by transrectal ultrasonography was efficient for identifying nonpregnant, infertile goats to optimize reproduction for economic goat rearing.

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Assessment of dietary supplementation of non starch polysaccharide hydrolyzing enzymes of broiler diets based on alternate protein meals by *In- vitro* technique.

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Abstract

The present investigation was undertaken to assess the *In-vitro* sugar release with different non starch polysaccharide (NSP) hydrolyzing enzymes, viz. xylanase, ß-D- glucanase, cellulase, mannanase and pectinase in broiler diets based on corn +soya (Diet I) and diets supplemented with alternate protein meals (APM) like guar meal, rapeseed meal and cotton seed meal, each at two different levels i.e. 3 and 6 percent (Diet II and Diet III respectively). The NSP enzymes were supplemented individually to all the diets at different concentrations. Based on the data the optimum concentration of each enzyme yielding maximum sugar was identified. The enzyme with maximum sugar release was further used in the combination studies at 3 different concentrations (i.e. 100, 80 and 60 %) in each of the test diet. Similarly a combination of all the enzymes was made at the lowest concentration of each of the enzyme, which was tested at 100, 200 and 400 per cent on each of the test diet. The maximum sugar release observed in diet-I, II and III was @ 60, 100 and 60 per cent respectively. i.e. (xylanase, ß-D-glucanase, cellulase, mannanase and pectinase @ 2400, 4800, 1800, 4800, and 2400 IU/kg respectively for diet-I; 4000, 8000 ,1900, 10000 and 4000 IU/Kg respectively for diet-II and 2400, 4000, 1800, 4800 and 2400 IU/kg respectively for the diet-III. Similarly the lowest concentration studies of the enzymes with diet I, II and III revealed a significant sugar release @ 100, 200 and 200 % concentrations i.e. (xylanase, ß-D-glucanase, cellulase, mannanase and pectinase @ 200, 120, 100, 100, and 200 IU/kg respectively for diet I, 400, 240, 200, 200 and 400 IU/Kg respectively for the diet II and diet III. It could be concluded that the maximum sugar release was reported in the diet I @ 60 per cent of enzyme concentration.

Keywords : *In-Vitro*, Non starch polysaccharides, Alternate protein.

Introduction

Efficiency in feeding has been the major concern in raising poultry, as nutrition and feeding costs 65 to 75 per cent cant of total expenses. Successful poultry farming predominantly depends on the nutrition and cost effectiveness of the feed. Maize soybean meal based diet is being practiced worldwide for all classes of poultry. Soybean is the major protein source of most of the commercial poultry diets. The corn-soya diets however contains 10-75 per cent of non-starch polysaccharides (NSP) (Choct, 2011). The NSP in cereals form a part of the cell wall structure and in vegetable proteins, especially legumes, play a role as an energy storage material.

Poultry farmers are looking for the alternative

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plant protein sources (APM) like guar meal (GM), (protein 33-45%), rapeseed meal (RSM), (protein 38-43 %) and cotton seed meal (CSM), (protein 40-42%). However, the non-starch polysaccharide (NSP) contents of GM, RSM and CSM are very high (78, 36.2 and 36.7%, respectively). Most of the NSPs from the cereals and vegetable protein sources can be broken down to simplest form of the sugars like oligosaccharides and polysaccharides, with the help NSP hydrolyzing enzymes. The amount of simple sugars released on supplementation of the NSP hydrolyzing enzymes can be determined by the phenol sulfuric acid method procedure laid by Dubois *et. al*., (1956).

In recent years, soybean meal (SBM) is being used as sole protein source which contains about 20% NSP, whereas other major ingredients used in broiler and layer diets i.e., maize and rice bran contains 9 and 25% NSP, respectively (Malathi and Devegowda, 2001) and half of which is the cellulose (Saunders, 1986). Present research was conducted to assess sugar release from 3 different diatory combinations of poultry feed to reduce feed cost.

Materials and methods:

The NSP enzymes investigated in present study were xylanase, ß-D-glucanase, cellulase, mannanase and pectinase. These pure enzymes were procured from Advanced Bio- Agrotech Limited, Pune, India. The xylanase, ß-d-glucanase, cellulase, mannanase and pectinase 160000, 200000, 1000000, 200000 IU/g, and 150000 respectively. The *in vitro* digestibility studies were undertaken for the corn soya diet as well as and diets with alternate proteins meals viz. guarmeal (GM), rapeseed meal (RSM) and cotton seed meal (CSM) and were assessed by two stage in vitro digestion assay and the total sugars released was estimated. The total sugar released from in vitro digestion was assessed as per the procedure described by Dubois *et.al,* (1956). Based on the available literature, various enzyme concentrations were selected to formulate different NSP enzymes combinations for different diets. The details of the ingredients is given in Table 1.The feed was prepared as per the standards (BIS, 2007).The different NSP enzyme concentrations selected for *In-vitro* studies are given in Table 2.The concentrations of enzyme selected for the in-vitro studies were mentioned as Lower (LC) and higher (HC).

About 0.1g of ground samples containing different NSP hydrolyzing enzymes in triplicate were incubated with 3 ml of 0.1 N HCl containing 2000 IU pepsin/ml at 40°C for 45 minutes to simulate the peptic / gastric phase. To the same tubes after 45 minutes, 1 ml of 1 M $NaHCO_3$ containing 2 mg pancreatin/ml were added and incubated for 2 hours at 40°C to simulate the pancreatic/intestinal phase. At the end, contents were centrifuged and the supernatant was stored in ice for total sugar estimation.

Total sugar estimation:

After pancreatic phase, the total sugars released due to NSP digestion was quantified by phenol-sulphuric acid method as was recorded with enzyme combination. An aliquot of the supernatant (0.5 ml) was diluted to 10 ml with distilled water. To 1 ml of this diluted solution, 1 ml phenol reagent and 5 ml conc. H_2SO_4 was added, and was allowed to stand for 20 minutes at room temperature and the absorbance was read in double beam UV spectrophotometer at 490 nm. The concentration of sugars in the sample was calculated using glucose standard graph and was expressed as mg/g substrate/ feed.

The data obtained on total sugars released was subjected to statistical analysis using SPSS 16th version and comparison of means was tested using Duncan's multiple range tests.

Table 1. Ingredient and nutrient composition of experimental diets

Ingredients	Diets		
	SBM	APM1	APM2
Maize	52.44	50.56	48.68
Soya bean meal 46	40.33	32.76	25.19
Cotton seed meal 36%	0.000	3.00	6.00
Rape seed meal (Ext)	0.000	3.00	6.00
Guar meal	0.000	3.00	6.00
Salt	0.380	0.380	0.380
DCP	1.997	1.946	18.95
Stone grit	1.060	1.058	1.056
DL- Methionine	0.204	0.200	0.196
AB2D3K	0.015	0.015	0.015
B- complex	0.010	0.010	0.010
Choline Chloride, 50%	0.050	0.050	0.050
Toxin binder	0.200	0.200	0.200
Trace mineral Mix	0.100	0.100	0.100
L Lysine HCl	0.072	0.155	0.239
Oil (veg)	3.132	3.565	3.997
Total	100.00	100.00	100.00
Nutrient Composition			
ME (kcal/kg)	2950	2950	2950
Protein (%)	23.00	23.00	23.00
Calcium (%)	0.90	0.90	0.90
Avail Phosphorus (%)	0.45	0.45	0.45
Lysine (%)	1.36	1.36	1.36
Methionine (%)	0.56	0.56	0.56

Table 2. Concentrations of NSP hydrolyzing enzymes selected for the In-vitro studies of corn soya and diets based on alternate protein meals each @ 3 and 6 % levels

Xylanase IU/Kg	ß-D-glucanase IU/Kg	Cellulase IU/Kg	Mannanase IU/Kg	Pectinase IU/Kg
200	120	100	100	200
450	480	500	500	800
700	1400	1100	1000	1400
1050	2800	1500	2000	2000
2100	6000	1900	4000	4000
4000	8000	3000	6000	7000
6000	10000		8000	10000
8000			10000	

Results and Discussion

The concentrations of individual NSP hydrolyzing enzymes mentioned in Table no 2 were studied using the corn soya as well as the diets with alternate protein meals each @ 3 and 6 % respectively. Quantity of total sugar release with supplementation of different levels of xylanase to three different diets is given in Table 3. The amount of sugar released with the enzyme supplementation was significantly higher ($P<0.001$) in all three diets compared to that of unsupplemented control diets. The optimum concentration (OC) of xylanase that released maximum sugar from corn-soybean meal as well as APM1 and APM2 were 4000 IU/kg for all three diets. The amount of sugar released at OC of the enzyme in SBM, APM1 and APM2 were 107.11, 108.70 and 110.30 mg/g, respectively and the lowest concentration that recorded statistically comparable sugar release with maximum sugar concentrations in three diets was 4000 IU/kg, for all the three diets (Table 3). The results obtained with xylanase supplementation indicated that the concentration of enzyme required for releasing highest sugar from the three diets increased with increasing the supplemental levels of alternate protein ingredients in the diet.

The NSPs are insoluble (cellulose) and soluble (b-glucose, arabinoxylan, arabinogalactose, xyloglucon etc). The soluble NSPs have the property to immobilize water in its matrix by forming loose gel network which is responsible for increased viscosity, there by depressing the digestibility of fats, proteins and starch. Present research was conducted assess sugar release from three different diatery combinations of poultry feed to reduce feed cost. These NSPs impair activity of endogenous enzymes by reducing the contact intensity between nutrients and enzymes, which results in sticky and moist droppings.

The results obtained with β-D-glucanase enzyme supplementation indicated that the concentration of enzyme required for releasing highest sugar from the three diets increased with increasing the supplemental levels of alternate protein ingredients in the diet (Table 4). As feed enzymes are most efficacious against soluble fractions of NSP (Chessson, 2001), Xylose and arabinose are the monomers of xylan backbone and are released by breakdown of β-1-4 linkages in the pentosan called arabinoxylan with xylanase supplementation (Massey *et al.*, 2014).

Table 3. *In vitro* sugar release (mg/g) from broiler diets supplemented with different levels of Xylanase enzyme

Concentration	Diet I Corn+ Soya	Diet II Corn + Soya + APM @ 3 %	Diet III Corn + Soya + APM @ 6%
Basal Diet	42.71^{g}	50.64^{g}	48.77^{h}
200	62.64^{f}	74.37^{ef}	27.70^{h}
450	76.37^{cd}	76.44^{ef}	30.10^{h}
700	89.51^{b}	99.77^{b}	71.57^{ef}
1050	90.71^{b}	98.64^{b}	75.84^{e}
2100	92.04^{b}	99.57^{b}	100.17^{bc}
4000	107.11^{a}	108.70^{a}	110.30^{a}
6000	70.31^{de}	10.3.37^{ab}	90.77^{d}
8000	73.04^{cd}	92.17^{ab}	65.51
10000	78.24^{c}	86.17^{c}	67.37^{cd}
20000	87.24^{b}	73.30^{d}	95.24^{d}
40000	77.04^{c}	75.97^{c}	67.37^{cd}
60000	64.37^{ef}	78.31^{e}	94.71^{cd}
80000	62.44^{f}	66.50^{f}	59.50^{b}
SEM	2.47	2.52	4.03
P value	0.000	0.000	0.000

The *in-vitro* sugar release for cellulase enzyme also revealed similar trend indicating that with increase in concentration of NSP fraction the required quantity of enzyme to hydrolyze these NSPs has also to be increased (Table 5).

The concentration of β-mannanase enzyme required to hydrolyze the NSP fractions from corn-soybean meal diet was lower as compared to the hydrolysis of NSP fractions from the alternate protein meal based diets (Table 6) in group II.

The sugar release from the in-vitro studies of pectinase enzyme is given in Table 7, which also indicated that NSPs from corn-soya based diets can be hydrolyzed with minimum concentrations of the pectinase enzyme. However the NSPs from alternate protein meal based diets required higher concentrations of the enzyme for hydrolysis of NSP fraction.

Table 4. *In vitro* sugar release (mg/g) from broiler diets supplemented with different levels of ß-D-glucanase enzyme

Concentration	Diet I Corn+ Soya	Diet II Corn + Soya + APM @ 3 %	Diet III Corn + Soya + APM @ 6%
0	42.71^{d}	50.64^{d}	48.77^{c}
120	75.97^{c}	34.97^{e}	35.11^{d}
480	93.77^{b}	55.57^{d}	36.31^{d}
1400	97.24^{b}	76.57^{b}	53.64^{b}
2800	96.51^{b}	81.57^{b}	54.17^{b}
6000	98.97^{a}	98.37^{a}	74.04^{b}
8000	109.64^{d}	107.37^{b}	77.11^{a}
10000	45.24^{d}	90.44^{b}	88.37^{a}
SEM	5.04	4.99	3.85
P value	0.000	0.000	0.000

Table 5. *In vitro* sugar release (mg/g) from broiler diets supplemented with different levels of Cellulase enzyme

Concentration	Diet I Corn+ Soya	Diet II Corn + Soya + APM @ 3 %	Diet III Corn + Soya + APM @ 6%
0	42.71^{d}	50.64^{d}	48.77^{e}
100	90.97^{b}	35.84^{e}	72.84^{d}
500	67.17^{c}	92.11^{c}	83.51^{c}
1100	85.44^{b}	107.24^{b}	89.77^{a}
1500	88.71^{a}	110.91^{b}	112.17^{b}
1900	122.11^{a}	131.57^{b}	99.17^{a}
3000	122.24^{a}	115.31^{b}	114.84^{a}
SEM	5.93	7.39	4.84
P value	0.000	0.000	0.000

Supplementation of Xylanase, β-D-glucanse, cellulase, β-mannanase, and pectinase revealed similar results indicating that increased concentration of the NSP hydrolyzing enzyme will be required to hydrolyze the NSP fractions from alternate protein meals as compared to the corn-soya meal based diets Table 8.

Table 6. *In vitro* sugar release (mg/g) from broiler diets supplemented with different levels of ß-Mannanase enzyme

Concentration	Diet I Corn+ Soya	Diet II Corn + Soya + APM @ 3 %	Diet III Corn + Soya + APM @ 6%
0	42.71^{d}	50.64^{g}	48.77^{de}
100	119.24^{b}	55.91^{g}	64.71^{c}
500	142.77^{a}	67.51^{f}	68.57^{bc}
1000	107.84^{c}	89.04^{e}	56.11^{d}
2000	122.44^{b}	111.64^{d}	66.91^{bc}
4000	123.64^{b}	114.91^{cd}	71.44^{bc}
6000	142.71^{a}	120.84^{b}	73.37^{b}
8000	149.04^{a}	138.04^{b}	89.24^{a}
10000	115.64^{b}	162.77^{a}	44.57^{e}
SEM	5.89	7.10	2.61
P value	0.000	0.000	0.000

Table 7. *In vitro* sugar release (mg/g) from broiler diets supplemented with different levels of Pectinase enzyme

Concentration	Diet I Corn+ Soya	Diet II Corn + Soya + APM @ 3 %	Diet III Corn + Soya + APM @ 6%
0	42.71^{c}	50.64^{f}	48.77^{e}
200	121.04^{ab}	125.57^{de}	109.37^{c}
800	140.17^{ab}	119.04^{e}	115.37^{c}
1400	93.11^{b}	126.97^{d}	114.97^{c}
2000	138.84^{ab}	149.24^{b}	131.51^{b}
4000	150.84^{a}	161.04^{a}	142.97^{a}
7000	118.97^{ab}	156.11^{ab}	130.24^{b}
10000	108.31^{ab}	134.91^{c}	99.04^{d}
SEM	8.28	6.81	5.67
P value	0.007	0.000	0.000

Table 8. Concentrations of NSP hydrolyzing Enzymes used for combination studies

Lower combinations (LC) – for all three diets					
Percentage of Enzyme	**Xylanase (IU/kg)**	**β-D-glucanase (IU/kg)**	**Cellulase (IU/kg)**	**Mannanase (IU/kg)**	**Pectinase (IU/kg)**
100%	200	120	100	100	200
200%	400	240	200	200	400
400%	800	480	400	400	800
Higher Combinations (HC)					
SBM					
100%	4000	8000	3000	8000	4000
80%	3200	6400	2400	6400	3200
60%	2400	4800	1800	4800	2400
APM1					
100%	4000	8000	1900	10000	4000
80%	3200	6400	1520	8000	3200
60%	2400	4800	1140	6000	2400
APM2					
100%	4000	10000	3000	8000	4000
80%	3200	6000	2400	6400	3200
60%	2400	8000	1800	4800	2400

The maximum sugar release for β-mannanase was obtained at 8000 IU/kg for SBM and APM1, however for APM2 the maximum sugar release was obtained at 10000. The maximum sugar release obtained in respect of pectinase was at 4000 IU/kg concentration for all the three diets. In respect of cellulase the maximum sugar release obtained for SBM, APM1 and APM2 diets were at 3000,1900 and 3000 IU/kg respectively. The maximum sugar release obtained from the, APM2 diets in respect of β-D-glucanse were at 8000 IU/kg for SBM, APM1, whereas it was at 10000 IU/kg concentration for the APM2. (Table 4). Thus, it clearly indicated that the amount of sugar released at OC of all the enzymes was found to be more in maize soya based diet as compared to alternate protein meals based diets APM1 and APM2. The sugar release decreased with increasing the levels of alternate protein supplements in the diets. The present findings of NSP enzyme supplementation might be due to higher concentration soluble fraction of mannose, glucose, galactose, galacturonic acid and glucuronic acids in alternate protein supplements compared to that of in SBM (Table 8). This can substantiate well with increased mannanase, pectinase, cellulase and β-D-glucanase requirement for maximum

sugar release, while increasing inclusion levels of alternate protein meals in the diets. The present findings are in accordance with Wilo *et al.* (1996) stated that addition of cell wall degrading enzymes viz., cellulase and xylanase not only released proteins and non-starch polysaccharides, but also increased the hydrolysis of cell walls. Castonon *et al.* (1997) observed that enzyme preparation solubilized NSP and hydrolyzed both original soluble NSP and those solubilized form the original insoluble NSP of cereals. Malathi and Devegowda (2001), who reported optimum amount of sugar release with supplementation of NSP hydrolyzing enzymes to the diets containing sunflower meal, soybean meal and DORB. Narasimha *et. al.* (2013[c]) concluded that in vitro NSP digestibility assay, simulating the gut conditions of poultry could be used as a simple and effective technique to evolve suitable NSP enzyme combinations. Aulrich and Flachowsky (1998) stated that *in vitro* simulation model is considered as a useful tool for preliminary estimation of the effectiveness of NSP-degrading enzymes in monogastrics. Similar findings were reported by Slominiski and Campbell (1990).

Conclusion

It can be concluded that the NSP hydrolyzing enzyme combination (HC -100) with maximum sugar release in all three diets (corn + soya, APM1 and APM2) can be selected as suitable NSP enzyme cocktail. Thus, NSP enzyme combination with maximum sugar release may be taken as a decisive factor for developing a suitable NSP hydrolyzing enzyme cocktail for commercial broiler diets supplemented with alternate protein meals.

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Microbiological quality of freshwater fish sold in retail market of a Urban City

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Abstract :

Present study was conducted to assess the microbial quality of fresh water fishes (Catla, Rohu, Tilapia and Murrel) collected from retail markets of Hyderabad. The Total viable count (TVC), Total coliform counts (TCC), Feacal coliform counts (FCC) and Total yeast and mould counts (TYMC) were in the range of 6.45-7.10, 3.06-3.25, 2.53-2.7 and 1.91-1.96 Log CFU/ gm respectively. Environmental sanitation, proper handling techniques and personal hygiene in retail fish market can reduce the risk of microbial contamination for food safety.

Key words : Fish, Viable count, Coliform, Yeast, Mould

Introduction :

Fish is considered as a high protein rich food in relation to vegetable and other animal foods. Especially in developing countries due to its high protein content and nutritional value of unsaturated fatty matters (Ahmed *et al.*, 2010). Fish is a highly perishable food, product, whose freshness and quality rapidly declines. The proteolysis is responsible for degradation of proteins followed by process of solubilisation and on the other hand, lipid oxidation is major cause of spoilage of fish, which involves reaction of oxygen with double bonds of fatty acid (Sahu, 2015). Consumers greatest concern is the quality and safety of food they eat. Hence, it is important to popularize good hygienic practices in fish handling. Many factors affect the quality of fish such as cleanliness of deck, equipments, utensils, quality of water used, personal hygiene of the fish handlers, sanitary conditions of the landing centers and infrastructure facilities at the auction halls (Duyar and Eke, 2009). Microbial assessment of fish at various stages of supply chain is important parameters to be studied from HACCP point of view (Sherikar *et al.*, 2013). Keeping in view, present study was designed to assess the microbial quality of freshwater fish.

Materials and Methods :

Four fish samples (Catla, Rohu, Tilapia and Murrel) from fresh water were collected from retail markets of Greater Hyderabad Municipal Corporation, (Telangana state) as detailed in Table 1.The samples were collected in sterile polythene bags as per the method described by ICMSF (1998). The samples were packed in ice box and transported to the laboratory , Department of Veterinary Public Health ,College of Veterinary Science Rajendra nagar, Hyderabad, for microbial assessment tests. Total viable count (TVC) was recorded by using Standard Pour Plate Technique with preparation of serial dilution of inoculums. A quantity of inoculums from 10^{-3} and 10^{-4} was used for pour

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plate technique in 0.1 ml to which molten plate count agar (45-50°C) was poured and mixed thoroughly by rotating plates. After incubation at 37°C for 24 hours and the bacterial colonies were counted with the help of the bacteriological colony counter and CFU. TVC were calculated by using standard formula as per method described by AOAC (1997).

$$\log_{10} \text{CFU/gm} = \frac{\Sigma C}{[n_1 + (0.1 \times n_2)] \times d}$$

Where, ΣC = Total number of colonies counted from all plates, n_1 = No. of plates of lower dilution, n_2 = No. of plates of higher dilution, d = Dilution factor

The diluted samples for TVC were pourplated on Mac-conckey agar (Nilla *et al.*, 2012) and the typical pink colonies were counted after 24 hrs and considered as total coliform count (TC). Similarly, dilutions made for TVC were pour-plated on MacConkey agar. Typical colonies were counted after 24 h of incubation at 35-37°C. The suspected isolates were streaked on modified fecal coliform (mFC) agar plates and incubated at 44.5°C for 24 h. Typical blue colonies were counted and were further confirmed by growing in eosin methylene blue (EMB) agar plates. An inoculum of 0.1 ml from 10^{-3} and 10^{-4} dilutions of samples were pour plated on Sabouraud Dextrose Agar (SDA) and incubated at 37 °C for 5 days. Colonies were analyzed for Yeast & Moulds. The Yeast and Mould counts were expressed in Log CFU/ gm.

Results and Discussion :

The total viable count of freshwater was high in Murrel (7.1 Log CFU/gm) followed by Catla (6.99 Log CFU/gm), rohu (6.76 Log CFU/gm) and least in tilapia (6.45 Log CFU/gm) (Table 1). The SPC count in rohu fish in the present study was 6.76 Log cfu/ gm, which was almost similar to the counts reported by Begum *et al.* (2010) in fish collected from local and super market in Bangladesh and Hassan *et al.* (2014) in fish collected from retail markets. Lower TVC count of 10^3/gm was observed by Goja (2013) and count of 10^5/gm was reported by Hassan *et al.* (2014) in fish collected from wholesale fresh fish markets. Higher SPC counts (10^7-10^8) in Rohu fish was reported by Pamuk et al. (2011) in Turkey than the present study. The TVC count in Catla Fish in the present study was 6.99 Log cfu/ gm which was almost similar to the counts reported by Hassan *et al.* (2014) in fish collected from retail shops, whereas lower counts were reported by them from wholesale markets (10^5). The TVC count in murrel fish was 7.1 log/CFU/gm in the present study, whereas perigreen *et al.* (1987) reported lesser count of TVC as 1.1×10^6–9.2×10^6 from cochin.

In the present study, the total coliform count (TCC) of freshwater fish was in the range 3.06-3.25 Log CFU/gm (Table 1). The TCC value of fresh water fish was high in Murrel (3.25 Log CFU/gm) followed by catla (3.13 Log CFU/gm), rohu (3.1 Log CFU/gm), and least in tilapia (3.06 Log CFU/gm). The lower count (75 CFU) in muscles of chitala fish than the counts in marine water fish of the present study was reported by Lilabati and Viswanath (1998). Begum *et al.* (2010) reported TCC as 46-240 MPN/gm in Rohu, 21-240 MPN/gm in tilapia fish from local markets and 0.9-240 MPN/gm in Rohu, 21-110 MPN/ gm in Tilapia from super markets, which was lower than the present study. The higher count of TCC (10^7-10^8) was reported by Pamuk *et al.* (2011) in common carp and a counts of $8.4\text{x}10^4$- $2.1\text{x}10^8$ CFU/gm in murrel in cochin was reported by Perigreen *et al.*, (1987). Bhaskar and Mahendrkar (2007) also reported higher counts of TCC 5.8 Log CFU in catla fish, whereas 1.35 $\text{x}10^4$ CFU/gm in common cat fish from Nigeria was reported by Ajai (2012). The count as 3.45 log MPN/gm in Rohu, Catla and carp fish

was reported by Surendraraj *et al.* (2009) and 120-9200 MPN/gm in Rohu fish was reported by Jeyasekaran and Ayyapan (2003).

The feacal coliform counts of freshwater fish was in the range 2.53-2.70 Log CFU/gm (Table 1). The highest FCC was found in Murrel fish (2.7 Log CFU/gm) followed by rohu (2.58 Log CFU/gm), catla (2.66 Log CFU/gm) and least in tilapia(2.53 Log CFU/gm). Alomost similar reports of 2.654 Log MPN/gm of FCC was reported by Surendraraj *et al*. (2009) in rohu and catla fish, whereas slightly higher counts of 1.08x 10^2- 1.22 x10^4 CFU/gm was reported by Perigreen et al. (1987) in Murrel of cochin markets. Mandal *et al.* (2009) reported 600 cfu/gm of FCC in tilapia of market samples and 200 CFU/gm in pond samples. Begum et al. (2010) reported 46 and 110 CFU/gm in rohu fish of local and super markets, respectively and 21 CFU/gm in tilpia from both local and super markets, which was lower than present study findings.

In the present study, the yeast and moulds count (TYMC) of fresh water fish was in the range of 1.91-1.96 Log CFU/gm (Table-1). The TYMC count of fresh water fish samples of murrel, catla, rohu and tilapia were 1.96, 1.96, 1.93 and 1.91 Log CFU/gm, respectively. The higher TYMC counts of 0-5x 10^2 and 0-5.2x 10^2 Log CFU/gm in rohu fish was reported by Goja *et al*. (2013). Refai *et al.* (2010) reported higher counts of Aspergillus flavua (9 x10^4), Fusarium (9x 10^4) and Candida (2x10^3) albicans in Tilapia fish. Begum *et al*. (2010) reported similar results of 8.4 x10^2 count in local markets and 4.6 x10^2 count in supermarket for tilapia fish, whereas in Rohu fish they reported higher counts in local and super markets, which was 2.07x 10^3 and 1.7x10^3 log CFU/gm, respectively. Bhaskar and Mahendrakar (2007) reported count of 2.8 Log CFU/gm in Catla fish, which was higher than present study findings. Pamuk *et al.* (2011) reported highest counts of 10^5-10^7 CFU/ml in common carp fish in Turkey.

Conclusion :

Microbiological quality of freshwater fish was of good quality. Personal hygiene, environmental sanitation and awareness to the fisherman and retail sellers are required to reduce the risk of food borne illness from fish in near future.

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Table-1: Microbial assessment counts of different fish samples

Sl No	Source	Fish	Microbial quality of fish (Log CFU/gm)			
			TVC	TCC	FCC	TYMC
1	FRESH WATER	Catla	6.99±0.09	3.13±0.27	2.66±0.12	1.96±0.04
2		Rohu	6.76±0.11	3.10±0.29	2.58±0.13	1.93±0.04
3		Tilapia	6.45±0.10	3.06±0.22	2.53±0.12	1.91±0.04
4		Murrel	7.10±0.11	3.25±0.19	2.7±0.12	1.96±0.05

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Effect of Non-genetic Factors on Hatchability of Broiler and Layer Chicken

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Abstract :

Study was conducted to observe the effect of different seasons and periods on hatchability performance of broiler and layer chicken. Data on 254 hatches of broiler (IBL-80) and 99 hatches of layer (Punjab red) chicken were collected from the incubation chart register maintained at hatchery unit of poultry research farm, GADVASU, Ludhiana. The overall least squares mean of hatchability (%) of total eggs (HTE) set was 64.46 ± 0.79 for broiler and 63.11 ± 1.05 for layer chicken. The effect of seasons were found out to be significant ($P \leqslant 0.001$, $P \leqslant 0.01$) for both broiler and layer hatches whereas effect of periods was found out to be significant ($P \leqslant 0.001$) for broiler and was not significant for layer chicken. Hatchability was highest in the winter months i.e., 69.26 ± 0.84 for broiler and 66.55 ± 1.33 for layer chicken. As hatchability is the major yardstick of poultry farm performance, controlling the effect of non-genetic factors by decisively following the proper managemental practices is of upmost importance for improving overall hatchability.

Key words: IBL-80, Punjab red, HTE, non-genetic factors

Introduction:

The success of any poultry farm operation depends on the supply of day-old chicks and hatchability is the major factor that needs to be investigated for its economic significance (Kingori, 2011). Heritability estimates for fertility and hatchability in chickens range from 0.06-0.13 (Sapp *et al.*, 2004), which indicates that the non-genetic factors have a higher influence on these traits. Depression of yolk size, albumen consistency; decrease in semen production and male fertility resulting in declining of hatchability due to high environmental temperature (optimum range is 12-26°C) and heat stress has been reported (Obidi *et al.*, 2008). Barbour *et al.* (1984) reported that improved managemental practices like better nest engineering, improved cleaning of hatching eggs and better criteria for selecting eggs for incubation significantly improved hatchability. So, the present study was designed to analyse the effect of non-genetic factors on hatchability of broiler and layer chicken.

Materials and Method:

Data on 254 hatches of broiler chicken (IBL-80) spread over 18 years (2000-2017) and 99 hatches of layer chicken (Punjab red) spread over 12 years (2006-2017) were collected from the incubation chart register maintained at hatchery unit of poultry research farm under Directorate of Livestock Farms, GADVASU, Ludhiana. Data were classified into 3 seasons i.e., summer (March-July), rainy (August-October) and winter

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(November-February). It was classified into 6 periods and 4 periods of 3 years each for broiler and layer, respectively. Least squares maximum likelihood program of Harvey (1990) was used to estimate and study the effect of non-genetic factors on hatchability of broiler and layer chicken.

Results and Discussion:

The overall least squares mean of hatchability (%) of total eggs (HTE) set was 64.46 ± 0.79 for broiler and 63.11 ± 1.05 for layer chicken (Table-1). Verma *et al.* (2018) also reported average hatchability of total egg set (%) as 64.81 ± 0.66 and 55.70 ± 2.31 in Kadaknath and Aseel breeds of chicken, respectively. Abdurehman and Urge (2016) reported hatchability of total egg set (%) as 67.78, 64.45 and 51.11 in eggs of indigenous, cross and exotic breeds of Ethiopia, respectively. The effect of seasons were found out to be significant ($P \leqslant 0.001$, $P \leqslant 0.01$) for both broiler and layer hatches, whereas effect of periods was found out to be significant ($P \leqslant 0.001$) for broiler and was not significant for layer chicken (Table-2). Hatchability was highest in the winter months i.e., 69.26 ± 0.84 for broiler and 66.55 ± 1.33 for layer chicken. Lowest hatchability was observed in the rainy i.e., 58.19 ± 1.69 and 58.55 ± 2.24 for broiler and layer, respectively. Over the years, hatchability (%) of total eggs set ranged from 59.16 ± 1.47 to 71.06 ± 1.77 for broiler and 59.91 ± 1.80 to 65.59 ± 2.04 for layer chicken. Islam et al (2008) and Jayaranjan (1992) also observed a significant effect ($P \leqslant 0.05$) of hatching season on hatchability. Jayaranjan (1992) found highest hatchability percentage in winter (68.09±4.83) and lowest in summer (66.81 ± 4.04). Yassin (2008) reported significant ($P < 0.001$) relationship of broiler egg hatchability with season and year.

Conclusion:

Regular production and supply of day-old chicks is influenced by the hatchability of the eggs, which intern influenced by the non-genetic/environmental factors. It was concluded that more number of hatches has to be set in the winter months and proper managemental practices of the breeding stock has to be undertaken for overcoming the effects of different non-genetic factors for improving overall hatchability.

Table 1. Least squares means of hatchability of total egg set (HTE) in broiler and layer chicken

Broiler			Layer		
	No. of hatches	Mean ± SE (%)		No. of hatches	Mean ± SE (%)
Total	254	64.46 ± 0.79	Total	99	63.11 ± 1.05
Summer	56	65.94 ± 1.41	Summer	29	64.22 ± 1.76
Rainy	40	58.19 ± 1.69	Rainy	18	58.55 ± 2.24
Winter	158	69.26 ± 0.84	Winter	52	66.55 ± 1.33
2000-02	37	71.06 ± 1.77	2006-08	22	65.59 ± 2.04
2003-05	45	66.39 ± 1.68	2009-11	27	64.53 ± 1.88
2006-08	34	62.23 ± 1.91	2012-14	30	59.91 ± 1.80
2009-11	54	59.16 ± 1.47	2015-17	20	62.39 ± 2.17
2012-14	45	63.61 ± 1.58	.....	.....	.....
2015-17	39	64.32± 1.66	.....	.....	.....

Table 2. Least squares ANOVA showing significance of non-genetic factors influencing hatchability in broiler and layer chicken

Broiler				Layer			
Factor	**Mean squares**	**F**	**p-value**	**Factor**	**Mean squares**	**F**	**p-value**
Season	1822.51	16.903	.0000	Season	425.13	4.730	.0100
Period	690.68	6.406	.0000	Period	1.858	1.858	.1404
Remainder	107.82	-	-	Remainder	-	-	-

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Incidence of Repeat Breeding and Anestrous in cattle due to Subclinical Theileriasis in cattle.

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(received 26/05/2018 - accepted 06/06/2018)

Abstract :

Tick infestation is common in dairy animals and particularly in crossbreeds. On screening of 300 anestrous and 150 repeat breeder animals, 66.67 percent anoestrus animals, whereas 73.33 per cent repeat breeder animals showed anemia and subclinical theileria. Hence, in present study incidence of subclinical theileria was diagnosed as one of the biggest factor for the reproductive insufficiency. About 90.00 percent animals were successfully treated with bupartvaquone and hematinics.

Key words: Subclinical theileria, anemia, repeat breeding, postpartum anestrous, buparvaquone .

Introduction :

Many veterinary clinicians handle the case of repeat breeding and anestrous with routine remedies. In spite of following all treatments and approaches, reproductive inefficiency and failures are observed in dairy cows. In the present study, 300 animals showing post partum anestrous and 150 repeat breeding condition were selected and detailed laboratory investigations of blood was carried out to diagnose blood parasitism and then appropriate treatments were undertaken to improve fertility.

Materials and methods:

A total of 300 animals showing postpartum anestrous and 150 animals showing repeat breeding condition were selected on clinical examinations. Detailed laboratory investigations of blood samples were proposed and accordingly, blood samples were collected in EDTA for CBC and clot activator tubes for serum profile evaluation. Hemoglobin, RBC, PCV, morphology of RBC, total leucocytic counts, differential leucocytic counts and hemoprotozoal detections were carried out from each sample. From serum sample of animals, total proteins, albumin and globulin, bilirubin , BUN and creatinine ((Benjamin, 1998)) were estimated.

Results and Discussion:

Clinical and problematic cases of infertility at field level and animals carrying history of wasting body conditions were investigated under present research work. Out of 300 post partum anestrous cows, 200 animals (66.67%) showed presence of less hemoglobin than the normal range. The hemoglobin of these 200 animals was between 5.8 to 6.6 gm%. 100 animals did not showed any abnormalities in blood parameters. All the 200 animals showed subclinical theileria and annisocytosis and microcytic hypochromic anemia. Total protein level was 5.6 to 6.7 gm%, albumin was between

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2.2 to 3.6 gm% and globulin was 2.4 to 4.3 gm %. BUN was ranged between 10 to 19 mg/ dl and creatinine level was between 1.2 to 1.88 mg/ dl. Total bilirubin was ranged between 0.3 to 0.5 mg/dl. All the 200 animals showed presence of piroplasm in the peripheral blood smears.

Out of 150 repeat breeder animals 110 animals (73.33%) were found positive for subclinical theileria. Hemoglobin levels were between 5.4 to 6.1 gm%, total protein level was between 4.8 to 6.2 gm%. Albumin level was between 2.1 to 3.8 gm% and globulin was 2.5 to 3.98 gm%. BUN level was between 12 to 20 mg/dl and creatinine level was between 1.34 to 1.93 mg/dl. Total bilirubin was ranged between 0.41 to 0.76 mg/dl. All 110 animals showed lymphocytosis and monocytosis with annisocytosis of RBCs and presence of piroplasms in peripheral blood smears.

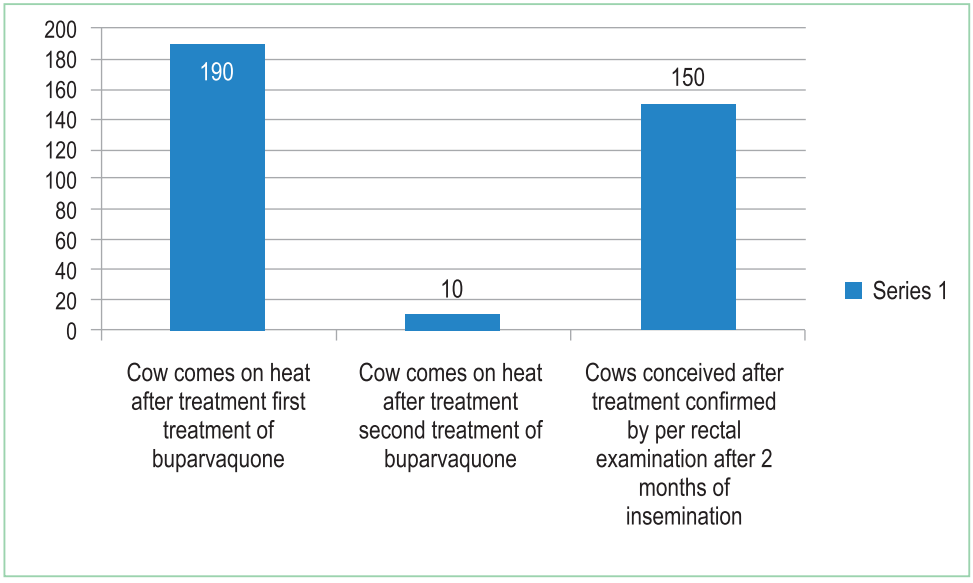
All subclinically positive animals for theileria were treated with inj. Buparvaquone @2.5 mg IM as single dose ; Inj. Oxytetracyclin @20 mg per kg body weight IV for 5 days; Inj. Iron dextran @5 ml IM daily for 7 days and Hematinics and liver tonics @100 ml per day orally (Radostits, 2006).

Postpartum anestruos cows showed success to the treatment as first treatment of buparvaquone resulted in induction of estrus in 190 cows, whereas the second treatment was successful to induce oestrus in 10 cows. After 2 months of breeding, total 150 cows were confirmed as pregnant by per rectal examination.

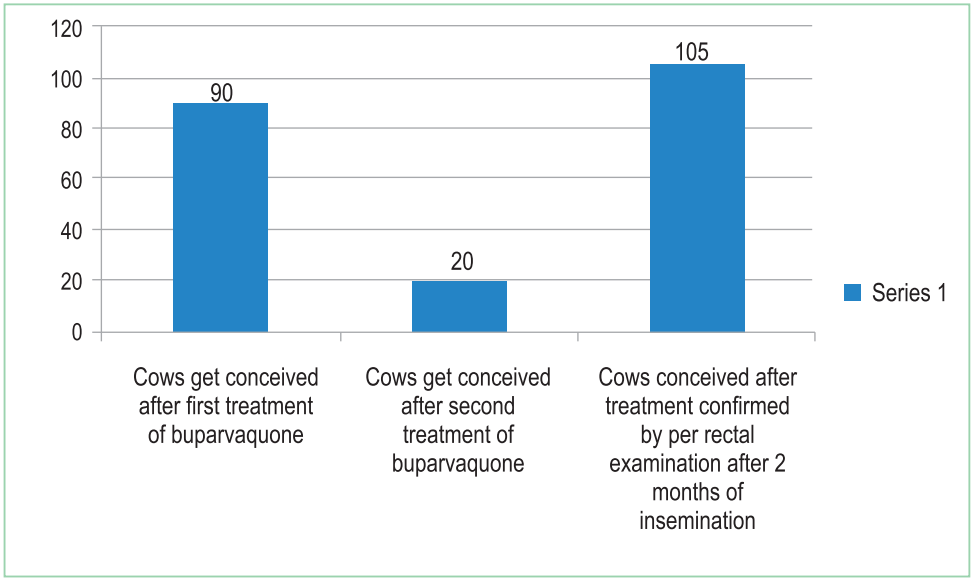
Similarly, 90 repeat breeder cows responded to first treatment of buparvaquone and 20 cows responded to the second treatment. Total 105 repeat breeder cows were confirmed for pregnancy after 2 months.

Results after treatment:

Graph no 1: Cases of post partum anestrous and effects of treatment



Graph no 2: Cases of repeat breeders and effects of treatment



Discussion:

Subclinical theileriasis is one of the important factor etiological factor for the postpartum anestrous and repeat breeding. Hemoglobin concentration in circulating blood if remains below the normal level, it adversely affects the production and reproductive performance of cattle. For the proper functioning of gonads, good quality uterine milk and triggering of gonadotropic hormones trace minerals viz-copper cobalt and iron and hemoglobin concentration plays.

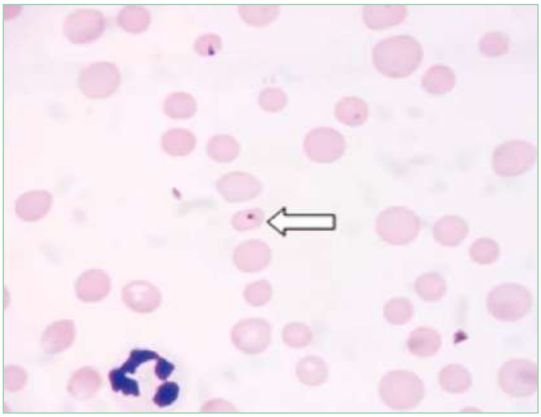
During the subclinical hemoprotozoal infection, hemopoiesis is going on at normal level but the destruction is at slightly higher side. Due to destruction of RBCs, animal remained in continuous anemic stress and body score of such animals are not found healthy. Reproductive performance of animal will interfere with farmer's economy and unnecessary wastage of money observed on non specific treatment of animals. Total protein, albumin, globulin, bilirubin, BUN and creatinine in correlation with theileria does not plays any significance role but it is nothing but an outcome of chronic anemia and sub acute phase reaction.

Almost 90 percent cases of infertility problems were resolved with specific treatment of theileria as supported by oxytetracyclins and hematinics. The rate of conception was also found to be 90 percent in all treated cases.

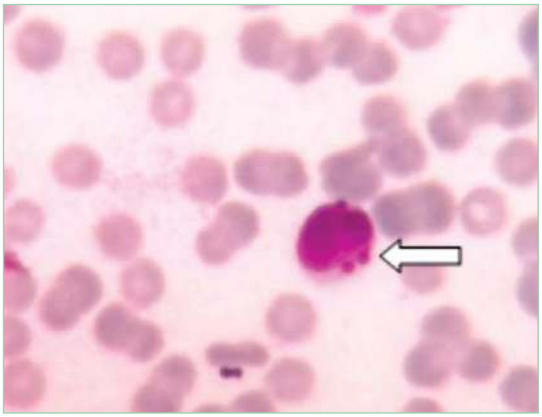
Conclusions:

Area, more prone to tick population, is also sensitive to infertility problems. Detailed investigation of blood profile and hemo-protozoal infections is useful for correct treatment and also to resolve infertility in dairy animals.

Annisocytosis and hemoprotozoa in RBCs



Koch blue bodies in lymphocytes



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Therapeutic management of sarcoptic mange in an Osmanabadi goat flock

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(received 10/04/2018 - accepted 16/05/2018)

Abstract:

Dermatitis outbreak on a sheep and goat farm was diagnosed with skin scrapings and effective treatment was undertaken to control the Sarcoptic mange.

Keywords: Sarcoptic , mange, goat, Osmanabadi

Introduction :

Sarcoptic mange, "scabies" is a form of acariosis caused by the mite, *Sarcoptes scabiei* (Urquhart *et al.,* 1996). The disease is contagious and zoonotic (Pence and Uekermann, 2002) and human beings as the original natural host of *Sarcoptes* species (Fain, 1968). The disease in goats is of immense economic importance in India and West Africa (Urquhart *et al*., 1996). The disease is highly contagious, hence transmission rates from affected does to kids is high. The present study discusses therapeutic management of "Scabies" outbreak in an Osmanabadi goat flock.

Clinical Observations :

An outbreak of dermatitis was reported from Sheep and Goat farm, Pohra Dist. Amravati. (MS) carrying flock strength of 245 Osmanabadi goats. More than 100 goats of both sex and different age groups afflicted with dermatitis. Among these all 17 kids (06 males and 11 female kids) were affected. Dermatitis was associated with symptoms of alopecia, ranging from bilateral periorbital hair loss, hair loss from ear pinna, around buccal region to hair loss from back, shoulders and limbs, along with thickening of skin, scaling, itching and pruritus.

Random skin samples from twenty goats were collected in 3ml of 10% potassium hydroxide contained in clean, sterile plastic vials. These samples were processed in the laboratory and diagnosis was made on the basis of characteristic morphology of *S. scabiei* mites as described in (Urquhart *et al*., 1996).

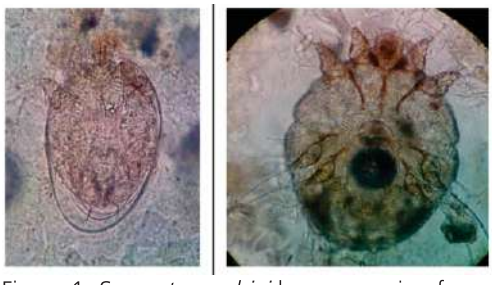

Figure 1. *Sarcoptes scabiei* larva emerging from an egg (left) and an adult (right) (as observed under 400X magnification)

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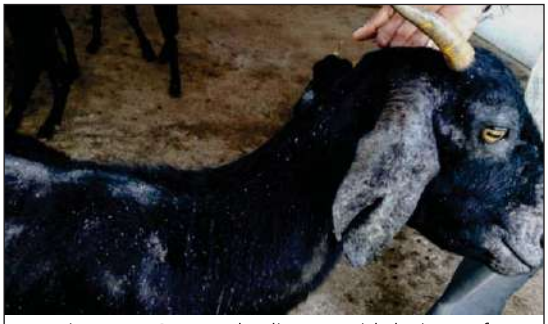

Figure 2. Osmanabadi goat with lesions of sarcoptic mange

Treatment and Discussion :

Affected goats were segregated and separated from healthy ones. Affected and in-contact goats were treated with Ivermectin (Hitek) at dose rate of 0.2 mg Kg-1 body weight, subcutaneously. Simultaneously, the affected goats were sprayed with Amitraz, 12.5% (Taktic) diluted as 02 ml per litre of water. In contact goats were treated once with Ivermectin. Amitraz treatment was repeated twice at 7 days interval. Infected goats were given two more treatments with Ivermectin at 14 days interval. Supportive treatment was provided with Chlorpheneramine maleate (Anistamin), daily for five days and injectable vitamin A at weekly interval for three weeks. Recovery of goats started within 21 days after initiation of treatment.

Pathogenesis of mange is initiated with mechanical damage due to feeding habits of mites ingesting cells, cells debris and tissue fluid oozing out from the deep burrows excavated by the parasites. Secretions and excretions of mites lead to further allergic reaction which may be due to type I (immediate) and type IV (delayed) type of hypersensitivity (Pence and Uekermann, 2002). Pruritus resulting from hypersensitivity reactions results in itching and scratching and against hard objects causing further injury. Fomites like contaminated bedding may also serve as source of transmission. As the saying goes, sarcoptic mange is difficult to diagnose, hence its diagnosis demands deep skin scrapings till capillary blood oozes out. Scabies is responsible for production losses due to loss of condition resulting in poor meat quality and low quality hide due to damage to the skin.

Dry mange in goats due to sarcoptic mange starts from less hairy parts like the face, axilla, udder, abdomen and spreads to other parts of the body. After establishment of infection around the buccal area, the skin hardens and thickens causing difficulty in feeding (Wosu and Onyeabor, 2015). Moreover, pruritus and itching interferes with feeding activity of animals and hence disease is associated with debility. Jackson (1986) reported sarcoptic mange as the most common and difficult to treat infectious skin disease in goats. Wosu and Onyeabor (2015) reported successful management of S. scabiei infestation in sheep and goats with ivermectin. As per Wosu and Onyeabor (2015), recovery of goats was visible by 28 days post treatment. In the present study, observable improvement began within 21 days. Slightly early onset on treatment may be due to simultanoues topical treatment with Amitraz, in the present study or may be individual variation.

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Efficacy of GnRH and Ovsynch protocols for treatment of Non-Infectious Repeat Breeding in Crossbred Cows.

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Abstract:

A total of 60 repeat breeder crossbred cows were evaluated on the basis of cervical Metricheck score and white side test to diagnose non-infectious category of the infertility problem and 24 crossbred cows were rejected as they were found with extreme and positive reports of these laboratory tests. Twelve non-infectious repeat breeder crossbred cows were treated with injection GnRH @ 0.0042 mg IM at the time of insemination in Group-I and twelve non-infectious repeat breeder crossbred cows were treated with injection GnRH @ 0.0042 mg IM on day 0 and day 9th with injection $PGF_2\alpha$ @ 263 µg on day 7th with fixed time insemination on day 10th in Group–II, whereas other twelve cows in Group–III were kept as untreated control and were inseminated as per routine proper schedule. Hormonal treatment in crossbred repeat breeder cows showed 83.33, 91.67 and 16.67 per cent conceptions rate in Group-I, II and III, respectively with 2.00 and 1.54 services per conceptions in Group I and II, respectively.

Key words: Ovsynch, GnRH, Repeat Breeder Cows.

Introduction

Reproductive inefficiency in lactating dairy cows is a source of frustration to dairy producers and deviation or prolongation in breeding rhythm of dairy cows results in progressive economic loss due to extension of days open and reduced number of calving and lactations during the life span of animal. In repeat breeders, assured ovulation and timed insemination are useful skills to improve conception rate. Hence, research experiment was undertaken to study the efficacy of GnRH and Ovsynch protocols in non infectious repeat breeder crossbred cows. Post-partum regular cyclic non-breeder cows, which failed to settle within three inseminations, were selected for the present trial.

Material and Methods

The present investigation was planned to conduct research trials on regular cyclic non-breeder cows, which failed to settle within three inseminations, were selected for the present trial. A total of 60 repeat breeder crossbred cows were evaluated on the basis of cervical Metricheck score and white side test to diagnose noninfectious category of the infertility problem and 24 crossbred cows were rejected as they were found with extreme and positive reports of these laboratory tests. Twelve non-infectious repeat breeder crossbred cows were treated with injection GnRH @ 0.0042 mg IM at the time of insemination in Group-I and twelve non-infectious repeat breeder crossbred cows were

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treated with injection GnRH @ 0.0042 mg IM on day 0 and day 9th with injection $PGF_{2\alpha}$ @ 263 µg on day 7th with fixed time insemination on day 10th in Group-II, whereas other twelve cows in Group-III were kept as untreated control and were inseminated as per routine. Follow up of all cases was continued to record conceptions and pregnancy rate.

Results and Discussion

Gynaeco-clinical observations of the protocol and control group have been presented in Table 1.Non-infectious repeat breeder crossbred cows during estrus stage treated with GnRH at the time of artificial insemination showed ovulations after 24 hours of treatment on per rectal examination. Five repeat breeder crossbred cows ovulated later than 48 hours of cessation of estrus and four repeat breeder cows were not ovulated from control group. It was revealed that 07, 02 and 01 repeat breeder crossbred cows were conceived from treatment group to first, second and third insemination as against 01, nil and 01 conception in control group respectively. Total 83.33 per cent repeat breeder crossbred cows from treatment group I and 16.66 per cent crossbred cows from control group were found to be conceived.

Exogenous GnRH treatment during estrus is expected to lead to LH peak and thus brings about ovulation and the effect of higher level of LH also leads to luteotropic activity for structural development of corpus luteum, which is expected to secrete progesterone for bringing about proliferation of endometrium, secretion of uterine milk and also increases chances of implantation for pregnancy continuation. Non pregnancies in two treated cases indicates involvement of factors other than hormones and management and may be preferably the nutritive or stress causes of the individual cases.

Available reports confirm present finding regarding improvement of conception rate with GnRH at the time of AI in non-infectious repeat breeder crossbred cows. However, the reports claim conception rate lower than present finding (Rangnekar *et al.,* 2002; Kumar *et al.,* 2010). GnRH has effective role in improvement of conception rate and hence its administration at the time of AI, day 5th, and day 12th has also been tried in non-infectious repeat breeder cows as single, double or even triple injection strategy; Jayakumar and Vahida, 2000; More *et al.,* 2012; Sarma *et al.,* 2013).

Gumen *et al.,* (2011) have recorded no effect of GnRH administration for improvement of conception rate in dairy cows and have indicated no greater LH surge with the exogenous GnRH injection thus insufficient LH surge for ovulation. Considering the importance of this report, redefining of role of GnRH therapy in repeat breeder cows is essential.

On attempting ovsynch protocol, twelve repeat breeder crossbred cows (100%) were found to be in estrus on day 10th. Twelve cows from treatment group II showing clear mucus discharges were inseminated without assessment of heat detection after 24 hours of GnRH Injection. All the responded cows were followed for confirmation of ovulation and it was observed that all the cows were found ovulated on day second of insemination. Non treated cows from control group were inseminated as per routine proper schedule and were per rectally followed for ovulation confirmation a day after insemination. It was observed that, three cows ovulated late, two cows showed anovulation and others were ovulated promptly.

The conception to second and third estrus in treatment group was one each, whereas the

Table 1: Gynaeco-clinical observations of GnRH at the time of AI protocol and ovsynch protocol in non infectious repeat breeder cows.

Particulars		Protocol group I		Control group	Protocol group II	
Animals treated		12		12	12	
Ovulatory oestrus		12		12	12	
Oestrus discharge		CD(12)	TD(00)	CD(03) 12	CD(12)	TD(00)
No. of animals conceived	1st oestrus	07	-	01	09	-
	2nd Oestrus	02	-	00	01	-
	3rd oestrus	01	-	01	01	-
	Overall	10		02	11	
No. of services per conception		2.0		10.33	1.54	
Conception rate (%)		10/12 (83.33)		02/12(16.66)	11/12 (91.67)	
Pregnancy rate (%)		10/12 (83.33)		02/12(16.66)	11/12 (91.67)	

(CD= Clear discharge, TD-Turbid discharge)

same was nil and one in control group. Thus, total eleven crossbred cows (91.67%) from treatment group II and two cows from control group were recorded as conceived.

It was recorded that 91.67 per cent cows were pregnant from treatment group II and 16.66 per cent cows were pregnant from control group. Evenafter Ovsynch protocol, actually three crossbred cows failed to conceive after first insemination, which is indicative of probabilities of etiology of repeat breeding beyond hormonal causes. Two cows from treatment group during subsequent estrus and also two cows from control group were found to be conceived indicating chance fertilization.

The Ovsynch protocol is based on effect of hormones given in a fixed schedule for induction and synchronization of estrus. GnRH causes the pituitary to release luteinizing hormone (LH) that acts to transform a large follicle containing an unfertilized egg into a CL. $PGF_{2\alpha}$ administration on 7th day is expected to regress the CL induced by GnRH. A new dominant follicle grows and is available for ovulation by the second GnRH injection. The cows were inseminated 24 hours after this GnRH injection, without detecting estrus.

The utility of ovsynch protocol in repeat breeder cows is related with non infectious nature of the infertility problem and more concerned with controlled breeding through exogenous hormones. The physiological events of estrus taking place with altered sequence in repeat breeder cows are corrected by the protocol and chances of fertilization are thus increased. The ovsynch protocol is useful in non infectious repeat breeder cows as, it brings about fresh follicular development, timely LH surge, prompt ovulation and favours fixed time inseminations.

On comparison of the treatment of ovsynch protocol with that of the GnRH protocol in non infectious repeat breeder crossbred cows, it was noted that the ovsynch protocol is numerically superior in terms of pregnancy establishment

and also on statistical analysis, there was significant difference between the groups. However, GnRH protocol is comparatively much cheaper in terms of treatment cost.

There are very few reports on use of ovsynch protocol in repeat breeder animals. Kasimanickam *et al.,* (2005) reported just 21.00 per cent pregnancy rate in repeat breeder cows with ovsynch, whereas Biradar *et al.,* (2014) reported 50.00 per cent conceptions in buffaloes. Both the reports indicate much less efficacy of ovsynch than present finding in repeat breeders.

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Therapeutic Management of hypodermosis in Cattle

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Abstract:

Three Holstein Friesian crossbred cattle with soft painful swellings on rear flank to shoulder region were found infested with larvae of *Hypoderma* spp. The larvae were safely and quickly removed by slow injection of hydrogen peroxide into the warbles and affected animals were treated with doramectin.

Key words: *Hypoderma* spp., warbles, doramectin.

Introduction

Cattle hypodermosis (warble fly infestation) is a notorious veterinary problem throughout the world. Larvae of *Hypoderma* spp. causes a subcutaneous myiasis of domesticated and wild ruminants. This disease is caused by *Hypoderma* bovis and *Hypoderma lineatum* in cattle (Hassan *et al.,* 2010) resulting a severe decline of milk and meat production and depreciation in hide quality due to exit holes (Hall and Wall, 1995). Only one species *viz., Hypoderma lineatum*. has been described from India affecting the bovidae with a prevalence rate of 50–90 % (Soni and Khan, 1945). Present case report documents *Hypoderma* spp. infestation in Holstein Friesian crossbred cattle and its treatment.

Clinical observations and Diagnosis

Three Holstein Friesian crossbred cattle in the age group between 3-5 years were brought to TVCC, Bikaner with history of high fever, drop in milk yield and soft painful swellings on rear flank to shoulder region. Clinical examination revealed high rectal temperature (103° to 104.5°C) and presence of about 50-60 soft swellings of 2-3 cms in diameter on back. These swellings were present from root of the tail to shoulders and topline to about one-third lateral distance down. The animals were depressed and showed pain on touching the swellings. After proper clipping of hair around the lesions, the hypoderma larvae were safely and quickly removed by slowly injecting 0.5 ml of 5% hydrogen peroxide solution into the warbles using a blunt needle shank of the syringe and taking care to pierce the larvae. Most grubs emerged within 15 seconds after foaming action.

Hand lens examination of larvae revealed barrel shaped larva with tapering towards anterior end with a length of 18-22 mm and whitish to light brown colour. Each segment of larva beared a number of flat tubercles and small spines in a row. The posterior spiracle of larva was removed and treated with 10% KOH for several hours then mounted on a slide covered with cover slip and observed under microscope (Soulsby, 1982). Pair of kidney shaped dark colour posterior spiracles with numerous radiating stigma

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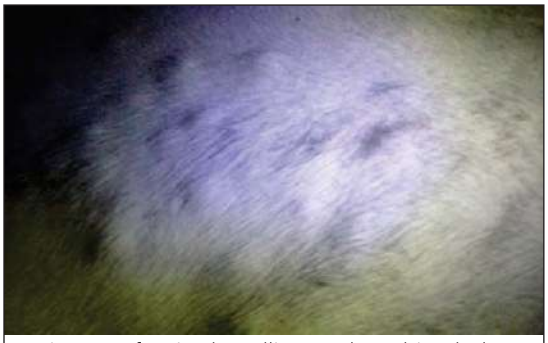

Fig. 1. Soft raised swellings or breathing holes (warbles) of larvae on animal body.

openings were observed which are pathogenic of *Hypoderma lineatum* larvae. On the basis of above clinical manifestations and morphological characters of larvae confirmative identification was done as *Hypoderma* spp. larvae. (Kachhawaha and Singh, 2010). The disease was diagnosed as hypodermosis caused by *Hypoderma* spp.

Treatment and discussion

The animals were treated with injection Doramectin @ 300 µg/kg b.wt. S/C, B-complex @10 ml, IM, Meloxicam @ 0.3 mg/kg body weight IM along with IV fluid therapy of dextrose normal saline @ 20 ml/kg b.wt. and Ringers lactate @ 20 ml/kg b.wt. to combat toxins likely to be released from dead larvae, which can cause systemic shock and local Inflammatory reaction (Srivastava *et al.,* 2013). Topicure spray was locally applied. The skin eruptions decreased in size after 7th day of medication and completely disappeared after 21 days of treatment.

The biology of hypodermosis is very much complex as it passes through ecto as well as endoparasitic stages in the life cycle. Moreover, the parasitic stage of hypodermosis lasts about 1 year in domesticated as well as in the wild animals, while in the adult stage, a free-living fly lasts only for few days.

Fig. 2: *Hypoderma* spp. third-stage larva coming out of warble

It must be noted that while removing larvae care must be taken not to kill the migrating larvae, as it may release toxins leading to systemic reactions (Leavasseur, 1991). Tympany and paraplegia may be seen in affected animals (Soulsby, 1982). During the summer season, female flies lay eggs on the hair of cattle; from these, first-instar larvae hatch, then migrate over several months through the fascial planes between muscles, along connective tissue, or along nerve pathways via the oesophagus. They secrete proteolytic enzymes that facilitate their movement. Larvae moult into second and third-instar larvae and form the typical subcutaneous nodules under the skin in the dorsal and lumbar regions of cattle (warbles) in late winter and spring (Otranto *et al*., 2006). If animal is left untreated, then these larvae will fall to ground and pupate on ground, adult flies emerge some 3-5 weeks later (Mason, 2017).

The results obtained in present case study indicated that of doramectin is 100 per cent efficacious in the treatment of cattle naturally infested with hypodermosis. Macrocyclic lactones are characterized by excellent efficacy against hypoderma arthropod ectoparasites. Similar results were reported previously by (Rehbein *et al.,* 2013 and Otranto *et al.,* 2016). who tested other commercial formulations

Fig. 3: *Hypoderma* spp. third-stage larva

containing ivermectin and other compounds of the macrocyclic lactone family.

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Successful Management of Recurrent Rectal Prolapse in Buffalo - A Case Report

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(received 11/05/2018 - accepted 26/05/2018)

Abstract:

A case of successful management of recurrent complete rectal prolapse in a graded buffalo was corrected with purse string suture, restricted diet along with supportive therapy and therapeutic measures.

Keywords: Buffalo, rectal, prolapse, purgative, sedative

Introduction :

In rectal prolapse, one or more layers of the rectum protrude through the anus due to persistent tenesmus associated with intestinal, anorectal, or urogenital disease. Prolapse may be classified as incomplete, in which only the rectal mucosa is everted, or complete, in which all rectal layers are protruded. Rectal prolapse may result from prolonged tenesmus or increased intra abdominal pressure due to bloat, proctitis, diarrhoea, act of parturition and constipation (Tyagi and Singh, 2010). Present case records successful recovery of rectal prolapse in a buffalo with purse string suture and appropriate therapy.

Clinical observations :

An eight year old buffalo was presented with history of rectal prolapse since last 6 days, the condition was corrected by owner himself with the help of quack but several recurrences case was reported to clinics. Clinical examination revealed completely prolapsed rectal wall, soiling with faeces, bleeding, pain, swelling and presence of lacerated wounds with some necrosed tissue. The case was diagnosed and treated as post-partum rectal prolapse (Patil *et al.*, 2011).

Treatment :

After physical restraining, the animal was controlled in standing position and administered caudal epidural analgesia with 10 ml of 2% lignocaine hydrochloride and 15ml of tranexamic acid (Texableed) to prevent bleeding. The prolapsed mass was irrigated with potassium permanganate solution (1:1000) and ice cold water applied for 30 minutes to reduce the swelling. Necrosed tissue of the prolapsed mass was removed.

The prolapsed mass was then lubricated with liquid paraffin and it was gently pushed through the anus to position. Retention of the prolapsed mass was achieved by applying purse string suture around the anal orifice with black braided silk no.1 (Jean and Anderson, 2006; Borobia-Belsne, 2006). Postoperatively, calcium magnesium borogluconate (Mifex) 450ml IV on first day along with Ciftriaxone tazobactum

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(Intacef tazo) 3375mg, Dicyclomine hydrochloride @15 ml, Meloxicam @15 ml IM for 5 days with triflupromazine (Sequil) @5ml, Luxabulk @1000 ml orally and Intalyte 1000 ml IV for 3 days were administered followed by daily dressing of suture with povidone iodine ointment (Betadine). Animal was put on succulent green fodder to half of its normal diet. On the 3rd postoperative day, as there was no tendency of the reduced mass to protrude, the suture was relaxed. However, as a precautionary measure, the suture was kept for another 7 days and then removed. Animal recovered successfully and no reoccurrence was observed.

Prolapse of genitalia is very common in buffaloes but relatively less cases of rectal prolapse are observed in buffaloes. There are some technical differences in undertaking treatment of these two types of prolapse conditions.

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Dystocia Due To Siamese Twin Monster In A Murrah Buffalo

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Abstract :

A case of dystocia due to a siamese twin monster fetus with thoracopagus condition in a Murrah buffalo was relieved by emergency caesarean section.

Key words: Buffalo, Conjoined, twin monster, Dystocia.

Introduction :

Fetal anomalies and monstrosities are common causes of dystocia in bovines (Shukla *et al*. 2007). Occurrence of dystocia due to conjoined twin monsters has been reported earlier in buffaloes by Pandey *et al*. (2012). Conjoined twin, in which the components or component parts are symmetrical, are called as Siamese twins (Roberts, 2004). For the obstetrical management of conjoined twin, delivery by caesarean section is usually undertaken (Whitlock *et al*. 2008). The present case report describes the delivery of Siamese twins through caesarean section in a Murrah buffalo.

Case history and observations :

A Murrah buffalo having full term pregnancy was brought to Veterinary Clinical Complex, LUVAS, Hisar with history that animal showed signs of parturition since last 8 hrs and the allantochorionic sac was ruptured 4 hrs before. One fetal leg with head was visible at the vulva without any progress and the animal was straining intermittently. The case was attempted by a local veterinarian but failed to deliver the fetus. The animal was alert with normal muzzle and good body condition. Following complete anamnesis, animal was restrained and epidural anaesthesia was administered (Lignocaine hydrochloride 2%, 5ml) at sacro-coccygeal junction. Per-vaginal examination following ample lubrication with liquid paraffin revealed another head present in the birth canal. Further deep exploration showed presence of two foetuses attached at the sternum and two limbs at just beneath the pelvic brim. Hence, it was

Fig.1: Siamese twin Monster

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diagnosed as a case of dystocia due to a conjoined twin monster and a decision to relieve it through an emergency caesarean section was undertaken.

Treatment and Discussion

Caesarean section was performed through ventro-lateral approach by giving 35 cm long incision parallel and lateral to milk vein. Taking care of aseptic conditions, fetus was delivered. Uterus, muscles and skin were sutured in routine procedure. After surgical intervention, antiseptic dressing was continued with liq. Povidone Iodine. Fly repellent spray was sprayed over the surgical site. For post operative care, inj. Meloxicam @ 0.5 mg/kg, Ceftriaxone plus sulbactum @ 4.5g, B-complex 10 ml IM for 7 days, fluid therapy (Dextrose Normal saline solution 5%, 5 litres along with Metrogyl 3gm IV for 3 days) and antiseptic dressing daily with ointment Povidone Iodine (5%), locally for 10 days was carried out. Sutures were removed on day 12 post-caesarean operation and the animal recovered fully without any complication.

Gross appearance of Monster :

Both the fully developed fetuses were of female sex having a separate head, neck, forelimbs, abdomen and hind limbs, but were attached at the sternum. On postmortem examination, it was found that both fetuses had separate normal female genitalia, intestines, spleen, heart but lungs were developed in one fetus and absent in another. Aside from the thoracic conjunction and the relatively similar size of fetus, no gross deformities of body form were apparent.

Discussion :

On the basis of observation, Siamese twin was named as Dicephalus, Tetraotus, Distomus, Tetrabrachius, Tetrapus, Dicaudatus Sterno-pagus monster (Roberts, 2004). Conjoined twins are monozygotic in origin (Arthur, 1956). The present case was a typical Siamese twin as duplication occurred at both cranial and caudal ends. Number of factors influenced by the genetic and environmental conditions may cause development of conjoined twins. It is thought that many factors are responsible for the failure of twins to separate after the 13th day following fertilization (Srivastava *et al*. 2008). However, such abnormal embryonic duplications, resulting in conjoined twin are rare and are not well documented in buffalo.

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Cow Side Tests to Monitor Negative Energy Balance and Subclinical Ketosis in Dairy Cattle: A Case Study

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(received 11/05/2018 - accepted 30/05/2018)

Abstract :

The present study was conducted on dairy farm for monitoring Negative Energy Balance (NEB) and Sub Clinical Ketosis (SCK) during transition period with cow side tests. One hundred pregnant graded Murrah buffaloes were confirmed as advanced pregnant. Eleven buffaloes which were in close stage were selected for the present study. Urinalysis with Ross modified Rothera's test was done. Blood glucose levels and beta hydroxy butaric acid levels were measured. Out of 11 animals, one graded Murrah buffalo was diagnosed as positive for NEB and SCK post calving. The animal was treated with gluconeogenic precursors and phosphorus injections.

Key Words: Graded Murrah, Buffaloes, Negative Energy Balance, Subclinical ketosis, Glucose, BHBA.

Introduction

Transition period is referred as period from three weeks pre-partum to three weeks postpartum (Moreira *et al.* 2015). Mostly the high yielding dairy cattle will visit a state of negative energy balance during transition period. Due to high production performances and exceeding high nutrition demands, exceeding metabolic capacities, leads to an aberrant physiological state of NEB known as negative energy balance (Irena *et al.* 2015). This NEB can be due to fewer intakes of dry matter and inadequate feed utilisation during transition period. The NEB is the initial stage of sub clinical ketosis without any loss of milk production. Most of the researchers are unable to draw an exact line between the NEB and SCK. Best biomarker for NEB and SCK are blood beta hydroxy butaric acid (BHBA) concentration and NEFA concentrations.

Present study was conducted with a cow side test on farm to diagnose NEB and SCK.

Materials and Methods

The present study was taken up on dairy located in Ranga reddy district of Telangana. Eleven buffaloes which were in three (3) weeks to (3) three days pre-partum period were selected from 100 advance pregnant buffaloes due to their close up stage. Urinary ketones were detected by Ross modified Rothera's test. Blood glucose was estimated by Dr. Morepen® blood glucose monitoring system Gluco One Blood Glucose Test Strip (Gluco one BG-03) with Testing range of 20mg/dl-600mg/dl. For ketones testing, BHBA testing is the best way to test as it is the most stable ketone body compared to acetone and acetoacetate. Testing BHBA ketone bodies is the gold standard test for detection of subclinical ketosis. X-tra precision strips are used

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with Xceed meter (Precision Xtra meter) in human medicine for diabetes monitoring. One buffalo was found positive for both NEB and SCK was treated with E-Booster (Gluconeogenic precursor + Nicotinamide + Cynacobalamine) for 5 days @200ml twice daily for two days and 100 ml daily for 3 days. (Novizac™) injectable phosphorus @25ml IM and 100 grams of Himalaya Batisa orally as electuary was the supportive therapy to case under investigation.

Results and Discussion

One hundred pregnant buffaloes were screened for advanced pregnancy and confirmed with insemination records. Out of which, eleven buffaloes which were in 3 days to three (3) weeks pre-partum period were selected for the present study. Out of eleven buffaloes, ten buffaloes were found within normal range of blood glucose and BHBA. Only one buffalo was found in NEB (Glucose-43mg/dL and BHBA-1.2mmol/L) during pre-partum. Urinary ketone bodies, blood glucose and blood BHBA values revealed 9% incidence of NEB during pre-partum. The same animal showed SCK (blood glucose-38mg/dL, blood BHBA-1.4mmol/L) after 24 hours of calving. Blood glucose and blood BHBA values were compared on 1st day and 10th day.

Table-1. Blood glucose and blood BHBA values of healthy buffaloes during pre-partum period.

Sl. No.	3 weeks to 3 days pre-partum period.	
	Blood Glucose (mg/dL)	Blood BHBA (mmol/L)
1	64	0.3
2	62	0.5
3	74	0.4
4	57	0.5
5	71	0.4
6	82	0.2
7	55	0.8
8	57	0.8
9	86	0.2
10	79	0.3
Mean ±SE	**68.7±11.27**	**0.44±0.22**

Mean values of blood glucose and blood BHBA of healthy animals were 68.7±11.27 mg/dL and 0.44±0.22 mmol/L respectively.

Blood glucose and blood BHBA values of buffaloes suffering from SCK during post-partum period were also estimated.

Table-2. Blood glucose and blood BHBA values of buffaloes suffering with SCK during post-partum.

Sl. No.	On 1st day of calving. (Before therapy)		On 10th day of calving. (After therapy)	
	Blood Glucose levels (mg/dL)	Blood BHBA (mmol/L)	Blood Glucose (mg/dL)	Blood BHBA (mmol/L)
1	38	1.4	63	0.4

All the buffaloes tested for blood glucose and blood BHBA were in the period of 3weeks to 3days pre-partum. All the buffaloes showed normal glucose and BHBA values except one. Blood glucose and blood BHBA levels were estimated using electronic hand held Xtra precision meter to find blood BHBA concentrations which is effective in monitoring the subclinical ketosis (Marek *et al.* 2014). Blood BHBA threshold level is 1.2mmol/dL to 2.9 mmol/dL for SCK (McArt *et al.,* 2012). In present study, one buffalo showed blood BHBA levels as 1.2mmol/dL was diagnosed for NEB before 3 days of calving. After calving, the animal was not active (blood blucose-38mg/dL, blood BHBA-1.4mmol//L). So E-Booster 200ml orally was administered and given Novizac Phosphorus 25ml IM 100grams of Himalaya Batisa was fed orally as electuary. E-Booster (Gluconeogenic precursor + Nicotinamide + Cynacobalamine) was continued for 5days 200ml twice daily for two days and 100ml daily for 3 days (Bhikane, and Syed, 2014). By the 10th day of calving blood glucose level has increased to 63 mg/dL and BHBA concentration has come down to 0.4mmol/dL .

Gluconeogenic precursors increase the concentrations of glucose and reduce the BHBA concentrations in the blood. Nicotinamide decreases the blood BHBA concentrations. The hand held device to measure blood BHBA concentration in pre-partum is a valid tool to prevent post partum hyperketonemia in dairy cattle (Tatone *et al.* 2015). Whereas glucometers can provide instant result of blood glucose values.

1. Blood BHBA level 1.4mmol/L to 2.5mmol/L is SCK (Radostits *et al.* 2006). However, at what level exactly individual cows will express a clinical signs is extremely variable (Andersson 1984). The NEB may be connected to retention of placenta (ROP) and further complications which finally ends up in less milk production and economical loss to the dairy farmer. In recent years most of the researchers are focusing on the NEB during transition period.

2. Subclinical ketosis is defined as a BHBA concentration of 1.2 to 2.9 mmol/L (McART *et al.* 2012). It is one of the important metabolic disorders occurring due to negative energy balance around calving. Subclinical ketosis (SCK) incidence is far more common than clinical disease and frequently goes unnoticed.

Monitoring of NEB/SCK during transition period by using cow side tests is useful to prevent postpartum complications and positive cases can be treated with gluconeogenic precursors and phosphorus injections.

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Anagallis arvensis toxicity in bullock – A case report

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Abstract:

A five year old bullock with respiratory distress, suspended rumination and blackish constipated feaces was diagnosed as *case of Anagalis arvensis* toxicity and was treated successfully with complete recovery.

Key words : *Anagallis arvensis,* Oxalic acid, constipation, oxalate nephrosis, hypocalcaemia

Introduction:

Various types of poisonous plants are distributed all over and *Anagallis arvensis* ("Blue pimperinel") is a most commonly occurring intercrop between main crops like jawar, wheat, cotton and maize in Maharashtra state (Musale *et al*. 2017). This weed contains different poisonous active principles like glycosides, volatile oil, saponin (anagallin), tannin and oxalates in its edible parts. Owing to its oxalate contents, this plant is found to cause oxalate poisoning leading to nephrosis. Acute poisoning of *Anagallis arvensis* was recorded in the present case and treatment success has been discussed.

Clinical Observations :

A five year bullock was reported to the TVCC, Parbhani with a history of accidental ingestion of *Anagallis arvensis* plant on field. Detailed clinical examination revealed that there was severe respiratory distress with respiratory rate 34 breath/min, tachycardia (73 beats/min), subnormal rectal temperature (99.6^{0}F), congested conjunctival mucus membranes and suspended ruminal motility. Hemato-biochemical findings revealed reduced serum calcium level (6.5mg/dl) and slight increase in serum inorganic phosphorus level (7.60mg/dl). Affected animal was showing symptoms like in-appetance, dullness, respiratory distress, mild abdominal pain, blackish hard feaces, bilateral swelling on perineal area and anuria.

The present case was diagnosed as *Anagallis arvensis* toxicity on the basis of history of accidental ingestion of plant; signs and symptoms exhibited by animal and hemato-biochemical findings.

Treatment and Discussion:

Treatment was undertaken with Inj. Calborol 450 ml IV slow once only, Inj. Amoxicillin-cloxacillin @ 10 mg/kg body weight IM, Inj. Tribivet 10 ml IM, Inj. Meloxicam @ 0.5 mg/kg body weight IM, Inj. Frusamide @ 0.5 mg/kg body weight IM, Inj. Dextrose Normal saline 3000 ml IV for five days and 10% lime water orally daily for seven days . The animal responded to the treatment and complete recovery was seen on 8th day of treatment.

Ruminants are more tolerant to the oxalates as compared to the monogastric animals due to the rumen bacteria which degrade oxalate into harmless formic acid and carbon dioxide (Allison

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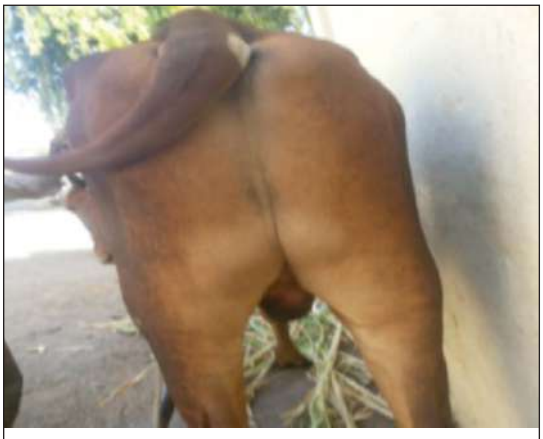

Fig.1: Bilateral perineal swelling

Fig.2: Severe dullness

et al.1977).

Oxalic acid present in the weed occurs in two forms i.e. soluble and insoluble. The soluble oxalic acid binds to minerals like calcium, magnesium and iron, thereby producing deficiency of these minerals in blood. Hypocalcaemia and hypo-phosphetemia thus produced leads to mobilization of calcium and phosphorus from bones. So, bones become weak and lameness develop (Rahaman *et al*. 2012).

Oxalate plant toxicity most commonly occurs in young animals than adults. The affected animal showed clinical signs and symptoms like tachycardia, respiratory distress, subnormal body temperature, constipated feaces, swelling on perineal area, anuria, congested mucus membranes and mild abdominal pain. Similar signs have been recorded in oxalate plant toxicity by various workers (Sadekar *et al*., 1995, Singh *et al*., 1995). Hematological findings in present case like reduction in hemoglobin, packed cell volume and total erythrocyte count with decrease in serum calcium (Ca) level and slight increase in serum inorganic phosphorus (P) level corroborates to the finding of Musale *et al*., (2017).

Anagallis arvensis toxicity affected animal showed renal insufficiency due to more concentration of calcium oxalate in blood which being insoluble causes damage to the renal tubules of kidney resulting in to renal insufficiency. Singh *et al*. (1995) and Dhoot *et al*. (1995) also mentioned that kidney is a target organ in oxalic acid toxicity. Previous studies indicated that diet containing 0%, 4%, 5% and 6% soluble oxalate to sheep caused slight hypocalcemia, increase in serum phosphorous and decrease in serum magnesium levels (James, 1972). James *et al*., (1968) found that diet containing low levels of (3.2% oxalate) halogeton glomeratus produces mild hypo-calcaemia, increased water intake and increased ruminal pH.

The severity of toxicity is affected by rate of ingestion and adaption by the animal. However, it is considered that < 2% soluble oxalate in the diet is appropriate for protecting ruminants from oxalate poisoning although blood calcium level may decrease (Rahman *et al.*, 2012).

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Fig.3: Blackish mucus coated feces

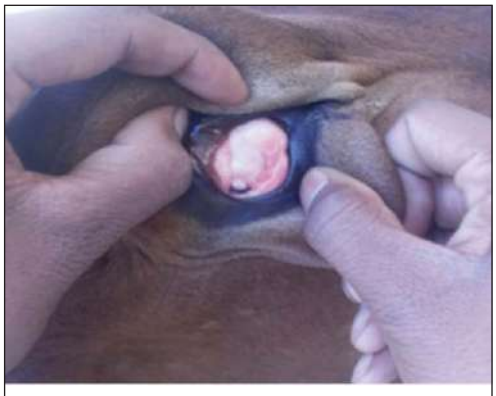

Fig.4: Pale mucus membrane

Fig.5: Animal after complete treatment

Fig.6: *Anagallis arvensis* weed

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Successful Therapeutic Management of Post Parturient Haemoglobinuria in a Buffalo

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(received 11/05/2018 - accepted 30/05/2018)

Abstract :

A Marathwadi buffalo with history of recent parturition and passing of red color urine showed anorexia, straining during defecation dyspnea and pale eye mucous membrane. The diagnosis by clinical findings, haematological investigation and biochemical findings as Post parturient haemoglobinuria. was confirmed and case was successfully treated and recovery started after first day of treatment.

Key Words: Buffalo, Parturition, Haemoglobinuria, Hypophosphatemia

Introduction:

Parturient haemoglobinuria is a non infectious haemolytic syndrome of milking buffaloes characterized by hypo-phosphataemia, intravascular haemolysis, haemoglobinaemia, haemoglobinuria and anaemia (Mahmood *et al.*, 2013). Phosphorus deficiency has been incriminated as a primary cause because hypophosphatemia is observed in many affected animals. Phosphorus deficiency in early lactation can be the result of high losses of phosphorus through the mammary gland, inadequate dietary phosphorus supply, or excessive dietary molybdenum content that hampers intestinal phosphate absorption (Constable *et al.,* 2017).

Clinical Findings:

A 12 years old Marathwadi buffalo was presented in the Department of Veterinary Clinical Medicine with history of recent parturition and passing of red color urine. History revealed that two days back parturition occurred with still birth of foetus and red to coffee coloured urine was started following parturition. Previously animal was fed kadbi, gudi and grazed on cotton field.

The buffalo continued to eat normally for 24 hours after discoloration of urine. Dehydration developed quickly, the mucous membrane was pale and the cardiac impulse and jugular pulse were much augmented. The physical parameters were pale conjunctival mucous membrane, normal rectal temperature, respiration rate, pulse rate and slightly reduced ruminal motility

On clinical examination, buffalo showed anorexia, reduced water intake, depression, diarrhea with straining during defecation, passing of dark red colored frothy urine (Fig. 2) and dyspnea. The physical parameters were pale conjunctival mucous membrane (Fig. 1) , rectal temperature 99 °F, respiration rate -23 per minutes, pulse rate 76 per minutes and ruminal motility zero per 3 minutes.

Whole blood with addition of EDTA was used for

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haemogram. The hematological investigation revealed haemoglobin – 4.7 gm/dl, total erythrocyte count - 1.97 mil/cumm, Packed Cell Volume – 12.5%, total leucocyte count – 15000/cumm. Differential leucocytic count was Neutrophil – 72 %, Lymphocytes- 20 %, Monocytes - 6 % and platelates 1, 92, 000. The serum calcium was 8.95 mg/dl and serum phosphorus level was 3.23 mg/dl.

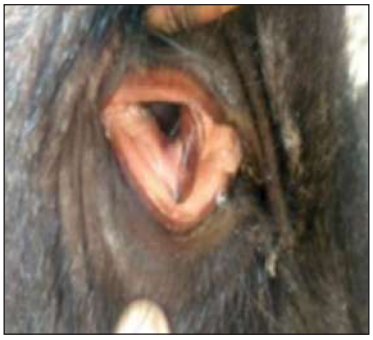

Figure 1

Figure 2

Figure 3

The diagnosis was confirmed on the basis of history, clinical findings, haematological investigation and biochemical findings as Post parturient haemoglobinuria.

Treatment and Discussion :

Buffalo was treated with phosphorous supplementation and supportive therapy. Buffalo was treated with Inj. Novizac phosphate buffer solution @ 50 ml IV slowly, In. Mifex @ 1ml/ kg body weight IV, Inj. Intamox D (amoxicillin-cloxacillin) @ 10 mg/kg IM, Inj. Isoflupredone acetate @ 0.02 mg/kg IM, Inj. Pheniramine maleate @ 0.5 mg/kg body weight IM, Inj. Multivitamin @ 10 ml IM, Inj. iron sucrose @ 10 ml IM and fluid therapy.

In present case, the buffalo was fed low phosphorus feed for longer time. Phosphorus-deficient soils, drought conditions, or rations based on sugar beet byproducts or clover are considered predisposing causes to post partum haemoglobinuria. In areas of severe phosphorus deficiency, the condition may occur at pasture (Constable *et al.*, 2017).

There is an association with hypophosphatemia and a low dietary intake of phosphorus and it is presumed that the drain of phosphorus at the onset of lactation causes further depletion of phosphorus reserves. The dependence of mammalian red blood cells on glucose metabolism for the main source of energy for viable function and structure makes them highly vulnerable to factors inhibitory to the glycolytic pathways. Hypophosphatemia results in a decrease in red blood cell glycolysis and adenosine triphosphate (ATP) synthesis. A marked decline of the intracellular ATP concentration in red blood cells results in altered function and structure, a loss of the normal deformability of these cells and an increase in osmotic fragility and hemolysis (Constable *et al.*, 2017).

The hematological investigation revealed haemolytic anaemia due to lysis of red blood cells due to phosphorus deficiency. Total leucocytic count was increased with neutrophilia. Thompson and Badger (1999) stated that RBC, Hb and PCV in cows with haemoglobinuria

decreased significantly. In this study, RBC, PCV and Hb concentrations in the buffalo were significantly lower compared with healthy buffaloes. The serum calcium was slightly reduced but serum phosphorus was markedly reduced to 3.23 mg/dl. Lowered serum phosphorous (3.23 mg/dL) was suggestive of hypophosphataemia. Similar low phosphorous levels in parturient haemoglobinuria cases were reported by Iqbal *et al*. (2011).

The present case report of nutritional haemoglobinuria was recorded in 7th lactation, which may be due to lactational stress. As number of lactations increases, stress on body also increases. In this study observed signs are in accordance with the Muhammad *et al.*, (2001).

The buffalo showed good response to treatment of sodium dihydrogen phosphate dehydrate and recovery started after first day of treatment. The animal recovered on 4th day with normal feeding, watering and change in urine colour to normal (Fig. 3).

Conclusion:

The buffalo developed the condition Post Parturient Haemoglobinuria due to the stress of pregnancy and feeding of diet having low phosphorus contents. The serum phosphorus level was severely reduced which lead to lysis of RBC and subsequently haemoglobinuria and anaemia. The buffalo gave good response to treatment with phosphorus and haematinic mixture with fluid therapy.

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Medical Management of Urethral Obstruction and Azotemia in a Male Cat

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(received 02/03/2017 - accepted 15/02/2018)

Abstract:

Suspected urinary obstruction (UO) on abdominal palpation during routine physical check-up was corroborated by in-house abdominal survey radiographs in a male cat. The critically ill patient was supported by laboratory diagnostics (urinalysis, blood work, abdominal radiography), and treatment schedule.

Key words: Urethral obstruction, Urinalysis, Catheterization, Medical care, Prescription diet

Introduction

Urethral obstruction (UO) or blockage of the urinary tract in domestic cats - a highly challenging problem encountered by the pet practitioners - may occur as a consequence of functional obstruction (idiopathic), or physical obstruction with uroliths/calculi (Westrop *et al.,* 2005). Microscopic debris, degraded exfoliated cells/ fragments and mucus often lead to urinary obstruction, especially in the male house cats with conspicuously narrow urethra at the terminal segment. The patho-morphological aberration may lead to a life-threatening situation owing to elevation of the circulatory potassium titer, culminating in cardiac arrythmias (Koneko *et al.,* 2008). Further, renal dysfunction may precipitate electrolyte-cum-water imbalance and azotemia. The causative factors include urinary tract infection (UTI), calculi and/or crystal formation in the stagnated urine, sterile cystitis (non-infectious inflammation of the bladder). The prognosis is generally favourable with the survival rate of 90-95%, and recurrence rate of 15-40% (Cooper, 2015).

Clinical observation :

Yoshi, a 3½ years old male Domestic Short Hair (DSH) cat, 8.6 kg (overweight; BCS 7/9) was presented at the Angel Animal Hospital Farmington Hills, USA. The owner noticed straining during repeated futile attempts to urinate for the last 3-4 days. Anamnesis revealed that the patient, with a previous history of UTI, was treated with a 7-day Clavamox antibiotic course, about one month earlier. Routine catheterization proving traumatic and painful, tom cat catheter was used in the patient placed under isofluorane gas anesthesia. The blood-stained turbid urine sample revealed moderate amounts of grit/ mucus.

In-house sequential abdominal radiographs revealed moderately full intact urinary bladder with no bladder/ urethral calculi. The cat was apparently sick with a tumor mass like feel in the ventral abdomen. The rectal temperature was

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102.5°F, pulse 210 bpm, respiration rate 28/ minute. Slight (<5 %) tissue dehydration was observed on skin turgor test.

At the Animal Emergency Center, Novi, USA following administration of Onsior 16 mg SQ and Polyflex (ampicillin) 250 mg SQ, the afflicted cat exhibited clear signs of recovery. The patient did not reveal any symptom of diarrhea/ purgation, but vomited once. Rectal temperature (RT) 99.2°F, pulse rate (PR) 220 bpm, respiratory rate (RR) 32 npm, attitude QAR, marginally dehydrated (5-7%) clinical status was documented. The oral cavity mucous membranes were light pink and moist; eyes clear; ears clear; nose no abnormal discharge; throat normal sounds; heart/lungs no murmur or arrhythmias on auscultation; pulse strong and synchronous, bilaterally; GI status: abdomen remained painful on palpation (the patient vocalized).

Microscopic examination of the centrifuged sediment revealed mostly intact RBCs suggestive of hematuria.

Treatment and Discussion: A 20 g sterilized i.v. catheter was inserted into the right cephalic vein and fluid therapy was started with sterile Normosol rehydration solution @ 36 ml/ hr for 40 minutes. Then Buprenex 0.11 mg and Cerenia 16 mg were administered IV. The oxygen flow was maintained @ 1 L/minute. Anesthesia, induced with 20 mg propofol (administered with endotracheal tube), was maintained with isoflurane gas for 30 minutes; The patient was placed in dorsal recumbence. An open ended tom cat catheter was introduced with gentle pressure and secured properly. The blood-tinged urine was notably viscous. The bladder was emptied by repeated suction, and a representative sample was subjected to urinalysis. The empty bladder was flushed with sterile saline solution until the washings became clear. A 3.5 Fr in-dwelling catheter was then carefully inserted into the urethra and attached to the sterile collection system.

LRS was continued @ 35 ml/ hr. At this interval, the cumulative IV fluid infusion was 50 ml, and the urine output, 15 ml. Unasyn (260 mg) was slowly administered IV with a syringe pump over a period of 90 minutes. Pepcid (5 mg) was given PO. Buprenex (0.11 mg) was given orally. Thus, Yoshi was kept under round the clock medical surveillance. Clavamox 125 mg (on the advice of the regular DVM), Bupremorphine 0.3 mg/ ml (@ 0.35 ml orally every 8 hr for pain relief), and Prazosin 0.5 mg (1 capsule orally every 8 hr. for 7 consecutive days) was used. Re-check for urinalysis was recommended in 10-14 days time.

Selected hemato-biochemical indices faithfully reflect kinetic changes in the internal milieu, induced by different agents and the restoration of homeostasis following judicious remedial strategies. In the instant case, leukocytosis (Table 1) pointed to latent infection. Further, lymphopenia and esinopenia were clearly attributable to the stress imposed by aborted attempts to void the stagnant urine from the turgid bladder.

Surge in primary stress hormone, epinephrine released from the adrenal medulla into the blood circulation appeared to be responsible for accelerated glycogenolysis in the functional hepatocytes, leading to markedly increased blood glucose concentration (Table 2). Early restoration of the blood sugar level to normalcy attests to bio-efficacy of the multi-dimensional medical management protocol.. This contention is further supported by the pertinent observation that the notably increased values of BUN and creatinine, suggestive of impaired renal function, were promptly restored to the respective normal range. Restoration of normal pale yellow colour of voided urine post-treatment indicates total absence of the sharp edged crystals, responsible for damaging the

Table 1. Hematological profile of male cat with urinary obstruction before treatment

Parameter (Units)	Recorded value	Normal Range	Comments
TLC (10^3/µL)	9.16	5.50-19.50	
Neutrophils (10^3/µL)	8.07	3.12-12.58	
Lymphocytes (10^3/µL)	0.95	0.73-7.86	
Monocytes (10^3/µL)	0.13	0.07-1.36	
Eosinophils (10^3/µL)	0.01	0.06-1.93	Low
Basophils (10^3/µL)	0.00	0.00-0.12	
Neutrophils (%)	88.10	38.0-80.0	High
Lymphocytes (%)	10.40	12.0-45.0	Low
Monocytes (%)	1.40	1.0-8.0	
Eosinophils (%)	0.10	1.0-11.0	Low
Basophils (%)	0.00	0.0-1.2	
TEC (10^6/µL)	9.34	4.6-10.20	
Hemoglobin (g/dL)	13.70	8.5-15.30	
MCV (fL)	43.90	38.0-54.0	
MCH (pg)	14.70	11.8-18.0	
MCHC (g/dL)	33.50	29.0-36.0	
Thrombocytes (10^3/µL)	245.00	100-518	

inner lining of the urinary bladder.

Successful medical management of the potentially fatal feline urinary obstruction, especially in the males mandates restoration of the water-cum-electrolytes homeostasis. A smaller (3.5 Fr) urethral catheter reduced the risk of re-obstruction. Concurrent flushing of the emptied urinary bladder with sterile iso-osmotic saline solution, at regular intervals, appeared to be highly beneficial with early restoration of the normal muscle tone and functional status of the sphincter.

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Table 2. Improved blood* biochemical profile of Yoshi following medical management.

Parameter (Units)	Recorded value (Time interval: 24 hours)		Normal Range	Comments
	12.12.2017 (4.50 PM)	13.12.2017 (4.50 PM)		
BUN (mg/dL)	111.6	27.9	15.0-32.0	Abnormally high value→normal range
Creatinine (mg/dL)	5.9	1.5	0.8-1.8	Abnormally high value→normal range
Calcium (Ca^{2+}) (mg/dL)	1.0	1.2	1.2-1.5	Low→near normal
Phosphorus (Pi) (mg/dL)	5.7	4.2	2.6-6.0	
pO_2 (mmHg)	35.8	34.4	27.0-50.0	
pCO_2 (mmHg)	36.9	35.7	31.0-51.0	
pH	7.4	7.4	7.3-7.4	
Sodium (Na^+) (m mol/L)	153.0	158.0	148-163	
Potassium (K^+) (m mol/L)	3.8	3.8	3.6-5.6	
Bicarbonate (m mol/L)	23.7	22.7	15.0-27.0	
Chloride (Cl^-) (m mol/L)	118.0	123.0	111-128	
Anion gap (m mol/L)	15.0	16.0	9-20	
Lactate (m mol/L)	1.2	3.3	0.5-3.2	High
Glucose (mg/ dL)	205.0	107.0	63-133	Abnormally high value→normal range

*Venous blood sample

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Post Mortem report of Bovine Ephemeral Fever Case

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(received 30/01/2018 - accepted 25/02/2018)

Abstract :

Post mortem of a two year old HF crossbred cow revealed fluid in the pleural cavity, congested and emphysematous lungs, a fibrinous covering on the heart, oedema and petecchial hemorrhages in the lymph nodes and areas of focal hemorrhages in the major muscles with the history of fever, stiffness, lameness and joint pain for almost 10-11 days, which confirmed diagnosis of ephemeral fever.

Key words: lesions; cattle; fever; limb stiffness, Ephemeral

Introduction :

Bovine ephemeral fever is an economically important arboviral disease that affects cattle. Among the cattle, age ranging from 6 months to 2 years are more susceptible (Radostits *et al.*,2000). It is prevalent both in indigenous and exotic breeds of cattle as well as water buffaloes (Mackrras *et al.*, 1940) The disease is characterized by high rise of temperature (103-107^{0}F), stiffness, lameness, muscular tremor with spontaneous recovery within few days, so known as "Three day sickness". The virus appears to be transmitted by arthropods (mosquitoes and biting midges). The disease is not spread by close contact, body secretions, aerosol droplets or through semen. The incubation period is usually 2 to 10 days. The virus localizes in the mesodermal tissues like joints, muscles, lymph nodes and thereby clinical manifestations like dyspnoea, limb stiffness supervene (Blood *et al.*,1983) are noted.

Clinical Observations:

History revealed death of two or more cows in the surrounding area with similar clinical signs of fever which was often biphasic to polyphasic, gait impairment, depressed, stiff, reluctant to move, inappetent with increased heart rate and serous or mucoid nasal discharge, dyspnea and pulmonary emphysema. Animals were recumbent and lost their reflexes and they showed ruminal stasis.

Post mortem lesions :

Diseased animal showed a fibrin rich fluid in the pleural , peritoneal and pericardial cavities with variable amount of yellow to brown typically gelatinous fluid in the joints also as observed by Basson *et al.*, (1969). Edema, lobular congestion and areas of atelectasis were apparent in the lungs. Other lesions included lymphadenitis, petechhial hemorrhages in the liver, lymph nodes and areas of focal necrosis in the major muscle groups.

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Fig. 1: Fluid in the pleural and peritoneal cavities

Fig.2: Congestion and atalectasis in lung

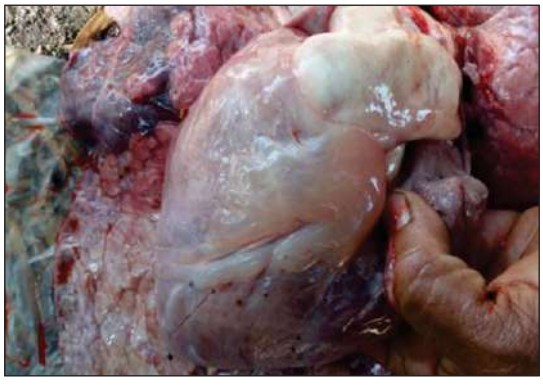

Fig.3: Fibrinous covering on heart

Fig.4: Bloated Carcass

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Fig. 5: Petecchial hemorrhages on liver

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Thyroid profile and electrocardiographic changes in a goat kid affected with Goitre

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(received 13/02/2018 - accepted 20/03/2018)

Abstract:

A 10 days old kid with bilateral swelling on the ventral aspect of the neck was diagnosed with congenital goiter based on very low levels of total T_4, low glucose (45.2 mg/dl) and high cholesterol (185.0 mg/dl) levels. Electrocardiogram was uncommitted with sinus rhythm and slightly increased heart rate (180 bpm). Treatment with Levothyroxine sodium and iodized salts for three months showed promising results.

Key Words: Electrocardiogram, kids, thyroid, T_3 and T_4

Introduction

Goitre is non-inflammatory and non-neoplastic swelling of thyroid glands predominantly seen in man and animals in endemic zones with iodine deficiency (Ani *et al.* 1998). Primary goitre is evident in animals on diets with goitrogenic compounds (plants of Brassica sp, soyabean bye product, water with high contents of calcium and nitrates). Congenital goitre is observed in newborn animals to dams on low iodine diets from different parts of the country (Joshi *et al.* (2016). However, reports from Southern Gujarat are lacking. Therefore, goitre in kid is reported and discussed.

Clinical Observations

A 10 days old male kid, weighing 3.85 kg was presented with the history of bilateral swelling on ventral aspect of neck region (Fig.1). The kid was born to a dam whose kids born in last two consecutive kidding failed to survive and also had similar swelling in the neck region. Owner reported that the swelling in the present case increased day by day. Initially suckling was normal but for last 4 days, the kid stopped sucking milk and become weak, dull and anorectic.

Clinical examination revealed grossly enlarged and palpable thyroid glands (Fig.1), pulsation in the neck, fast heart rate, and normal temperature (101.4^{0}F). Detailed investigations revealed low level of T_3 (0.677 nmol/l), T_4 (19.308 nmol/l) and blood glucose (45.2 mg/dl); and higher level of total cholesterol (185.0 mg/dl). Electrocardiogram revealed sinus rhythm with

Fig.1. Bilateral thyroid swelling in a ten days old goat kid.

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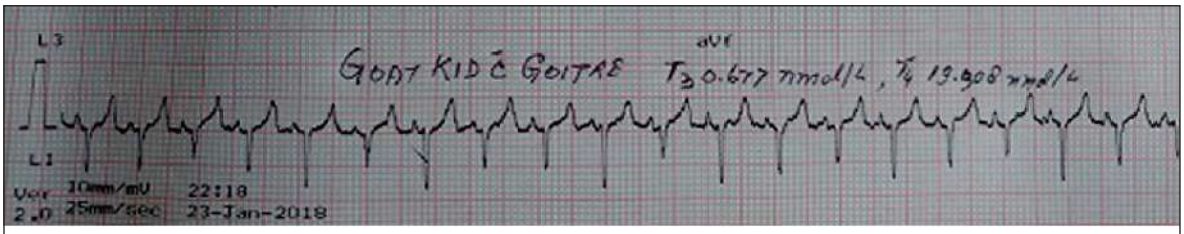

Fig.2. Electrocardiogram of the goitre affected kid showing sinus rhythm with heart rate as 180 bpm, variable amplitude of 'S' wave (0.4 mV to 0.8 mV) and predominant positive 'T' wave (0.4 mV,0.12 sec).

heart rate as 180 bpm, normal 'P' wave (0.1 mV, 0.04 second), small imperceptible 'r' wave (0.05 mV), predominant 'S'wave (0.5 to 0.8 mV with alternans) and normal 'T'wave (0.5 mV, 0.06 second) (Fig.2).

Treatment and Discussion :

The kid was treated with oral Levo-thyroxine sodium @ 0.1 mg and iodized salt daily orally up to three months.

Palpable enlarged thyroids with pulsation in neck and increased heart rate supported suspicion of goitre. Laboratory findings of low level of T_3 (0.677 nmol/l) and T_4 (19.308 nmol/l) as compared to those (0.7 to 1.12 nmol/l for T_3 and 56.8 to 73.35 nmol/l for T_4) reported in healthy small ruminants (Almeida *et al.,* 2002) confirmed goitre in the neonate kid. The present observation of marginal low level of T_3 also in the neonate kid with goitre does not agree with the observations of Hassan *et al.,* (2013) and Joshi *et al.* (2016) who observed increase in T_3 in kids with goitre. Thyroid function tests are not equivocal in humans with goitre (Nagataki *et. al.,*1972). Some workers have reported fall in T_4 only (Nagataki *et al.* 1972) while others have reported an increase in T_3 with marked decrease in T_4 with or without moderate elevation in TSH (Vagenkis *et al.,* 1973). Dams' diet deficient in iodine or rich in goitrogenic substances have been accredited for thyroid hyperplasia in kids born to these dams (Capen, 2002) by decreasing thyroxinogenesis leading to decreased levels of T_3 and T_4, treatment with Levo-thyroxine and iodized salt led to an increase in T_3 (0.86 nmol/L) and T_4 (51.2 nmol/L) levels with reduction in the size of the gland. Dam's diet deficient in iodine or rich in goitrogenic compounds seems to be the cause of goitre in neonate kid (Vijlder, 2003). Goitre *in utero* is caused due to either primary or secondary iodine deficiency. Since iodine cannot be synthesized in the body, it has to be provided through dietary sources (Bires *et al.*, 1996). Vegetables such as cabbage, soybeans, lentils, linseed, peas, peanuts and all of the cruciferous (mustard-like) plants possess goitrogens such as thiocyanate and goitrin, which is especially prevalent in the Brassica family. They interfere with the process of trapping iodine by the thyroid, and their effects can be counteracted by increasing levels of iodine in the ration. Electrocardiogram (Fig.2) showed sinus rhythm with tachycardia and 'S' wave alternans (varying amplitude of S wave). These changes do not seem to have any clinical significance. Treatment with Levo-thryroxine sodium along with iodized salt for three months led to an improvement in general condition with an increase in the levels of T_3 and T_4 ; and decrease in the size of thyroid glands. Similar observations have also been reported by Hassan *et al.* (2013).

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Rare Case of Monstrosity in Non-descript Cow - A Case Report

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(received 11/05/2018 - accepted 30/05/2018)

Abstract:

A dead monster fetus having rare multiple congenital anomalies like parrot mouth condition, cleft palate condition, micromelia of forelimbs, ankylosis of hind limbs, cryptorchidism, short and abnormally located tail and atresia anii was delivered successfully by caesarean section in a non descript cow.

Key words: Monstrosity, Non-descript Cow, Dystocia

Introduction:

Monstrosity represents the developmental abnormalities of ovum, embryo and fetus occurring in all the species of domestic animals. Abnormal phenotypes are products of the genetic constitution of individual and the molecular, cellular, and histogenic environment in which they grow (Colin and Carl, 1988). Every case of monstrosity is different from other and hence recording, reporting and analysis of monstrosities is necessary to reduce the incidence. Moreover, defined monstrosities may carry additional developmental abnormalities, as it was evident and reported in the present case.

Case Observations:

A full term pregnant Non-Descript cow ageing 7yr in forth parity was presented at TVCC, Parbhani in recumbent position with the history of labor pain since 12 hours. Completion of gestation period was reported by the owner with first water bag ruptured before 8 hours. Animal was recumbent with severe straining.

The clinical examination revealed that animal was dull, depressed and partially anorectic. The rectal temperature was 103.5^{0} F, respiration rate was 22/min, pulse rate was 50/min, and dehydrated state was recorded. Per vaginal examination after proper lubrication revealed that the three short legs were palpable in birth canal and fetus was in posterior longitudinal presentation, lumbo-sacral position with right unilateral shoulder flexion. Further, an intensive exploration revealed the bilaterally flexed fetlocks with joint immobility and abnormal sized fetus. Futile efforts were made to align the hind limbs in extended posture so as negotiate the birth canal. Eventually, the decision was taken to go for caesarian section.

Plate 1: Abnormal, dead, male, monster fetus with multiple defects.

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Surgical approach and discussion:

As the delivery per vaginam was not possible caesarean section was performed under local infiltration analgesia using standard procedure and a dead monster fetus was delivered. After completion of caesarean section, five days supportive therapy with antibiotics was given to the cow to avoid post-operative complications. Subsequently, the Non-Descript cow recovered successfully.

A detailed examination of abnormal fetus (Plate1) revealed the shorter lower jaw than the upper one (parrot mouth condition) is inherited as simple recessive trait. Tongue was found attached to lateral side of the lower jaw. There was an abnormal short small opening in the mid of hard palate, recognized as the "Cleft palate condition". Lungs were not bifurcated into two lobes & found joined with each other in mid thorax region. The monster had a small, flattened and deformed pelvic cavity with rudimentary lumbar, Sacral & Coccygeal vertebrae. The present findings corroborate with the case reported by Patil, *et al.* (2017). Fore limbs were not properly developed and found little bend with swollen joints, whereas hind limbs were strongly ankylosed and flexed that prevented natural delivery in the present case. The tarsal and metatarsal bones were malformed, congenital absence of anal opening (Atresia anii) and short and abnormally located tail (found attached to lumbar region) was evident. Cryptorchidism was evident with consequential aplasia of scrotal pouch and two testicles were found in the abdominal cavity after post-mortem examination. One testicle was located in the anterior abdomen, whereas, another was found in the posterior portion of abdomen.

Developmental anomalies occur due to expression of autosomal recessive genes (Roberts, 1971) when appear in homozygous constitution. History of inbreeding was also confirmed in present case. Inbreeding enhances the incidence of these anomalies within a herd to high enough to be of considerable economic importance (Janmeda *et al.*, 2014). Dissemination of undetected genetic recessives to a large portion of the population has been an inadvertent and unintended consequence.

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Postpartum vaginal prolapse in sheep: A case report

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(received 07/12/2017 - accepted 09/02/2018)

Abstract:

A two year old sheep with post partum vaginal prolapse after normal lambing was successfully treated under epidural anaesthesia.

Key words: Ewe, Postpartum, Sheep, Vaginal prolapse, Uterine tonic.

Introduction

Vaginal prolapse is a common reproductive problem in ruminants (sheep and cattle). It occurs usually in late gestation, occasionally in postpartum and rarely in non pregnant animals where the predisposing factors include hormonal imbalance, hypocalcaemia, fat or thin body condition, multi-gravid uterus, short docked tail, high fibre diets, inadequate exercise, dietary oestrogens, steep field, vaginal irritation, previous dystocia and genetic predisposition (Noakes *et al.,* 2009). Most of these predisposing factors are responsible for ante-partum prolapse however; postpartum predisposing factors have been so far remained ambiguous. Success of treatment depends on duration and degree of severity of the concerned case. A case report of postpartum vaginal prolapse in a sheep and its successful treatment management is discussed.

Clinical Observations

A two years old ewe was presented with the complaint of vaginal prolapse with the history of lambing a day before and subsequent to the lambing, prolapsed mass was observed protruding out through the vulva after few hours

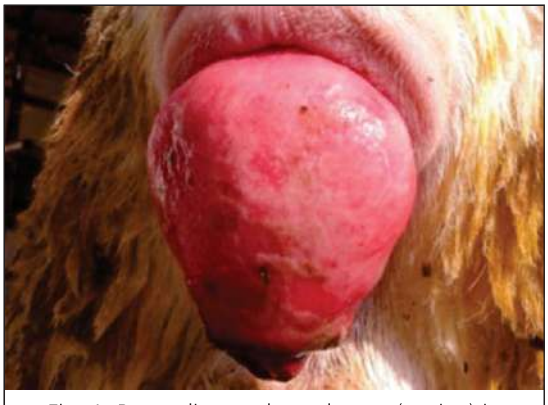

Fig: 1: Protruding prolapsed mass (vagina) in post partum sheep

(figure 1). The lambing was normal with normal and healthy lamb. Prolapsed mass was in the state of continuous prolapse (2nd degree prolapse). The rectal temperature, pulse rate and respiration were normal. The prolapsed vaginal mass was swollen, mutilated with faecal matter/or debris but the mass was apparently healthy but congested.

Treatment and Discussion

Epidural anaesthesia was administered with 3 ml of 2% lignocaine hydrochloride into lumbo-

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sacral space to prevent straining during replacement of prolapsed mass. Debris and faecal material were gently removed and the prolapsed mass was washed with diluted potassium permanganate solution (1:10000). An additional volume of 3 ml of 2% lignocaine was further administered epidurally as straining was interfering with the manoeuvre of the prolapsed mass. The prolapsed mass was subsequently lubricated with liquid paraffin and replaced gently by pressure using palm and both the hands to the normal position (Figure 2). Injections Ceftriaxone @ 10 mg/kg body weight and Flunixin Meglumine @ 2.0 mg/kg body weight were given intramuscularly once daily for five consecutive days to prevent secondary bacterial infection and inflammation. Uterine tonic (Uterotone liquid) was given @ 30 ml orally twice a day for three consecutive days to promote uterine involution. There was no recurrence of prolapse mass as observed by follow up in fortnight.

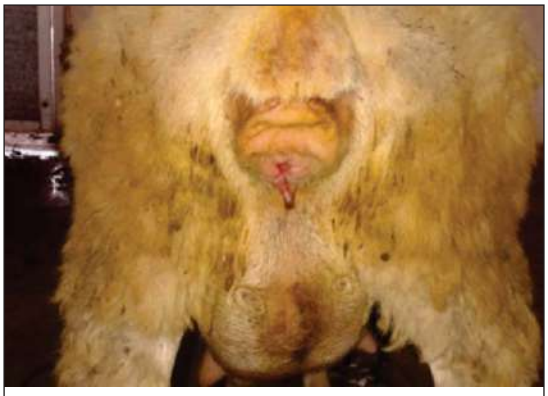

Fig: 2: Replacement of prolapsed vagina in a post-partum sheep

The sheep had too short docked tail and hence difficulties while choosing the right epidural space for epidural anaesthesia were noted. Too short docking could have been the predisposing factor for this prolapse, as it has been also reported and documented that too short docking of tail damages the structure that support the pelvic girdle (Kahn, 2005). The successful treatment and management of postpartum vaginal prolapse in sheep were also reported by Wani *et al.* (2000) and Manokaran (2006). The relaxation of pelvic ligament along with straining and lack of uterine tonicity might be the cause for the occurrence of uterine prolapse (Wani *et al.,* 2000)

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Right heart failure in an adult Pomeranian suffering from fatal Dirofilariasis

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(received 22/02/2018 - accepted 02/04/2018)

Abstract:

A case of right heart failure in an adult male Pomeranian dog with fatal dirofilariasis is reported and discussed.

Key Words : Dirofilarisis, *D. immitis,* electrocardiogram, Pomeranian, right heart

Introduction

Canine heartworm disease or Dirofilariasis, caused by *Dirofilaria immitis,* is a mosquito borne serious and potentially fatal disease and has been reported from different parts of the country (Borthakur *et al.,* 2015). Clinical manifestations varies from asymptomatic carrier to more fulminating clinical signs related to pulmonary and cardiovascular systems. In clinical cases, electrocardiographic changes are also not constant and varies as per pathology of the disease. Right heart failure in a Pomarenian dog with fatal Dirofilariasis is reported.

Clinical Observations

An adult 18 year old male Pomaranian dog was presented at the hospital with the history of chronic erratic dry coughing, marked weakness, dyspnoea and distended abdomen for about two months. Detailed clinical examination revealed marked weakness, exercise intolerance, exertional dyspnoea, anorexia, fluid thrills in abdomen (ascites), coughing (erratic and episodic), pale mucus membrane, inspiratory crackles, ronchi, salivation and slight elevated temperature (102.8^{0}F). Knotts' test revealed the preponderance of eosinophils and microfilarae having tapering tail (Fig.1) indistinguishable from those of *Dirofilaria immitis* (Ettinger and Feldman, 2000). SNAP 4Dx test (Fig.2) confirmed *Dirofilaria immitis* infection. Radiographic examinations (Fig. 3 and 4) revealed reverse 'D' shaped heart, distended vessels and ground glass appearance of the abdomen. Electrocardiogram (Fig.5) revealed heart rate as 80 bpm, sinus rhythm, broad 'P'(0.02 mV, 0.08 sec), normal'R' (0.8 mV), deep'S' (lead I 0.2, Lead II 1.2, Lead III 1.0 and avF 1.2 mV), broad QRS (0.20 sec), broad T (0.7 mV, 0.2 sec) and mean electrical axis on frontal plane as -109^0. Based on clinico-haematological, immunological test (SNAP 4DX) and radiographic observations the diagnosis was confirmed as Dirofilariasis caused by D. immitis. The dog collapsed before any therapeutic intervention.

Results and Discussion

Clinical manifestations characterized by marked weakness, exercise intolerance, exertional dyspnoea, anorexia, fluid thrills in abdomen, coughing, pale mucus membrane, inspiratory

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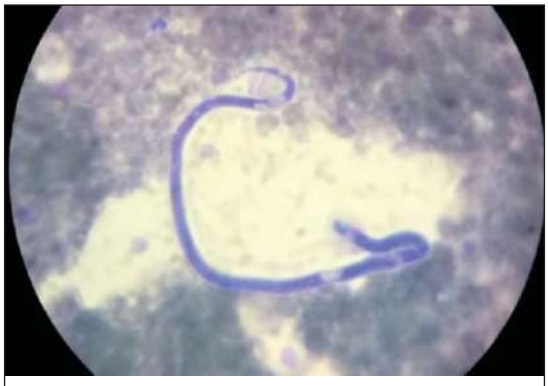

Fig.1. Smear made from the Pomeranian dog (Knot test) showing microfilaria with tapering tail and head characteristic of *Dirofilaria immitis.*

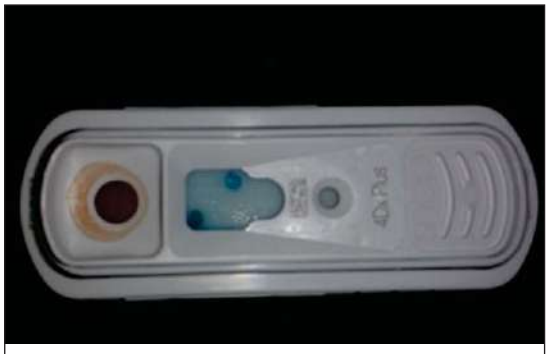

Fig. 2. Snap 4DX test using blood of the same Pomeranian dog showing colour development in the sample spot of *Dirofilaria immitis* antigen confirming *Dirofilaria immitis* infection.

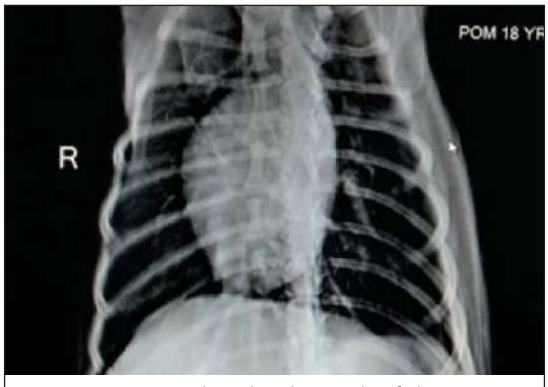

Fig. 3. Ventro-dorsal radiograph of the same Pomeranian dog showing right heart enlargement.

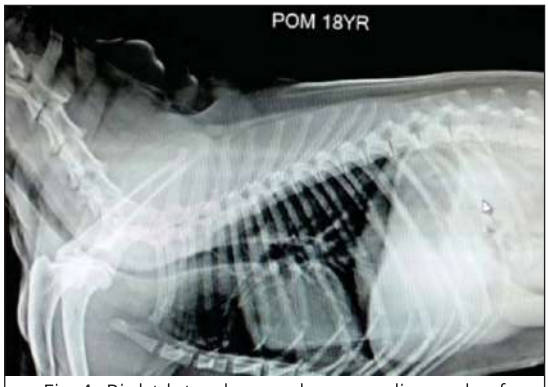

Fig.4. Right lateral recumbancy radiograph of the same Pomeranian dog showing right heart enlargement and hepatic enlargement

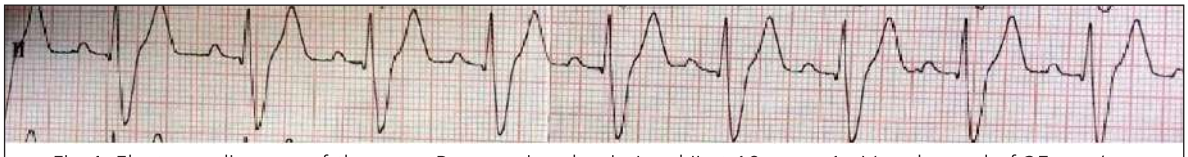

Fig.4. Electrocardiogram of the same Pomeranian dog in Lead II at 10 mm= 1mV and speed of 25 mm/sec showing heart rate as 80 bpm, sinus rhythm, boroad 'P' (0.02 mV, 0.08 sec), normal'R' (0.8 mV), deep'S' (lead I 0.2, Lead II 1.2, Lead III 1.0 and avF 1.2 mV), broad QRS (0.20 sec), broad T (0.7 mV, 0.2 sec) and axis on frontal plane as -109 0 (calculated from lead I and lead III) suggesting right ventricular enlargement and right axis deviation.

crackles and ronchi, salivation and slight elevated temperature (102.8^{0}F) in the Pomeranian dog aroused suspicion of compromised cardio-respiratory systems. Radiographic examinations of the chest revealed reverse 'D" shaped heart and changes in vessels suggesting right deviation of the heart and aroused suspicion of dirofilariasis. Ground glass

appearance of the abdomen was consistent with ascites. These radiological observations further supported to suspicion of dirofilariasis. Preponderance of microfilarae having straight tail (Fig. 1), resembling with those of *Dirofilaria immitis* confirmed Dirofilariasis. Though, blood examination indicated *D. immitis* infection, it was confirmed by .SNAP 4Dx test (Fig.2). The pathology of the lung and major arteries, owing to *D. immitis* can cause wide variety of clinical manifestations as observed in the present case (Ettinger and Feldman, 2000). Demonstration of microfilaria, characterized by straight body, straight tail and tapering head, with modified Knotts' test has been considered 60% successful in the diagnosis of *D. immitis* infection in dogs (Ettinger and Feldman, 2000). Antigen detecting ELISA is 100 per cent specific. Hence *D. immitis* was confirmed by SNAP 4Dx test in this case. Exercise intolerance and ascites observed in this case, were the manifestations of cardiac involvement as confirmed by right ventricular enlargement (deep 'S' wave in lead I, II, III, aVF and broad QRS) and right axis deviation (- 109^0) in electrocardiogram. These changes are in agreement with the electrocardiographic changes described by Tilley (1992) in dogs with marked pulmonary vascular resistance in cases having severe dirofilariasis. Electrocardiographic changes varying from normal electro-cardiogram, sinus arrhythmia, atrial fibrillation, Ta wave to low voltage complexes have been reported in dogs infected with Dirofilaria immitis (Varshney *et al.,* 2008). Death in this case seems to be due to acute respiratory distress syndrome and congestive heart failure.

Acknowledgements

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Surgical Management of Atresia Ani in Three Calves

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Abstract:

Three new born calves were operated with the history of non-passage of faeces and imperforate anus under local anaesthesia for reconstructive surgery and all cases had an uneventful recovery.

Keywords: Atresia Ani, Calves, Congenital

Introduction

Atresia ani is a congenital malformation of the anorectum due to the failure of the urorectal fold to divide the cloaca completely or of the failure of the perforation of the fetal anal membrane that divides the rectus and anus during fetal development. This condition is inherited in an autosomal recessive manner, but no candidate genes have been found unlike pigs (Albarella *et al.,* 2017). All congenital anomalies require immediate attention towards its correction. With the ease of its identification, cases are referred immediately for treatment. Present report communicates three cases of atresia ani, which were treated successfully.

Clinical Observations :

Three newborn calves were presented with the history of recent birth and non-passage of faeces and imperforate anus. The affected calves were two females (Jersey crossbreed) and one male (Non-descript). Clinical examination revealed variable signs of dullness, depression, restlessness, partial anorexia, attempt of defecation, straining, abdominal distension and absence of anal opening in all calves. Conjunctival mucus membrane was congested with slight capillary refill time in all cases. On abdominal pressing the bulging at the anal region was observed. With the visual inspection and above mentioned clinical signs, the cases were diagnosed as atresia ani.

Surgical intervention :

Cefquinome (Cobactan® 2.5%Injection, Intervet India) antibiotic was given @1 mg/kg body weight IM as a prophylactic antibiotic before half an hour to surgery. Pre-emptive analgesia was provided with analgin (Vetalgin® Vet Injection, Intervet India) @20 mg/kg body weight IM. Local anaesthesia was attempted by infiltration of 2% lignocaine hydrochloride (Lox* 2%, Neon Laboratories) solution SC around the surgical site. Affected animals were restrained on lateral recumbency with the raised hindquarter to avoid the staining. Perineal region was shaved and prepared aseptically. A plus (+) shaped incision was made over the skin, where the aril bulging was observed. The perineal muscles were dissected bluntly. The blind end of rectum was identified, exteriorized to the level of anus and anchored to skin with stay sutures using silk material. Rectum was incised, which voided meconium on abdominal compression. The

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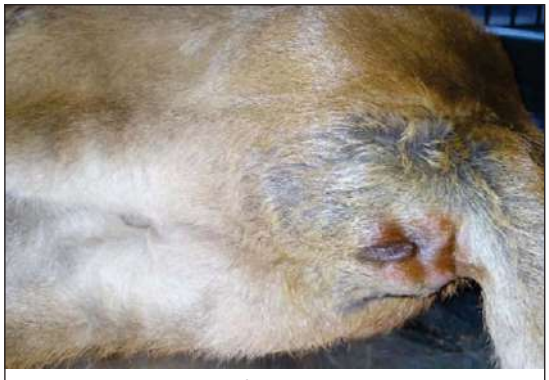

Fig. 1: Calf with atresia ani

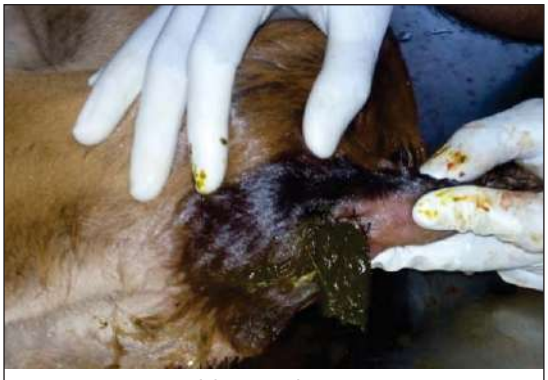

Fig. 2: Voiding of faeces after surgical correction

rectum wall and skin were sutured together in a simple interrupted technique using braided silk. The constructed anal was douched with normal saline and smeared with povidone iodine ointment. Routine postoperative care was provided for five days with Cefquinome @1 mg/kg body weight intramuscularly twice a day and analgin @20mg/kg body weight intramuscularly once a day. The skin sutures were removed on 14th postoperative day.

Discussions

The history and physical examination findings in calves with intestinal atresia are frequently similar to atresia ani (Kilic and Sarierler, 2004). In the present study, all the cases were diagnosed as type 1 atresia with mucosal blockage within the intestine lumen, without involving other intestinal deformities as suggested by Kilic and Sarierler (2004). Type I atresia was diagnosed and confirmed by physical examination, with bulging of perianal region after application of mild pressure over flank region. The calves showed marked improvement by 3rd to 4th day and were completely recovered by 11th to 13th day of surgery without further complications. Epidural and systemic anaesthesia may also be followed for higher degree of atresia with other deformities and for associated vaginal fistulous condition (Phiri *et al,* 2016). For atresia type I, local infiltration is sufficient to conduct the surgery smoothly. To maintain the patency, tubular plastic and syringe material were placed in rectum lumen (Kamalakar *et al.* 2015). To conclude, reconstructive surgery is the only treatment for correcting atresia ani and success of surgery depends on severity of multiple deformities. Though the treated animals may recover eventfully but further breeding of animal is not recommended (Phiri *et al.,* 2016).

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Dystocia due to fetal ascites in a non - descript goat

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(received 12/03/2018 - accepted 15/04/2018)

Abstract:

A case of full term pluriparous non-descript doe presented with dystocia due to fetal ascites was successfully relieved following abdominocentosis and normal traction.

Keywords: Dystocia, doe, ascites

Introduction

In goats, dystocia or difficult birth occurs less frequently than cattle and sheep (Hanie, 2006). Most commonly dystocia occurs due to foetal anomalies and monsters. Ascites refers to Accumulation of serous fluid in the peritoneal cavity which is caused by a variety of etiological factors (Pradhan, *et al.,* 2008 and Turkar *et al.,* 2009). Ascites may be caused either by the overproduction or insufficient drainage of peritoneal fluid (Sloss and Dufty, 1980). The present paper describes a case of dystocia due to fetal ascites in a non-descript doe.

Case History and Observations

A five year old, pluriparous, non-descript doe was presented to First Grade Veterinary Hospital, Nohar, Hanumangarh with the history of approximate full term, showing straining with the rupture of water bag three hours before but without any progress in the parturition. Vaginal examination revealed that the fetus was in posterior longitudinal presentation, Lumbo sacral position with both the hind limbs extended into the vaginal passage. Traction on both the hind limbs of the fetus failed to deliver the fetus. Further, careful clinical examination of the fetus indicated the presence of distended abdomen with huge fluid accumulation. Hence, the case was diagnosed as dystocia due to fetal ascites.

Treatment and Discussion

The fetal abdomen was punctured by applying the small obstetrical hook and traction was applied on both the hind limbs of the fetus. Around one litre of clear, watery and straw coloured fluid was drained out and finally dead female ascetic fetus (Fig.1) was delivered by gental traction. All these observations of the fetus indicated that it was a case of fetal ascities. The doe was treated with Inj. 5% DNS- 250 ml IV Inj. Oxytetracyclin 5ml IM, Inj. Oxytocin- 2ml IV Inj. Chlorpheniramine maleate- 2ml IM, Inj. Vitamin B complex-3 ml IM, Bolus. Cleanex 2 boli IU and herbal ecobolic Himrop 30 ml orally for 5days. Antibiotic and anti-inflammatory drugs continued for three days lead to uneventful recovery.

Foetal dystocia are numerous and often due to postural abnormalities. Foetal ascites is more common in bovines but rare in other domestic animals (Velankar and Deopukar, 1994).

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Management of dystocia with fetal ascites warrants evacuation of accumulated fluid (Prakash *et al.,* 2017) or cesarean operation (Gandotra *et al.,* 2003). In the present case, the fetal abdominal size got reduced following the drainage of the ascetic fluid and aided for the vaginal delivery. Portal hypertension raises capillary hydrostatic pressure and is associated with accumulation of transudate in fetal peritoneal cavity (Mohri *et al.,* 2007) or the obstruction of the lymphatic may prevent the disposal of peritoneal fluid and lead to fetal ascities (Sloss and Dufty, 1980). Selvaraju *et al.* (2009) reported that application of Williams's long obstetrical hook in the abdominal wall just behind the costal arch was sufficient to release the ascetic fluid in a graded Murrah buffalo. But in present case, the fetus was in posterior presentation so the small obstetrical hook was applied in the abdominal wall.

Summary

A case of dystocia due to fetal ascites in a non-descript doe and its obstetrical management is reported.

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Clinical Management of Anaemia in a New Born Puppy with Whole Blood Transfusion

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(received 11/03/2018 - accepted 16/04/2018)

Abstract:

Present case of 12 weeks old puppy having anaemic clinical symptoms and blood parameters such as packed cell volume (PCV)- 12 % and haemoglobin (Hb)-7gm/dl altogether was treated successfully by adopting an emergency whole blood transfusion along with other supportive therapy.

Keywords: Blood loss; Flea infestation; Blood transfusion; Anaemia; Veterinary medicine.

Introduction

Anaemia is defined as reduction in the total amount of red blood cells (RBCs) or haemoglobin in the blood, or a lowered ability of blood to carry oxygen. Clinical signs of anaemia include pale mucous membrane of tongue, gums and increased capillary refill time (CRT) Greco and Davison 2017), ear pinna turns white and lethargy. New born puppies with prolonged flea infestation means huge blood loss, which may result in anaemia. The paper highlights clinical management of anaemia in a new born puppy with an immediate emergency whole blood transfusion.

Table 1. Blood sample report of donor and recipient.

Parameters	Packed cell volume (PCV) %	Haemoglobin (Hb) g/dl	Platelets Count (PLC)
Donor	45	15.5	3,10,000
Recipient	12	7	2,00,000

Fig. 1. Represents affected anaemic puppy with symptoms like dull ,lethargy and weakness.

Fig. 2. Represents clinical signs such as pale gums white colour ear pinna.

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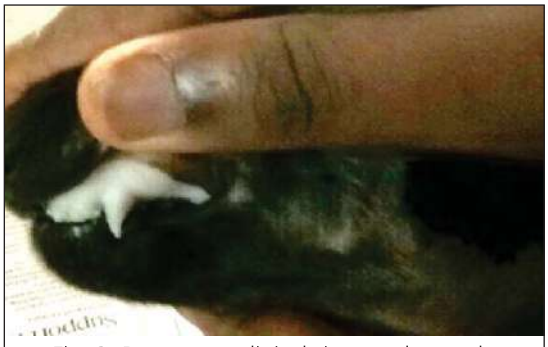

Fig. 3. Represents clinical signs such as pale gums white colour ear pinna.

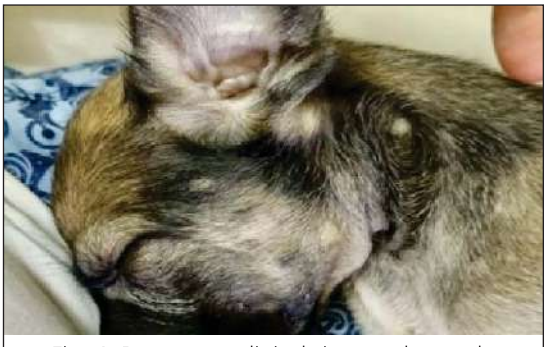

Fig. 4. Represents clinical signs such as pale gums white colour ear pinna.

Fig. 5. Blood sample of donor and recipient.

Fig. 6. Blood sample processing.

Clinical observations :

A twelve weeks old puppy was presented to clinics in dull, lethargic and weak form. All visible mucus membranes were pale. Clinical parameters revealed normal body temperature (100C^{0}F), eterated pulse (98/min) and exhaustive respiration (26/min). Based on physical status, clinical signs, clinical examination and blood sample report (Table1), severe anaemic status of puppy was confirmed. Further, immediate treatment intervention in the form of an emergency whole blood transfusion was sought so as to prevent mortality of the newborn puppy.

Treatment

Following complete analysis of the puppy's status, an emergency whole blood transfusion was planned. Before starting transfusion, base line evaluation of the recipient's attitude, rectal temperature, pulse rate and quality, respiratory rate and character, mucous membrane colour and capillary refill time were recorded. Subsequently, around 20ml of blood was drawn from the donor dog and immediately transfused to the puppy by following systematic methodology and practices. During the transfusion, the recipient puppy was watched carefully till the end of the procedure.

Discussion

a. Donor Selection

A thumb rule for the treatment of severe anaemia is to transfuse when the packed cell volume (PCV) is less than 10% to 15%. If the

PCV falls acutely to 20-25% and adequate hydration has been accomplished, whole blood should be given at a rate of 13-22 ml/kg of body weight. This can be repeated once or twice during the first 24 hours until stabilization of the PCV above 20%. The worst part is that anaemia can even lead to death of a newborn puppy. As veterinary critical care becomes more and more sophisticated, the advantages of a basic knowledge of transfusion therapy will be of paramount importance.

On the very next day a well maintained, properly vaccinated, 3 year old non pregnant female bitch was identified by the pet owner to serve as a donor and was brought on empty stomach to the outpatient ward for blood donation.

b. Cross matching Protocol

Blood samples of both the donor and recipient were taken for routine investigation to ascertain various parameters such as packed cell volume (PCV), haemoglobin (Hb), presence of blood borne parasites as well as to ensure compatibility of blood type among them through a cross-matching protocol (Major and Minor Cross match).

Major cross match - (Donor cells + Recipient serum)

Minor cross match - (Recipient cells + Donor serum)

The major and minor cross matching tests are done for agglutinating and/or haemolytic reactions between donor and recipient. For dog and cat, agglutinating tests are sufficient whereas in equines agglutinating and haemolytic tests are required because of presence of agglutinating as well as haemolytic antibodies in equines.

Fig.7. Donor and Recipient.

c. Blood Collection from donor.

On the same day after the preliminary investigation, about 20ml of blood from jugular vein of the donor dog was collected aseptically at the rate of 10 ml of blood per kg BW (Wardrop *et. al.,* (2008) in to an empty metronidazole-(Flagyl^{R}) sterile 100ml container to which anticoagulant (3.85%) sodium citrate was previously added at a dose rate of 1ml of Na Citrate for every 9 ml of whole blood (Kisielewicz *et. al.* 2014).

d. Transfusion protocol.

The whole volume of 20 ml blood was transfused through intravenous route by connecting the one end of the transfusion set to the container and the other end with a 23G scalp vein needle which in turn was connected to the cephalic vein located on one of a left forelimb. In the beginning, rate of transfusion was adjusted to 0.25 ml per Kg over a 30 minute period during the time period patient's vital parameters such as pulse rate and quality, respiration rate and quality, heart rate monitored carefully for the possibility of development of transfusion reactions. After 30 minutes period in the absence of anaphylactic reactions, transfusion rate was increased to 10 ml per Kg per hour as the recommended transfusion rate of whole blood in dogs is less than 22 ml/Kg/day (Turnwald. 1985) and the patient was continuously watched at 45 minute and 60 minute and there after every 30 minute interval and so on. The total volume of 20 ml of blood transfusion was completed in 1 hour and 45 minute and there was no episode of any adverse reactions. On completion of transfusion the recipient was immediately examined for

imminent possibility of anaphylactic reactions. The recipient was continuously monitored for the subsequent 4 days as a follow up protocol to ascertain development of any delayed type of adverse reactions. In addition to whole blood transfusion, the puppy was advised with oral haematonics containing amino acids syrup (Elemental-F^{R}) and multi vitamin syrup (Mulmin^{R}) at a dose rate of 5ml twice a day for a period of 15 days.

The puppy started feeding on solid food from 10th day onwards and completely recovered from clinical anaemia after a period of 21 days, which was apparently evident by rechecking the blood smear of the recipient puppy with following marked improvement in parameters such as packed cell volume (PCV)-35% and haemoglobin (Hb)-12.5g/dl ,pinkish colouration of gums, tongue and ear pinna changed to its original colour.

The present case involved successful field level blood transfusion for an anaemic puppy with the available and low cost inputs and adopting simple protocol.

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Fig. 8. Blood collection in progress.

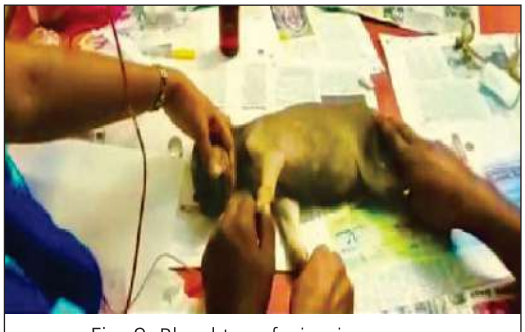

Fig. 9. Blood transfusion in progress

Fig. 10. Complete recovery after twenty one days.

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Successful Therapeutic Management of Secondary Hypothyroidism associated with prolonged Corticosteroid Therapy in A Labrador Dog – A Case Study

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(received 23/04/2018 - accepted 26/05/2018)

Abstract:

A five years old Labrador Retriever dog was investigated clinically and also through biochemical analysis, which revealed secondary hypothyroidism and was treated successfully with thyroxine sodium and other medication within two months.

Key words: Dog, Hypothyroidism, T_3, T_4, TSH and Eltroxin.

Introduction:

Hypothyroidism is the most common over-diagnosed endocrine disease in dogs (Miller *et al*, 2013) with an estimated prevalence of 0.2% (Panciera, 1994). Hypothyroidism is a disease of middle aged dogs at age 2 to 6 years, characterized by reduced production of T_4 (Thyroxine) & T_3 (Tri iodo thyroxine) by the thyroid gland. At cellular level, T_4 and T_3 are important for O_2 consumption, cell proliferation and normal BMR (Basal Metabolic Rate). Present case of secondary hypothyroidism, resulted due to prolonged usage of Whysalone (predinisalone) tablet for treating dermatitis, was treated successfully and discussed.

Clinical Observations :

A five years old black colour Labrador Retriever dog was presented to the Veterinary Clinical Complex, College of Veterinary Science, Korutla, Jagtial district, Telangana, with the history of obesity, lethargy, dullness, unable to stand on its own and difficulty in walking, having exercise intolerance, constipation for two months, severe hair fall, dandruff and has normal appetite. Further, the dog was given Whysalone (Prednisalone) tablet for six (6) months for treating dermatitis.

Detailed clinical examination revealed the body weight of 58 kg with dermatological symptoms of rat tail appearance, non pruritic alopecia, severe dandruff over the entire dorsal surface of the body and decrease in size of the testicles (Fig.3). Auscultation revealed weak heart beat and bradycardia, decreased pulse (35/minute), increased rectal temperature (103^{0}F) and labored breathing were noticed. On tactile purcusuion, there was no fluid thrill and ascites was ruled out. Blood and serum analysis were done at hospital and thyroid function test was done in thyrocare by radio immune assay.

Treatment and Discussion:

Complete blood picture showed normocytic normochromic erythrocytes with slight decreased haemoglobin (12.5 g/dL) and increased total leukocyte count (26.5X103/µL)

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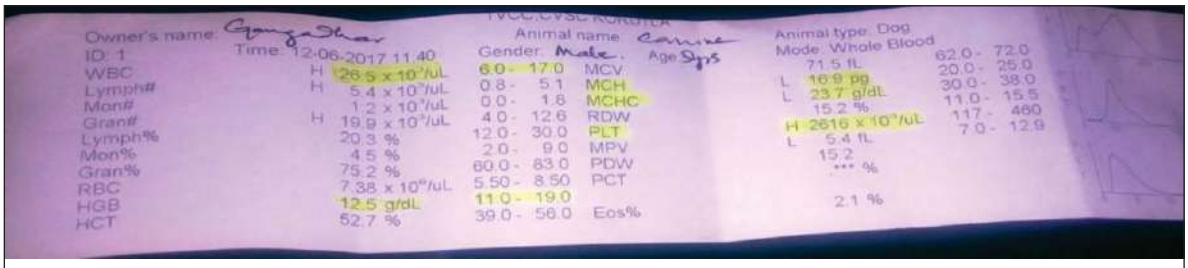

Fig. 1. Haematological Investigation

indicating infection in pituitary gland (Fig.1). Serum examination revealed hypercholesterolemia (Ettinger, and Feldman, 2009), hypocalcemia and Increased plasma creatinine. Thyroid function test revealed decreased levels of T_3 @ 33 ng/dL (75-200 ng/dL), T_4 @ 0.3 mcg/dL(4.5–12 mcg/dL) and TSH @ 0.01 µiu/mL (2-5 ng/dL) (Fig.2). Based on these findings, the case was diagnosed as secondary hypothyroidism resulted due to dysfuction of pituitary gland leading to decreased production of TSH.

Therapy was started with Eltroxin (Thyroxine sodium) 100 mcg tablet, given one (1) tablet orally with empty stomach in early morning for a week and the response was poor. Then, the dose was increased to two (2) tablets daily, one in morning and another in evening for a period of two months. Given Inj. Ceftriaxone @ 500 mg IM for five (5) days to correct pituitary infections. Also given tablet Phentramin-D1 given one (1) tablet daily, before food for two months for weight reduction. Prescribed syrup Ostocalcim 20 mL twice daily for 2 months to enhance the absorption of Eltroxin. Above all, advise for vigorous exercise was suggested.

Dog started showing good response to the therapy by a significant reduction in body weight from sixth day onwards and became active and lost its weight from 58 kg to 40 kg after one month of therapy and also alleviation of dermatitis signs were noticed. The therapy was continued for two months and later dose was tapered to one tablet in a day and continued for one more month. Then serum analysis was done which revealed normalization of T_4, T_3 and TSH concentrations, on discontinuation of treatment.

Discussion :

Hypothyroidism can be primary due to dysfunction of thyroid gland with decreased T_4 and T_3 production, secondary due to a reduction

Fig. 2. Serum Investigation by Radio Immuno Assay

Test Name	Technology	Value	Units Reference Range
Total Triiodothyronine (T_3)	C.L.I.A.	33	75-200 ng/dL
Total Thyroxine (T_4)	C.L.I.A.	<0.3	0.5 µg/dL
Thyroid stimulating hormone (TSH)	C.L.I.A.	<0.01	2.5 ng/dL

Comments : If not on drugs suggested Ft3 & Ft4 estimation, Please correlate with clinical conditions.
Method :
T_3 - Competitive Chemi Luminescent Immuno Assay, T_4 - Competitive Chemi Luminescent Immuno Assay, TSH - ULTRA sensitive

Figure 3. (Clockwise): Increased body weight and lethargic activity; Rat tail appearance of tail indicating hypothyroidism; Non-pruritic dermatitis with dandruff.

in pituitary thyroid stimulating hormone (TSH) resulting in decreased T_3 and T_4 and another tertiary hypothyroidism due to reduction in hypothalamic thyrotropin releasing hormone (TRH) secretion (Ettinger and Feldman, 2009). Causes for secondary hypothyroidism could be pituitary malformation, pituitary cyst (or) destruction (or) neoplasia, TSH molecule defect, prolonged glucocorticoid therapy, hypophysectomy and radiation therapy.

Clinical signs similar to present case were observed in earlier cases affected with hypothyroidism (Prasad and Moulikrishna, 2010). Prolonged oral administration of prednisolone will affect thyroid function in dogs leading to hypothyroidism (Moore *et al.*, 1993).

Prolonged steroids usage can cause low T_4 concentration (Eisenschen, 2016). Assay of serum TSH is likely to prove helpful in the differential diagnosis of primary, secondary, and tertiary hypothyroidism in dogs (Williams *et al.*, 1996).

It was concluded that, the assay of serum TSH is likely to prove helpful in the differential diagnosis of secondary hypothyroidism form primary hypothyroidism in dogs. Further, oral calcium supplementation has to be given for enhancing the absorption of Eltroxin and obesity management should be combined along with the therapy. Further caution should be excised during administration of prolonged corticosteroid therapy.

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Successful therapeutic management of babesiosis in a Labrador: a case report

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(received 23/4/2018 - accepted 26/05/2018)

Abstract:

A case of Babesiosis in a labrador dog was diagnosed and successfully treated with single dose of imidocarb with supportive measures.

Keywords: Labrador, Babesiosis, imidocarb, Anemia

Introduction:

Canine babesiosis (Piroplasmosis) is one of the most significant intraerythrocytic tick borne disease occurring worldwide either single or as concurrent infection with other haemo-protozoans. The most common naturally occurring pathogens in dogs belongs to species *Babesia canis* and *Babesia gibsoni* (Uilenberg *et al.,* 1984).

Clinical Observations :

A male Labrador aged 3 years was presented to the Out patient unit, Veterinary College, Bidar with a history of anorexia for last one week and tick infestation. Clinical examination revealed pyrexia (105.2ºF), enlarged lymph nodes and pale mucous membrane. Haemato-biochemical investigations revealed anaemia, thrombo-cytopenia elevated SGPT, hypoproteinemia, hypoalbuminemia (Table 1). Blood smear examination revealed intraerythrocytic small oval shaped *Babesia gibsoni* organisms (Fig.1). Hence, a diagnosis of babesiosis was confirmed.

Treatment and Discussion :

The dog was treated with single dose of inj imidocarb dipropionate @ 5 mg/kg BW deep IM. Supportive treatment included D 25% I/V and Melonex 2ml I/M for 3 days along with syrup Dexorange 5ml bid P/O for two weeks. 48 hours after initiation of treatment, dog became stable with normal temperature and improvement in appetite. After two weeks of treatment, animal was completely active, improved. Food intake and blood smear was negative for any infection with haemato-biochemical values returning to normal range.

Discussion

The most common clinical signs associated with canine babesiosis include fever, pale mucous membrane, icterus, haemoglobinuria, hepato-megaly, spleenomegaly and enlargement of lymph nodes. The biochemical variations includes elevated activity of alanine amino-transferase (ALT), aspartate aminotransferase (AST), total bilirubin, BUN, creatinine with altered protein profiles (Zygner *et al.,* 2007; Salem and Farag, 2014). The present case report records the haemato-biochemical changes of babesiosis and its successful therapeutic management in a Labrador dog.

The haematological parameters in the present case were suggestive of anemia and

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Table 1: Haemato-biochemical changes in babesiosis affected dog before and after treatment

Parameters	Normal Reference Range	0th Day Before Treatment	15th Day After Treatment
Haemoglobin (g/dl)	12-16	6.80	11.20
PCV (%)	35-50	21.20	33.40
RBC (10^6/µl)	5-8	3.20	6.20
WBC (10^3/µl)	6-16	18.00	12.00
Neutrophils (%)	60-74	82	64
Lymphocytes (%)	15-30	17	15
Monocytes (%)	3-8	01	02
Platelets (Lakhs/µl)	2.11-6.21	0.91	1.98
BUN (mg/dl)	8-28	40.20	24.06
Creatinine (mg/dl)	0.5-1.7	3.20	1.72
ALT (U/l)	12-118	182	105
Total protein (g/dl)	6-8	5.68	6.40
Albumin (g/dl)	2.6-4.0	1.86	2.40
Globulin (g/dl)	2.1-3.7	3.82	4.00

thrombocytopenia. The anaemia resulted from an increased osmotic fragility of erythrocytes (Makinde and Bobade, 1994) and immune mediated platelet destruction. Further, oxidative stress may cause damage to erythrocytes that results in increased susceptibility to phagocytosis (Murase *et al.,* 1996). Biochemical studies of the patient revealed hypoprotenemia and hypoalbuminemia, which have also been reported in other studies (Salem and Farag, 2014)

Treatment was successful with a single dose of Imidocarb @ 5 mg/kg BW deep IM along with supportive measures. But Lin and Huang (2010) reported use of triple antibiotic combination of Doxycycline-Enrofloxacin-Metronidazole combination with/without Diminazene aceturate to treat naturally occurring canine babesiosis caused by *Babesia gibsoni* which did not necessarily eliminate the infection.

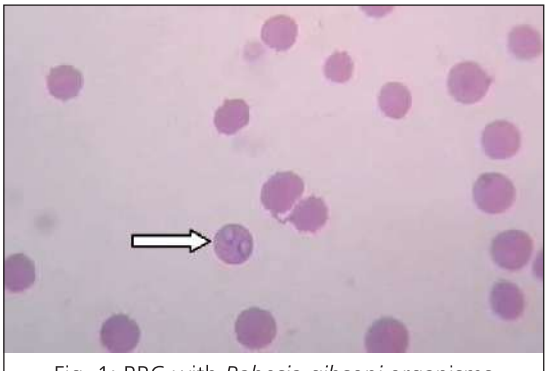

Fig. 1: RBC with *Babesia gibsoni* organisms

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Degenerative Joint Disease in a Grey Francolin (Grey Partridge or Teetar)

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(received 13/4/2018 - accepted 16/05/2018)

Abstract:

A three year old Teetar presented with hard, swollen and painful hock joints, as "Degenerative joint disease", was planned on two ways i.e. Managemental and Medicinal treatment and the condition was improved within 15 days.

Key words: Degenerative joint disease, hock joint, Teetar.

Introduction

The grey francolin (Grey Patridge or *teetar*, scientific name francolinus pondicerianus) is normally found foraging on bare or low grass covered ground in scrub and open country. Degenerative joint disease (DJD), also referred to as osteoarthritis, is defined by bony remodelling of a synovial lined joint, and can include formation of osteophytes, degeneration or erosion of articular cartilage, fibrosis of joint capsules and inflammatory changes associated with infectious arthritis or articular gout (Rothschild and Ruhli, 2007).

Clinical Observations :

A three year old teetar was presented to TVCC, with history of hard, swollen and painful hock joint of the both legs but left hock joint was observed more swollen and hard in consistency and no flexion of the joint was observed. There was history of providing high rich diet of protein i.e. cashew and almonds. On clinical examination, left hock joint was very much flexed, stiff and hard on palpation.

On the basis of history i.e. high rich protein diet and on the palpation of hock joint, tentatively it was diagnosed as "Degenerative joint disease".

Treatment and Discussion :

Managemental treatment consisting of: increasing the bird fluid intake, modifying in the bird diet i.e. less protein diet and hot fomentation with dipping of hock joint in luke warm water mixed with salt with application of Oint Inflamin locally was initiated. Medicinal treatment comprising of Allopurinol (Tab Zyloric 100 mg) used 1/8 parts mixing with drinking water and multivitamins (Syp A to Z – 5 drops PO, OD and Tab VM-65 ¼ tab in drinking water PO, BD) for 15 days was continued. On 15th day, condition was improved, the bird was able to bear weight and slightly walk on limbs. The treatment was continued for next months.

Discussion :

Degenerative Joint Disease (DJD) usually begins because of joint imperfections, instability, or trauma and is not related to age. These problems

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Picture 1: Swollen hock joint of both legs

lead to joint inflammation and cartilage damage. Older or overweight pets may also exhibit DJD due to joint "wear and tear."

The bird hock or ankle joint is homologous with the human knee, both morphologically and functionally (De Margerie, 2002). The similarity of the bird ankle (distal tibiotarsus) and human knee (distal femur) is so great that the one has often been mistaken (by non ornithologists) for the other. Osteoarthritis is common in bird hock (analogous in morphology to the human knee) joints with significant variation in species susceptibility, and the frequency of osteoarthritis is independent of weight. A retrospective assessment of skeletal collections of captive and free-ranging hawks and pigeons revealed 3% and 9.8% prevalence, respectively, of osteoarthritis, all localized to the tarsal joint (Rothschild & Panza, 2006). Scattered reports of DJD have been reported in captive waterfowl (Palya *et al.,* 2003). Degenerative joint disease of the pelvic limb is a complex, multifactorial disease that has received little attention in the non poultry avian literature (Degernes *et al.,* 2011).

Picture 2: Unable to walk properly

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Compromised development of Hypothalamo-Pituitary-Adrenal axis in foetus can delay the parturition - Case report

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(received 10/05/2018 - accepted 10/06/2018)

Abstract:

A rare case of defective neurogenesis associated with prolonged gestation in a five year old buffalo was diagnosed as dystocia due to foetal hydrocephalus.

Keywords: Dystocia, buffalo, hydrocephalus.

Introduction :

Foetal hydrocephalus (Hydro-water; Cephalus-Head) is a congenital pathological condition characterized by the abnormal accumulation of fluid in the ventricles or subarachnoid space which leads to enlargement of foetal head and a defective function of hypothalamus and pituitary gland. The process of parturition is triggered by foetal cortisol released under the influence of foetal ACTH from anterior pituitary in response to stress factors like hypoxia, hypoglycaemia, hypercapnoea, insufficient space etc. at full term. Congenital hydrocephalus is associated with simple autosomal recessive dominant gene with incomplete penetration (Purohit *et al*., 2012). It is rare in buffaloes (Kumaresan *et al*., 2003) and mare (Singh *et al*., 2013). The present investigation describes a unique case of extremely enlarged foetal head due to hydrocephalus and explains the correlation with prolongation of gestational length.

Clinical Observations :

A five year old buffalo weighing 450 kg body weight was presented in TVCC, Parbhani with the history of extended gestation by 15 days. Straining was started since preceding night with rupture of first water bag. Case was previously handled by local practitioner that failed to relieve the dystocia. The clinical parameters of dam were recorded as normal. Per-vaginal examination revealed the anterior longitudinal presentation, dorso-sacral position and normal posture of foetus with enlargement of head. Obstruction in expulsion of foetus was found at pelvic brim due to enlarged head. Based upon gyneco-clinical observations, the case was diagnosed as dystocia due to foetal hydro-cephalus.

Obstetrical manoeuver :

The obstetrical intervention was carried out under epidural anaesthesia by injecting 5 ml Lignocaine HCI (2%) at sacro-coccygial space. Head of foetus was entangled in pelvic inlet due to enlargement of head. The oversize of hydrocephalic head was reduced by puncturing the cranium with help of Buhner's needle. After removal of fluid (4.7 Lit.) from fetal head, size was reduced. The traction was applied by tying a

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Plate 1: Hydrocephalic dead buffalo calf wrapped partially in amniotic membrane

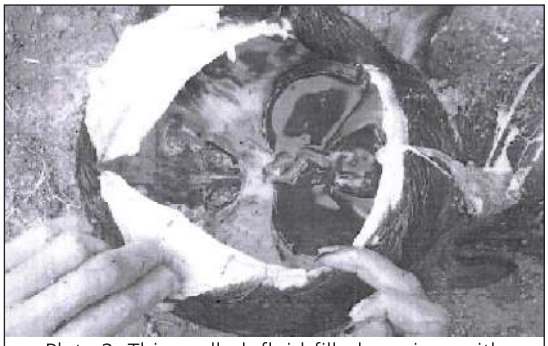

Plate 2: Thin-walled, fluid-filled cranium with cerebral hypoplasia

cotton rope around the fetal neck and using ample amount of sodium carboxyl-methyl cellulose gel as a lubricant, head was manipulated and dead male fetus was removed by using traction. Obstetrical procedure was followed by supportive treatment of dam viz. Inj. Dextrose 5% @ 5000 ml and Inj. Calcium borogluconate @ 400 ml intravenously, whereas Inj. Phenaramine malate @ 10 ml and Inj. Adchrome 10 ml through intramuscular route and Bol. Cleanex @ 4 boli were administered through intrauterine route. After completion of all obstetrical procedure with supportive therapy, animal recovered from discomfort.

Post-mortem examination of hydrocephalic calf was carried out by incising the poll region of head. The head was thin-walled containing a fluid-filled cranial cavity with cerebral hypoplasia. Epical cap of the bony skull was not developed and the rest of cranial bones were also found markedly thin. The foetal head was football sized measuring 21.5 x 19 cm of diameter. Upon post-mortem examination, it was observed that the grey matter of brain was highly ill-developed evidenced as a thin layers of cerebral hemispheres without gyri and sulci. The ventricles were filled with excessive watery fluid, which was already drained by cranial rupture. Microscopic examination did not reveal any cellular contents in this fluid.

Discussion:

The site of fluid accumulation is ventricle in case of internal hydrocephalus, whereas if the fluid accumulates in space between brain meninges, it is known as external hydrocephalus or Meningocele (Roberts, 1971). Current case report recorded former type of hydrocephalus in buffalo calf. Calves with hydrocephalic condition are usually born dead or die shortly after birth (Thangamani *et al.*, 2018). The association of hydrocephalic fetus with prolonged gestation is well established and attributed to impaired function of fetal HPA axis due to agenesis or hypo-neurogenesis of hypothalamus and pituitary (Newman *et al.*, 1999). Similar observations were recorded in the present case as the matter of brain was highly ill-developed evidenced as a thin layers of cerebral hemispheres without gyri and sulci. Further, the history of insemination proved that parturition was delayed by 15 days, hence supported the existing notion. Multiple etiological factors are responsible for fetal hydrocephalus. Previous studies have reported autosomal recessive gene to be one of the major etiological factors resulting in hydrocephalic fetus (Sloss and Dufty, 1980).

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Unilateral Facial Nerve Paralysis In A Non-descript Bullock

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Abstract :
A case of unilateral facial nerve paralysis in a non-descript bull was successfully treated and recovery was recorded.

Keywords: facial nerve, paralysis, non-descript, ceftrixone, Nervine tonic.

Introduction :

Paralysis denotes a condition where there is incomplete or complete loss of nervous control over any bodily functions. This may comprise loss of sensory or motor power or both. The facial nerve, cranial nerve VII, exits the brainstem near the vestibulocochlear nerve, passes through the petrous temporal bone and then exits the skull through the stylomastoid foramen and splits into auricular, palpebral and buccal branches. Asymmetry of facial expression is common with unilateral lesions of the facial nucleus or nerve in most species. Facial paresis is reduced movement of the muscles of facial expression and indicate milder nucleus or nerve involvement (Merck, 1998). Facial paralysis occurs most frequently in horses and less frequently in cattle.

Clinical signs of facial paralysis vary with the location, severity and chronicity of the lesion. Trauma is a common cause of facial paralysis in all species. If a unilateral lesion is located in the facial nucleus or proximal portion of the facial nerve, paresis or paralysis of the eyelid, ear, lips and nostrils on that side are seen (Merck, 1998).

The trigeminal and facial nerves are mixed nerve, which supply motor fibers to muscles of face and ear. Fractures of the petrous temporal bone, localization of the Listeria monocytogenes infection and compression of facial nerve over the mandible during prolonged recumbence are the main causes of the facial paralysis (Tyagi and Singh, 1993).

Case history and Clinical observation :

A four year old non-descript bullock was referred to the Department of Veterinary Medicine, Parbhani with a complaint of anorexia, regurgitation, inability to take feed and water, drooping of left ear and nostril. Detailed clinical examination indicated drooping of left ear, eyelid and nostril, regurgitation of food from mouth. Whereas, temperature and heart rate were within normal physiological range. The animal was dull, depressed and with difficulty while feeding and watering. Examination of mouth cavity revealed accumulation of cud between right cheek and molars.

During clinical examination, animal showed sluggish response, palpebral reflex was absent,

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Fig.1. Bullock with drooping of left eyelid and ear

no ear prick response, lack of tonicity in facial muscles of left side, abnormal jaw movements and asymmetry of muscle contraction. On the basis of history, clinical signs like dropped left ear, upper lip and eyelid (Fig. 1) and symptoms case was diagnosed as unilateral facial nerve paralysis of left side.

Treatment and Discussion:

The animal was treated with Inj. Ceftrixone @10mg/kg BW IM and Inj, Meloxicam @0.5mg/kg BW IM for five days. Nervine tonic (Inj. Tribivet) 5ml IM for seven days and five injections of Inj. Tonophosphan on alternate days. To stimulate the facial nerve, infrared therapy was given around the base of ear and cheek for three minutes for seven days. After 6th day of treatment, animal started feeding and watering slowly. By 15th day animal started movement of ear and upper eyelid.

In acute denervation, the ear carriage is often lower on the side of the lesion in all species, but in chronic denervation with muscle fibrosis, the ear carriage may be higher. In acute lesions, lips on the paralyzed side may hang loosely, exposing mucosa. When the animal eat or drinks, food and fluids may fall from the lips. The animal may drool excessively and food may collect between the lips and teeth. Chaudhary *et. al*. (2001) treated unilateral facial nerve paralysis with Inj. Prednisolone and Inj. Tribivet with no improvement in the condition. Usually nervine disorders take longer time to recover, some require two weeks or may take months, sometimes there may not be any response to treatment. In present case, animal showed completely recovery after 20th day with normal feeding and watering with movement of ear and eyelid.

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Management of Viper Snake Envenomation in a Non-Descript Bullock

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Abstract :

A non-descript bullock was referred with marked swelling and fang marks at the upper right nasal region with oozing of blood from the bitten site. The bullock was treated with Polyvalent snake antivenin, Ciprofloxacin, Meloxicam and carbazone therapy successfully.

Keywords: Non-descript, bullock, Viper, envenomation, Polyvalent Antivenin.

Introduction :

Envenomation by snake bite in farm animals is a life threatening emergency commonly reported in monsoon season and more from rural areas. Annually, more than 1 lakh animal death in the world due to snake bite have been reported by Bucheri *et al.*, (1968). The toxins in venom include Neurotoxins, causing flaccid paralysis, pupillary dilation and paralytic respiratory failure; Cytolisins, associated with tissue necrosis; Hemolysins; Thrombase; anticoagulants leading to a hemorrhagic tendency; Myotoxins, causing muscle necrosis and myoglobinuria (Radostits *et al.*, 2003). The viper venom contains enzymes that induce the production of endogenous cytokines and inflammatory mediators. The prognosis of snake bite envenomation depends on the size and species of snake, location of the bite, size of the victim, amount of venom injected and the time lapsed between the bite and institution of treatment. The present paper puts on record management of a serious case of viper snake bite in a non-descript bullock and its successful management.

Clinical Observations :

A six year old non-descript bullock was referred to the Department of Veterinary Medicine, COVAS, Parbhani with the history of snake bite before 08 hours. Profuse swelling over nasal and facial region extending towards dewlap and forelimbs, salivation, oozing of blood from the bitten site (Fig.1) and severe depression was noticed. The owner saw the snake bite. The clinical examination of bullock revealed rectal temperature, respiration rate, heart rate elevated, conjunctival mucus membrane highly congested and clear fang marks on right nasal region. The whole blood clotting time (WBCT) was 24 minutes. Haematological analysis indicated decrease hemoglobin (7.4 gm %), PCV (20%), TEC (3.9x106/µl) and increase in total leukocyte count (16.8x103/µl). On the basis of history of snake bite, clinical manifestations and

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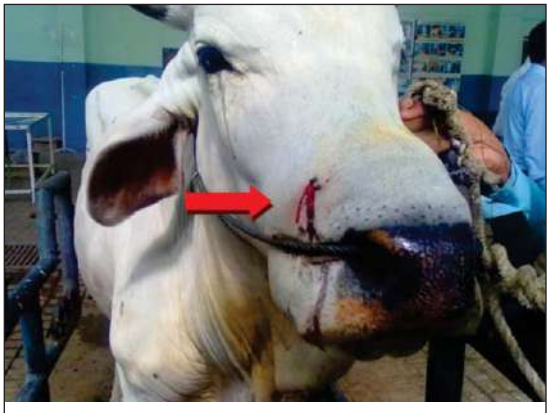

Fig. 1. Oozing of blood from site of bite

fang marks with oozing of blood from the bitten site, the case was confirmed as viper envenomation.

Treatment and Discussion :

The bullock was subjected immediately to the therapy of snake venom antiserum I.P. (Polyvalent, Enzyme refined Equine immunoglobulins) 30 ml diluted in 3000 ml of normal saline with the speed of 2 ml/ minute intravenously. The other supportive therapy comprised of broad spectrum antibiotic Inj. Ciprofloxacin @ 05 mg/kg BW IM, Inj. Meloxicam @ 0.5 mg/kg BWIV, Inj. Monosemi Carbazone (Inj. Adchrome*, G. Loucates S Co. Mumbai)) @ 20 mg (total dose) IM and calcium glucono lactobionate IM. After comprehensive therapy, On second day, the swelling started regressing and whole blood clotting was reduced to 12 minutes. Subsequently, Snake Venom Antiserum I.P.20 ml IV was repeated along with supportive regimen. On third day, there was marked reduction in swelling (Fig.2) and animal started taking feed and water.

The antivenin therapy and critical care should be instituted at the earliest as biochemical constituents of venom initiates cascade of irreversible effects immediately. The effect of snakebite (envenomation) depends upon the species of the snake involved, the size of the bitten animal, location of the bite, particularly with reference to the thickness of the hair coat and the quantity of subcutaneous fat (Radostits *et al.*, 2007). Procoagulant enzymes present in viper venom causes disseminated intravascular coagulation (DIC) resulting decreased levels of clotting factors and incoagulable blood. Biochemically, Viper venom contains hemorrhagins, necrotic toxins, hemolytic and myolytic phospholipases, which damage cell membranes, capillary of blood, endothelium, skeletal muscles, nerves and RBCs resulting in local swelling, spontaneous oozing of blood, non- healing ulcers and gangrene of the bitten part.

The clinical confirmation of viper envenomation can made by local swelling, bleeding at the site of bite and marked oedema. (Reid and Theakston,1983). Farm animals are more likely to be bitten on facial or at limb extremities (Leisner *et al.*, 1999). Clinical signs, rapid progressive swelling and oozing of blood are pathophysiological consequences of venom enzymatic and non-enzymatic components (Klaassen, 2008). Immediate therapy of

Fig. 2. Marked reduced swelling after treatment

polyvalent antisnake antivenin neutralized putative effects of viper envenomation and the bullock recovered showed uneventful recovery within a fortnight period.

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Hyperthyroidism - a cause of excessive meowing in a young female cat

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Abstract

A young cat suffered excessive meowing sinus, tachycardia, weight loss and elevated levels of thyroxine and serum creatinine due to hyperthyroidism with stage 2 renal failure and was treated with methimizole, propranolol, which resulted in normal sleep-wake cycle.

Key words: Cat, hyperthyroidism, meowing, methimizole

Introduction

Meowing in cats is a normal communication behavior, but its excess is annoying. It can be a sign of estrus, pain, boredom, hyperthyroidism, loss of vision / hearing, senility or feline hyperesthesia syndrome, are generally seen in old cats. Amongst pathological conditions, hyperthyroidism is most common cause of excessive meowing in aged cats. Nevertheless, it has also been reported in about 5.0% young cats (Peterson *et al.,* 1994). It is biochemically characterized by an increased level of T_4 hormone resulting into an increased metabolic rate and multi-organ clinical manifestations (Boretti, *et al.,* 2009). The present report discusses a case of excessive meowing due to hyperthyroidism in one year old cat.

Clinical Observations :

A female cat, one year old, weighing 3.5 kg, was presented at the hospital with the complaint of excessive meowing throughout day and night, and disturbed sleep-wake cycle for a month. The cat had been refractory to diazepam therapy given by a local Veterinarian. Detailed clinical examination revealed excessive meowing, normal temperature (102.0^{0}F), increased thirst, increased urination, fair general condition, rough hair coat, uneasiness, panting, hearty appetite, tachycardia, hyperactivity and aggressive behavior.

Initial investigations revealed normal haemogram (Hb. 10.2g/dl , RBC 5.8 x 106/µL , PCV 30.0 %, TLC, 4.8 x 103/µL, Platelets 250 x 103/ µL, Nutrophil 55%, Lymphocyte 38%, Monocyte 5% and Eosinophil 2%, blood smear negative for haemoprotozoa or ehrlichia); stage 2 renal failure (serum creatinine 2.1 mg/dl, BUN 21 .0 mg/dl, serum sodium 140 mEQ/l, serum potassium. 4.8 mEq/l, serum chloride 144 mEQ/l); increased level of T4 (5.4 µg/dl) with normal level of T3 (1.12 ng/ml) ; normal liver profile (ALT 50.0 U/l ; SAP 38 .0 U/l; Bilirubin 0.2 mg/dl); kidneys with hyperechoic cortical area and hypoechoic spleen; radiographically normal Chest and abdomen; and sinus tachycardia (heart rate 210 beats per minutes with regular R-R interval – Fig.1) .

The case was diagnosed as hyperthyroidism.

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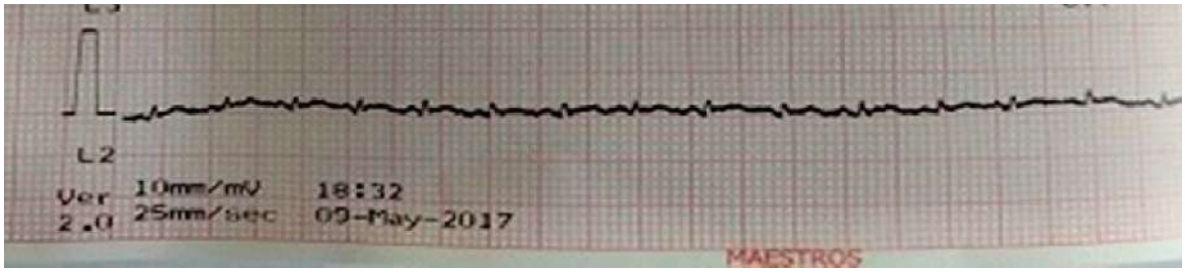

Fig.1. Initial electrocardiogram of Cat with hyperthyroidism showing sinus tachycardia (H.R. 220 bpm)

Treatment and Discussion :

The cat was treated with DNS 250 ml with vitamin B complex 0.4 ml IV, pantoprazole 4 mg orally, sodium bicarbonate 40 mg orally TID, Phosphate binder antacid 1.0 ml orally BID for 5days; nandrolone 5 mg IM fortnightly for four ocassions; methimizole 1.25 mg PO BID and propranolol 2.5 mg orally daily along with renal diet. Thyroid hormones, serum creatinine, and blood urea nitrogen were evaluated at one, four and 10 months post therapy. Electrocardiogram was taken again at 10 month post therapy. serum creatinine (at one month 1.9 mg/dl, four months 2.0 mg/dl, and at 10 month 2.1 mg/dl), and BUN (at one month 16 mg/dl, at four month 22 mg/dl and at 10 month 20 mg/dl) were evaluated at one, four and 10 month post therapy visit. Electrocardiogram was recorded initially and again at 10 month post therapy visit.

Excessive meowing in cats is not only annoying but also creates uneasiness in the neighborhoods. If the cat is properly cared and not in estrus, excessive meowing seems to be a reflection of some chronic disease condition. The history of excessive meowing with changed sleep-wake cycle in the cat (not in estrus) for a month aroused suspicion of hyperthyroidism. Though symptoms observed were not very specific, hyperkinetic behaviour with aggressiveness (excessive meowing) were suggestive of hyperthyroidism (Panciera, 1992). Normal haemogram ruled out haemoprotozoan or ehrlichial infection. Serum T_4 (5.4 µg/dl) concentration was higher than the values (T_4 - 1.0099 to 4.42 µg/dl) reported for normal cats by Skinner (1998) and T_3 (1.12ng/ml) was within range (T_3- 0.4 to 1.12 ng/ml) described by Panciera (1992) for normal cats. Higher values of T4 (> 4.42 µg/dl) are consistent with hyperthyroidism. T_3 concentration is more variable than T_4 and have been reported in normal range in 5-10% hyperthyroid cats (Panciera, 1992). Slightly higher value of serum creatinine (2.1 mg/dl) suggested grade 2 renal failure .Renal changes seem to be a part of pathophysiology of hyperthyroidism. If hyperthyroidism is not treated, it may lead to severe renal failure. Normal values of SAP and ALT activity were suggestive of normal hepatic function. Electrocardiogram (Fig.1) was consistent with sinus tachycardia agrees with the observations of Joffe (1986) in hyperthyroid cats. Investigations confirmed that excessive meowing in young cat was due to hyperthyroidism. These results were little surprising as hyperthyroidism is more common in old cats. However, Peterson *et al.* (1994) reported that about 5% of hyperthyroid cats were younger.

The cat was treated with fluid, pantoprazole, sodium bicarbonate, phosphate binder antacid and nadrolone for stabilizing renal function as renal failure is quite common in cats with hyperthyroidism. Methimizole is a licenced drug of first choice available for long term treatment of hyperthyroidism in cats. It acts by blocking

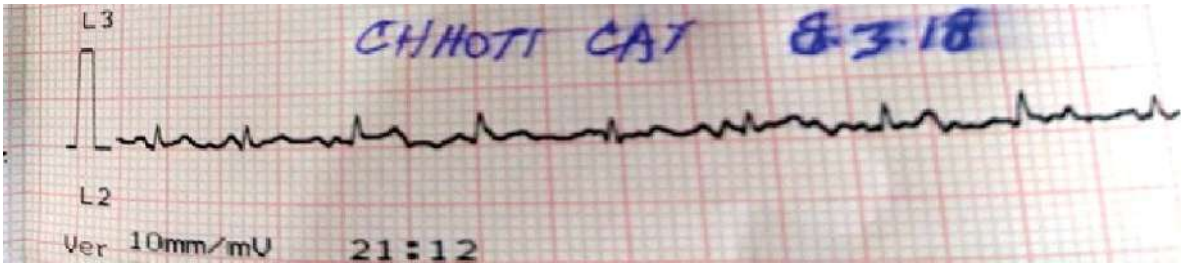

Fig. 2. Electrocardiogram of Cat (10 month post therapy with methimizole) showing reduction in heart rate (H.R.165 bpm)

thyroid peroxidase thus inhibiting biosynthesis of thyroid hormone (Trepanier and Peterson, 1991). Its lowest dose (1.25 mg PO BID) as recommended by Peterson *et al.* (1988) was chosen . The dose was effective as T_4 level reduced from 5.4µg/dl to 1.56 µg/dl at one month post therapy and remained within normal limits (2.1µg/dl at 4 month and 3.35 µg/dl at 10 month post therapy). T_3 levels remained within normal range (0.32 ng/ml at 1 month,0.38 ng/ml at 4th month and 0.42 ng/ml at 10th month). Serum creatinine (at one month 1.9 mg/dl, at four months 2.0 mg/dl, and at 10 month 2.1 mg/dl), and BUN (at one month 16 mg/dl, at four month 22 mg/dl and at 10 month 20 mg/dl) levels fluctuated within narrow range indicating no progressive renal damage. Propranolol, beta-adrenergic antagonist, was used to control cardiac complications and hypertension associated with compromised renal function in hyperthyroidism. At the end of 10 month therapy, heart rate reduced from 220 bpm to 165 bpm (Fig.2).

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Prof. Dr. Ajit S. Ranade
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Dean, Krantisinh Nana Patil College of Veterinary Sciences,
(MAFSU), Shirwal-412801 Dist.- Satara (MS)

Dr. Ajit Ranade is senior Professor and Head of Department of Poultry Science and has 35 years of professional experience. Dr. Ranade has guided 54 M. V. Sc. students in Poultry Science for post graduate research. His specific recommendations to poultry industry are widely accepted and found to be most economic. He was principal investigator of many research schemes and has 50 technical publications to his credit. Dr. Ranade was invited to deliver expert lectures during National and International Conferences. He is proud recipient of Ayurvet Award 2011 and fellowship of Indian Poultry Science Association 2010 with dozen other awards.

Q.1 . What are the present problems faced by the poultry sector?

The industry annually faces certain problems regularly. All these problems can be grouped into 3 categories:

a. Un-remunerative prices received by producers : Unfortunately eggs and poultry meat, similar to other agriculture and animal agriculture products, do not get the remunerative prices throughout the year. The selling prices are not dependant on the cost of production. Hence many times the farmers incur losses.

b. Shortage and high prices of raw materials to be used for feed : Looking

at growth of the sector, the requirement of feed is also increasing year after year. However, due to marginal growth in agriculture as such and the tendency of the farmer to move towards cash crops from the traditional cropping pattern, there is a shortage of raw material which can be used as feed ingredients for poultry feed. This has cause gradual rise in the cost of raw material and feed increasing cost of production.

c. The disease outbreak throughout the country : There is always a threat of various bacterial and viral diseases for the birds. The newer and newer diseases or old diseases are re-appearing in more virulent form and get resistant to commonly used antibiotics. Viral diseases, re-emerging diseases and newer diseases are big threat to the poultry sector. Unless quality of birds, feed management and bio-security is ensured these cannot be kept away.

The problem of un-remunerative prices could basically be solved by regulated production, which is being done. Developing foolproof marketing solutions for poultry like co-operative marketing is required to be developed. Consumer awareness and processing with value addition could be the long term solutions. As regards raw material availability and prices, efficient utilization of available raw materials by preparing the diets exactly as per the needs of the birds and using feed additives and feed supplement could ensure efficient utilization. In addition, improved management and avoiding feed wastages would be necessary. As regards disease threats, continuous monitoring and surveillance, timely diagnosis and treatment would be required. Stringent bio-security measures along with proper diagnosis, vaccination and treatment will have to be continuous process.

Q.2. What is the future of the poultry sector?

The future of the industry is bright as though India stands at 3rd position in the world in egg production and at 4th position in poultry meat production, the per capita availability of eggs and meat is very low. As per the recommendations of NIN and WHO, at least half an egg and 11 kg of meat per capita per annum should be consumed. However, India lacks behind both the figures by huge margin. Considering the population being constant, the industry has to grow 10 folds as of now to meet these minimum per capita consumption figures and as the population is constantly growing, the industry has tremendous scope to grow. Moreover, people have now realised the importance of high protein diet and hence the consumption is increasing.

The thrust areas would involve all attempts of reaching to the customers. Processing, value addition, ready-to-cook, ready-to-eat and consumer friendly preparations need to be developed for supply to the market. The changing consumer demands, especially of young population need to be understood and industry has to gear up to meet them. In addition, research in the area of development of superior breeds and strains and the feed with best conversion ratio will have to be produced. Extension work in popularising the egg and poultry meat will be the major thrust areas to attain and sustain the growth that has been achieved.

Q.3. What are the problems in popularizing the products from the poultry industry among the consumers?

The consumer awareness will be a prime importance in future. The people are having

quiet a good number of mis-conceptions or myths about poultry products. There is still resistance to accept eggs as vegetarian food, although the milk has been accepted long back. The myths or wrong information about cholesterol content of eggs, about heat generated from eggs, about diseases getting transmitted through animal origin products, about antibiotic resistance getting spread in human etc are the issues which the customers are concern about. Clearing the doubts in minds of people and emphasizing the goodness of poultry products would be required in future. The consumer demands are changing as more than 60 % of our population is in the age group of 18-35 and they have completely different requirements with respect to food habits as compared to previous generations. The requirements of this generation are influenced by global scenario in this era of internet and social media. Hence reaching to them and giving them what they want is really a challenging task.

Q.4. What are the nutrient contents of eggs and meat and how they are beneficial for the body?

The eggs contain 11.9% of protein out of which 97% is bio-available for the human body. It contains lots of amino acids and vitamins with very low calorific value. Hence are considered as the fantastic source of nutrients for the human body. The poultry meat has 21 % protein and also is full of essential amino acids as required by the human body. Poultry meat is considered as white meat just like fish and not categorised as red meat. Poultry meat is preferred by health conscious people. Both these products are extremely good with respect to value for money and are available at very reasonable price. Thus are affordable by the common people and it serves another noble cause of eliminating malnutrition especially among rural poor.

As eggs are animal origin substances and they do contain cholesterol. A normal egg has 180-220 mg of cholesterol. A normal healthy adult requires about 800-1000 mg of cholesterol every day as it is an important nutrient for human body. Hence moderate consumption of eggs doesn't have direct influence on blood cholesterol levels. Moreover, in a normal healthy human body, there exists a feed-back mechanism which regulates cholesterol synthesis in the body. Hence dietary cholesterol has no direct bearing on blood cholesterol levels. The eggs also contain phospholipids like lecithin which prevents the cholesterol from sticking to blood vessels. Most importantly the cholesterol is one of the essential nutrients for human body and is required for synthesis of important hormones in the human body. Hence should not be avoided in our daily diets.

Q.5. How does poultry helps to alleviate poverty?

The poultry sector in our country got three tires. The backyard, the commercial and the rural. Though the commercial sector suffices the need of urban population, the backyard and rural poultry sector are really doing a great job in providing small but regular income to the rural people and which is helping them to survive. Hence, these two sectors are providing nutritional security and financial sustainability to the rural poor of our country. Non descript backyard birds maintained by farmers in very few numbers on almost zero input technology and specially developed strains for rural poultry production maintained in moderate numbers ranging from 50-500 are providing substantial income to the farmers. It may be noted with the farmers solely dependent on agriculture are committing suicide. The poultry sector in true sense is doing the job of poverty elimination.

Q.6 Which are the poultry sector related allied industries?

The poultry sector is dependent on various other

equally important industries/ segments and all these segments work together to form a completely dependent self sufficient agri-based industry. Some of the important segments could be listed as 1. Breeder farm 2. Hatcheries 3. Feed manufacturing 4. Equipment manufacturing 5. Pharmaceutical industries 6. Vaccine and biologicals 7. Laboratories and diagnostics 8. Marketing 9. Transport of various inputs required for poultry 10. Numerous farmers engaged in maize, soybean and other agriculture products which indirectly are part of the poultry sector as they provide by-products as raw material for the feed. 11. The veterinarians who provide service to poultry sector. Each component has a specific and well defined role to play and when they all operate synergistically on scientific basis, the poultry sector as a whole functions in the country.

Q.7. What practices can be followed in poultry industry to face the environmental problems ?

Environmental pollution and disposal of waste generated from poultry farm is of late becoming a big issue due to intensive farming culture. Huge quantities of wastes are generated from the farms in the form of excreta, dead birds, waste water, feathers, dust and the smell around the farms. All these products, if not handled properly and disposed off scientifically, can create a menace and would contribute to the environmental pollution. In addition, the waste generated from allied industries like hatchery waste, slaughter waste also add to the problem. Use of composting of the excreta, generation of biogas and use of leftover slurry as a fertilizer should be followed on every big farm. Burial or burning of dead birds through incinerator should be done. The hatchery and slaughter waste should be subjected to rendering plant and waste water must be treated before allowing it to percolate in the soil. Maintenance of cleanliness, hygiene, sanitation and disinfection is necessary to keep the dust and smell away. The other problems like flies, rats etc should also be handled efficiently by using scientific methods and on timely basis.

Q.8. What are the measures to reduce the poultry feed cost?

Efficient utilization of feed produced ensuring it's proper conversion into eggs or meat, assisting the birds in complete digestion of the feed and using improved strains would be the intrinsic solutions to reduce the expenses on feed. Use of unconventional feed ingredients, nullifying the effects of toxic/anti-nutritional factors present in them and fortifying them with suitable feed additives and supplement would also helps in reducing the feed cost. However as the quality of feed determines the quality and quantity of output. the excessive compromise to reduce feed cost should be avoided. Instead, more efforts might be taken for ensuring better price fetched by the products in the market.

ICRA predicts Indian poultry domestic market as fastest growing industry

ICRA Limited (ICRA) is Indian independent and professional investment information and credit rating agency, which has predicted Indian poultry domestic market growth due to favorable socioeconomic support @ 2.62 in last decade and also reported fastest growth of the sector in the globe. The domestic poultry industry mainly consists of broiler meat and table egg with other poultry meat forming marginal proportion of overall market. Based on average chick placements per month, total broiler market size is estimated at 4.2 million tons (carcass weight), translating into volume growth of 7% year-on-year during calendar year 2017. Per capita meat consumption is around 3.6 kg p.a. which puts total broiler meat market size at Rs. 730 billion in terms of retail price. The domestic table egg production for the calendar year 2017 is estimated at 84 billion eggs translating to a per capita egg consumption of 63 egg p.a. and market size of Rs. 420 billion. The broiler volume growth is intentionally kept at manageable levels to avoid supply glut given industry wide supply control measures adopted. The corporate sector rating will help boost poultry investment in near future.

Amul optimistic to increase turnover @ Rs. 50000 crores per annum.

'AMUL doodh pita hai India', very famous slogan from dairy industry is set to achieve 20 per cent growth during this financial year. The 18 member unions of Gujrat Cooperative Milk Marketing Federation, AMUL, is set to expand turn over to new height with positive support of growing consumer portfolio, premiumisation and rising demand. At present, AMUL has farmer strength of more than 36 lakh across 18,700 villages of Gujarat, and is procuring on an average 211 lakhs litres of milk per day. The co-operative has also recently tied up with the government and lenders,

under the Pradhan Mantri Mudra Yojana, to procure easy loans for its farmer partners. The scheme will help rural entrepreneurs immensely, to upgrade their facilities and will also help distributors and transporters. It will enhance the overall employment opportunities in rural India

It is possible to achieve turn over target as the consumer product portfolio has been growing at nearly 15 per cent on a volume basis, whereas, branded consumer products have registered a growth of 14 per cent in the last financial year, with products such as cheese, butter, milk beverages, paneer, cream, buttermilk and dahi having grown at 20-40 per cent.

NDDB Dairy Innovation Award to finest dairy institutions on 'World Milk Day'

With a view to recognize the efforts of producer owned institutions and inspire them to sustain their efforts in future, NDDB has honored finest dairy cooperatives of the country with 'NDDB Dairy Innovation Awards' on eve of world Milk day at the hands of Shri Parshottam Rupala, Hon'ble Minister of State for Agriculture & Farmers Welfare and Panchayati Raj, Govt of India at Anand (Gujrath) The award would set benchmarks and help the organizations to adopt best practices and would encourage them to come up with innovative ways to expand their business operations through management excellence, transparency, quality products, process improvement, productivity enhancement, efficiency, value to farmers, social and gender inclusion and financial inclusiveness. Dairy cooperatives have played a pivotal role in the progress of the dairy industry and rural dairy farmers have gained strength to sustain their livelihood while contributing to increased supply of milk to consumers. The cooperatives have provided rewarding employment to farmers and brought them closer to the market.

Know the prestigious Institute

भाकृअनुप–केन्द्रीय पक्षीअनुसंधानसंस्थान इज्जतनगर, बरेली. 243 122 (उ0प्र0)

ICAR-Central Avian Research Institute

(An ISO 9001:2008 Certified Institute)
Izatnagar, Bareilly-243122
Indian Council of Agricultural Research
Department of Agriculture Research and Education
Ministry of Agriculture, Govt. of India

ICAR-Central Avian Research Institute (CARI) was established on the 2nd November, 1979 at Izatnagar, Bareilly, Uttar Pradesh under the aegis of the Indian Council of Agricultural Research (ICAR) to provide all-round support to the growth of poultry sector. Since its inception, this Institute has been playing an important role by providing need based R&D support for diversified poultry production, processing and marketing, apart from Post-graduate education, training and technology transfer activities for augmenting productivity, production and profitability of the Indian poultry sector. Moreover, the Institute has been continuously updating and reorienting its R&D focus abreast with the latest developments taking place globally and in accordance with the changing needs of the domestic poultry sector. This institute has been the major driving force steering the Indian poultry sector through various phases of development during the past four decades providing much needed technological support to the poultry industry especially the rural poor. The institute's Regional Centre at Bhubaneswar, Odisha is dedicated for research on genetic improvement of ducks and

development of location specific germplasm for catering the needs of Eastern North-Eastern parts of the country.

The institute has also made significant contributions towards evaluation and standardization of alternate and newer feed resources to help in lowering down the feed cost besides developing feed formulae for computing low cost ration under different climate and regions of the country. The improvement in feed efficiency has also been brought through increasing the nutrient availability. Institute has developed the protocols for about two dozen value added processed products utilizing poultry egg, meat and byproducts and development of methods for their shelf-life extension. The universal semen extender for different poultry species was developed which can maintain the fertility till 24 h. Besides the institute has also contributed significantly in frontier research like molecular genetics and biotechnology, nutrigenomics, metagenomics. Institute's HRD program has been providing trained manpower for manning large commercial poultry houses in the country.

This institute is only one of its kinds wholly dedicated to Poultry Science research, education and extension in the country with the following vision, mission and the mandate.

Mandate:

- Basic and applied research on productivity enhancement for sustainable production in diversified avian species.
- Human resource development and capacity

Vision

- Revolutionizing the diversified poultry production for household nutritional security, income and employment generation as a viable alternative to chicken.

Mission

- Developing and popularizing appropriate poultry production and processing technologies in respect of diversified avian species for enhanced profitability.

The institute main R&D activities are

- Genetic improvement, characterization and propagation of diversified poultry species through breeding and molecular tools, research in advance areas, conservation of indigenous chicken.

Species	Commercial crosses/strains/varieties developed by CARI
Quail	CARI Pearl, CARI Sunheri, CARI Uttam, CARI, Ujjawal, CARI Swetha
Turkey	CARI Virat
Guinea fowls	Chidambari, Kadambari, Swetambari
Ducks	White Pekin, Khaki Campbell, Moti Desi
Dual purpose chicken	CARI Debendra
Improved indigenous fowls	CARI Nirbheek, CARI Shyama, Hitcari, Upcari
Broilers	CARIBRO Vishal, CARIBRO Dhanraja, CARIBRO Mrityunjai, CARIBRO Tropicana
Layers	CARI Priya and CARI Sonali

- Poultry waste management and its conversion into energy.
- Conducting research on basic and applied aspects of avian nutrition and rendering diagnostic and consultancy services viz., feed analysis, quality assurance.
- Basic advance and applied research on various aspects of avian physiology viz. reproduction, stress, digestion etc.
- Development of value-added poultry products viz., chicken meat stocks, egg rasamalai, lactobacillus enriched (fermented) poultry meat products innovative techniques for preservation, packaging and shelf-life enhancement, assessment and amelioration of potent bio-and phyto-contaminants as well as processing and utilization of poultry by-products.
- Conducting training, providing advisory and consultancy services, awareness creation about poultry production trainings technologies through participation in national and regional exhibitions, Radio and TV talks, technology assessment and transfer through on-farm trials, germplasm supply and publication of books/bulletins.

CARI Pearl Quail
(White Egg Laying strain)

CARI Virat (Turkey)

CARI Sonali
(Brown egg commercial layer)

CARI Debendra (Dual purpose)

CARIBRO Vishal
(Commercial White Broiler)

CARIBRO Dhanaraja
(Commercial Coloured Broiler)

Pioneer's Profile

Dr. Aditya Kumar Misra
Vice Chancellor
G. B. Pant University of Agriculture and Technology,
Pant Nagar - 263145 (Uttarakhand)

Prof. A. K. Misra graduated (BVSc & AH) from Mathura Veterinary College in 1979 and obtained MVSc and PhD degrees in Veterinary Gynaecology and Obstetrics in 1981 and 1996, respectively with academic distinctions. Prof. Misra was awarded 'University Silver Medal' in BVSc & AH and 'Chancellor's Gold Medal' for MVSc. His pioneering PhD work on embryo biotechnology in buffalo was lauded as the outstanding post-graduate research work, for which he was awarded with the prestigious 'Jawaharlal Nehru Award' from ICAR, New Delhi.

During his career, Prof. Misra worked in several capacities very successfully including Vice Chancellor, Maharashtra Animal and Fishery Sciences University (MAFSU), Nagpur for five years; Director, Project Directorate on Cattle (now ICAR- Central Institute for Research in Cattle), Meerut for five years; Professor, Animal Reproduction, Gynaecology and Obstetrics, GB Pant University of Agriculture and Technology (GBPUAT), Pantnagar; General Manager (CEO) of Sabarmati Ashram Gaushala (SAG), a unit managed by the National Dairy Development Board. Besides, many other positions following recruitment as Executive Trainee by the National Dairy Development Board (NDDB). Prof. Misra has the distinction of working with 'excellence' in the corporate body, state agricultural/ veterinary universities and an ICAR institute.

His areas of work include management of completely mechanized ~ 1000 acre agriculture and exotic bull and bull mother farms, a bull progeny testing programme involving 4 districts of Gujarat and state-of-the-art largest frozen semen production station of the country. He did pioneering work in the field of embryo biotechnology, particularly in buffalo and produced the first buffalo calf by successful freezing and thawing of embryos, non-surgical and surgical embryo transfer in India/Asia. He

successfully implemented ONBS project for the first time in Asia and was also involved in the successful vitrification of immature buffalo oocytes. Under the mission mode National Science and Technology Project on Embryo Transfer of the DBT, NDDB being the lead implementing agency, he established a network of Main ET Lab at Bidaj, 4 Regional ET Labs at Nasik, Hessarghatta, Raibareli and Nekarikallu and 15 State ET Labs in different states of India and produced thousands of cattle and buffalo calves. Under this project, he produced a record 11 calves following transfer of 15 embryos, in to 14 recipients (78.6% conception), which was widely acclaimed by the media and the Prime Minister. At Pantnagar University, Prof. Misra has taught UG , PG courses and guided many students for their Master/Doctoral research. He established OPU-IVF technology in buffalo and Sahiwal cows at Pantnagar, that produced the first buffalo calf through OPU-IVF in India. As Director PDC, he included indigenous cattle breeds Sahiwal, Gir and Kankrej for their development in India and established two more field progeny testing centre at Pantnagar and Gangtok. Also, Molecular Breeding and Spermatogonial Stem Cell Labs were established to do research in these frontier areas of science.

When Prof Misra joined MAFSU in September 2012, the largest Veterinary and Animal Sciences University of India with 10 constituent colleges (5 Veterinary colleges, at Mumbai, Nagpur, Parbhani, Udgir and Shirval, one post graduate institute in veterinary and animal sciences at Akola; two Dairy Technology colleges at Warud and Udgir; two Fishery Science colleges at Nagpur and Udgir) and 100 affiliated Diploma Schools imparting two years diploma in Livestock Management and Dairy Production, and two more Veterinary colleges are being established at Jalgaon and Akola. MAFSU was going through turmoil as a large number of pension cases of retired employees and payment of other dues pending for various reasons for a period of 6 months to 5 years were paid. Probation of more than 500 employees pending since 2007-08 was cleared. Vacant positions of Deans, Directors, Associate Deans, Heads of the Departments and large number of Assistant Professors etc. were filled in a transparent manner and without any complaint. Prof. Misra took several new initiatives in the field of education, research, extension, general and financial administration and infrastructure development. Prof. Misra brought the University back on the path of progress and prosperity, which is evident from the fact that out of total 71 Agricultural/ Veterinary Universities (including 13 Veterinary Universities, 3 Central Agricultural Universities and 4 Deemed Universities) under ICAR, MAFSU was ranked overall 16th and 3rd amongst Veterinary Universities for the year 2016-17 by ICAR.

In the existing tenure of Vice-Chancellor, GBPUA&T, Pantnagar, Prof Misra was successful in holding two Convocations in the University. Two All India Farmers' Fair were held in October 2017 and February

2018. The University started Krishi Gyan Portal and Kisan App developed by the scientists of G.B. Pant University. Foundation week was celebrated in the month of November. To promote Agriculture and allied sciences in Nepal, Hon'ble Prime Minister of Nepal visited the University and in a special convocation, he was awarded Hononary degree of Doctor of Science. A delegation of France under the leadership of Prof. Cristopher Grole, India Network Coordinator, visited Pantvarsity from 12-16 November 2017. This 18 member delegation consisted of Agriculture Counselor of French Embassy and representatives from various educational institutes of France. The university started bilateral collaboration with French institutes in fisheries almost a decade back through exchange of students. The staff working in the research and extension activities through ICAR were not getting pension due to some technical reasons, with the efforts of the state government the matter has been resolved. During this period, University has taken new strides by getting third time in a row Governor's Best University Award of Uttarakhand-2017, 351+ ranking in Times Ranking of Asian Universities, 116th ranking in QS ranking of Best Universities of BRICS Nations, Mahindra Samridhi Award for development and dissemination of the technology etc. He settled long pending issues of recovery of farm dues, promotions under Departmental Promotion Committee and Assured Carrier Promotion, Appointments based on compassionate ground, Personal Promotions through Career Advancement Scheme etc.

He has authored 7 books/book chapters, 6 manuals, many reports, 71 scientific papers in peer reviewed journals (International- 30, National- 41) and presentation of over 150 scientific papers/ lectures in conferences. He has been the Member of the Editorial Board of 'Journal of Buffalo Science' (international) and Indian Journal of Animal Science (two terms of 3 years each), Indian Journal of Dairy Science, Indian Dairymen. He was identified as consultant/ resource person by the ICAR for the establishment of the Afghan University of Agriculture and Technology; International Atomic Energy Agency (IAEA), Vienna-Austria; Integrated Watershed Development Project Hills-II (Kandi), Solan (H.P.), a World Bank Project; NABARD, Mumbai; Uttaranchal Livestock Development Board, Dehradun.

He has visited many countries including USA, Germany, Italy, The Netherlands, Denmark, Brazil, United Kingdom, Canada, France, China, Indonesia, Sri Lanka, and Afghanistan as Visiting Professor/ Invited/Sponsored Speaker/Chairman of the Session or other professional work.

He has been honoured with ICAR - Rafi Ahmad Kidwai Award for the biennium 2005-06, NAAS - Dr. P. Bhattacharya Award for the biennium 2013-14; ICAR-Jawaharlal Nehru Award 1997; President, Indian Society for the Study of Animal Reproduction 2014-2016; Lokmat National Education Leadership Award-2014; Dewang Mehta National Education Award–2018; CR Sane Oration Award-2010; Prof. Nils Lagerlof Memorial Award 1993; CR Sane Oration Award-2015;

CLFMA Achievement Award in Dairy Nutrition – 2016; Nakul Award – 2013; Hari Ohm Ashram Prerit Shri Bhaikaka Inter-University Smarak Trust Award 2006-07; Commonwealth Bureau of Animal Health Prize -1980; Jawahar Lal Nehru Fund Award-1980 etc.

He has been the Chairman, of the Research Advisory Committee of the ICAR-Central Institute for Research on Cattle, Research Advisory Committee of the ICAR-National Research Centre on Yak, Dirang, Arunachal Pradesh, Research Advisory Committee of the ICAR-Central Institute for Research on Goats, Mathura, Central Monitoring Unit (CMU), of the Department of Animal husbandry, Dairying and Fisheries (DAHDF), Govt. of India, Chairman of the Committee for the 'Accreditation of Embryo Transfer Laboratories in the Country for production of embryos', of DAHDF, Govt. of India. He worked as the Member, Veterinary Council of India, Governing Body of the Indian Council of Agricultural Research (ICAR) Society, New Delhi, Research Advisory Committees of the National Dairy Research Institute, Karnal, Research Advisory Committee of the Central Institute for Research on Buffaloes, Hisar, "Task Force on Biotechnology Based Programmes for SC/ST Population" of the Department of Bio-technology, Govt. of India, Management Committee of National Meat and Poultry Processing Board of Ministry of Food Processing Industry, Govt. of India, Boards of Management of Rajasthan University of Veterinary and Animal Sciences, Bikaner, Indira Gandhi Agriculture University, Raipur, Chattisgarh Kamdhenu University, Durg, Pt. Deen Dayal Upadhyay Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan, Mathura, Steering and Monitoring Committee for the project "Maharashtra Gene Bank Programme in Maharashtra", Govt. of Maharashtra etc.

He has been awarded with the Fellowships of National Academy of Agricultural Sciences – 2015, National Academy of Veterinary Sciences – 1999, Indian Society for the Study of Animal Reproduction-2009 and Indian Society for the Advancement of Canine Practice -2013. He has been the Chairman of the Search Committee for the Vice Chancellor of the NanaJi Deshmukh Veterinary University, Jabalpur; Member of the Search Committees of the Vice Chancellors of Kamdhenu University, Durg, Chhattisgarh and Kerala Veterinary University, Pookode and Member of the Search-cum-Selection Committee for the appointment of ICAR National Professors and National Fellows including B. P. Pal Chair in Plant Breeding and Norman Borlaug Chair in Biotechnology Scheme etc.

As a sportsman, he represented Cricket and Hockey teams of the CSA University of Agriculture and Technology, Kanpur (UP) and was Captain of the Hockey Team of the College of Veterinary Science and Animal Husbandry Mathura.

Guidelines To Contributors

The contributions to the journal are accepted in the form of review articles, research articles (clinical / field studies), case reports, other information pertaining to animal health and production. The decision of the Editorial Board members will be final regarding acceptance of the article for publication. The manuscript should be typed on one side of the paper with double spacing except for footnotes and references for which single spacing be used. The style of reference citing should be followed as shown below.

The manuscript should be arranged in the following order:

Title:	Capitalize proper nouns.
Name/s of author/s:	Initials necessary for all authors, avoid extra names.
Place of work :	District, pin code, state, SAU, affiliation.
Abstract :	Just 01 per cent words of total script.
Key words :	Maximum 5 words.
Introduction :	Brief, necessity to publish.
Material and Methods :	Specific, stepwise, precise.
Results and Discussions :	Explanatory, self define, scriptic, flow.
Summary / Conclusions :	Very short conclusion.
Acknowledgment :	(If necessary)
References :	Recent, few, pertinent carrying all details.
Periodical/s :	Surname/s and initial/s of author/s, year of publication in parenthesis, title, abbreviated name of journal (italics), volume number, (Bold), Issue number first and last page number/s.
Books :	Name/s of author/s., year of publication in parenthesis, title of the book, edition (Bold), name of publishers (Italics) and place.
Tables and Figures:	Tables are to be numbered in Roman numbers (1 II and so on). Each table should have a clear title. Figures should be of good quality and numbered in Arabic numbers (1,2,3 and so on).
Clinical articles and short communications:	Not exceeding 3 to 4 typed pages. In case reports, history, observation, tentative and confirmatory diagnosis, line of treatment and follow up on the case should be given. Trade names of drugs should be given in the Material & Methods and their details like composition, manufacturer etc. as a footnote.

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HORMONES

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COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Buserelin acetate 0.0042 mg equivalent to 0.004 mg buserelin.	• True anoestrus	5 ml, IM	Vial of 10 ml and 2.5 ml
	• Improvement of conception rate (at the time of AI)	2.5 ml, IM	
	• Ovarian cyst (Follicular), Irregular oestrus, Nymphomania	5 ml, IM	
	• Delayed ovulation & Anovulation	2.5 ml, IM	
	• Improvement of pregnancy rate (11-12 days post AI)	2.5 ml, IM	WITHDRAWAL PERIOD Milk : 0 (Zero) days Meat : 0 (Zero) days
	• Improvement of post partum fertility (10-15 days post-calving)	5ml, IM	

CHORULON®

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each vial contains human Chorionic Gonadotrophin (hCG) 1500 IU as freeze dried pellet of natural glycoprotein human Chorionic Gonadotrophin	• Improvement of conception rate (cows/buffaloes)	1500 IU at AI or mating, IM or IV	Box containing 5 vials (1500 IU each) with 5 vials of solvent
	• Enhancement of luteal function post AI	1500 IU, 4-6 days post AI, IM	
	• Cystic Ovarian Disease (anoestrus, prolonged estrus, nymphomania)	3000 IU, IV	
	• Induction of ovulation (mares)	1500-3000 IU, IM or IV, 24 hours before AI/mating	WITHDRAWAL PERIOD Milk : 0 (Zero) days Meat : 0 (Zero) days

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COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each vial contains Pregnant Mare Serum Gonadotrophin injection (Freeze dried) 1000 IU	Females:	Cow/Buffalo	Box containing 5 vials (1000 IU each) with 5 vials of solvent
	• Anoestrus	Anoestrus : 500 - 1000 IU IM	
	• Super ovulation	Super ovulation: 1,500-3,000 IU, IM between day 8-13 of cycle	
	• Increase of fertility rate after progestagen pre-treatment	300-750 IU, IM, at the end of a progestagen treatment	WITHDRAWAL PERIOD Milk : 0 (Zero) days Meat : 0 (Zero) days

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COBACTAN 2.5%

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml of suspension contains 29.64 mg Cefquinome Sulphate (equivalent to 25 mg Cefquinome).	Cattle • Respiratory disease caused by *Pasteurella multocida* and *Mannheimia haemolytica* • Digital dermatitis, infectious bulbar necrosis and acute interdigital necrobacillosis (foul in the foot) • Mastitis Calf • *E. coli* septicaemia	1 mg cefquinome/kg bw MI (2ml/50 kg bw) 1 mg cefquinome/kg bw MI (2ml/50 kg bw) 1 mg cefquinome/kg bw MI (2ml/50 kg bw) 2 mg cefquinome/kg bw MI (4ml/50 kg bw)	50 ml multidose vial. WITHDRAWAL PERIOD Cattle : Meat : 5 days, Pig : Meat : 3 days Milk : 1 day

COBACTAN LC

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each syringe of 8 gm contains 75 mg Cefquinome sulphate as active ingredient.	For the treatment of clinical mastitis in lactating cows caused by *Staphylococcus aureus, Streptococcus uberis, Streptococcus dysgalactiae, Escherichia coli* & other entero-bacteria susceptible to cefquinome.	Gently infuse the contents of one syringe into the teat canal of the infected quarter every 12 hours after each of 3 successive milkings. Milk out the affected quarter (s). After thoroughly cleaning & disinfecting the teat & teat orifice, gently infuse the contents of one syringe into affected quarter. Disperse the product by gently massaging the teat & udder of the affected animal.	Box of 3 injectors with 3 isopropyl alcohol soaked towels WITHDRAWAL PERIOD Milk : 84 hours (7 milkings) Meat : 2 days

Floxidin™ VET

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Floxidin 10% injection : Each ml contains - Enrofloxacin I.P. 100 mg	- Alimentary canal e.g. Enteritis, calf scours. - Respiratory tract e.g. Pneumonia - Urogenital system e.g. Metritis, cystitis - Skin e.g. Bacterial dermatitis, pyoderma. - Mastitis, & Haemorrhagic Septicaemia.	Floxidin can be given once daily, for 3-5 days. Cattle, Sheep & Goat 2.5-5 mg/kg body weight IM Dog/Cat (adult) 5 mg/kg body weight IM Camel 2.5 mg/kg body weight IM	15 ml, 50 ml Now also available 100 ml WITHDRAWAL PERIOD Milk : 3.5 days Meat : 14 days

Tetracycline WSP VET

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each gm contains Tetracycline Hydrochloride I.P. 50 mg	In Sheep & Goat : Pneumonia, Joint ill, Anthrax, Septicaemia, Contagious Caprine Pleuro-Pneumonia, Scours, Acute Mastitis, Acute Metritis, In Cattle : Infectious diseases like Haemorrhagic septicaemia, Anthrax, Black Quarter, Leptospirosis, Foot Rot & Contagious Bovine Pleuro-Pneumonia, Calf Scours, Calf Diphtheria, Pneumonia, Septicaemia, Acute Metritis, Acute Mastitis.	Sheep & Goat : 1 gm/kg body weight Cattle : 2.5-5 gm/15kg body weight for 5 days	Sachet of 100 grams WITHDRAWAL PERIOD Milk : 7 days Meat : Cattle:22 days Poultry : 5 days Pig, Sheep & Goat : 28 days

METRICEF™

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each single dose syringe of 19 g contains: Cephapirine Benzathine intrauterine suspension in pre filled syringe-500 mg	• Subacute/chronic endometritis in cows over 14 days postpartum • Repeat breeders (3 or more unsuccessful inseminations).	Single dose syringe to be administered intra-uterinely	Single dose (19 g) syringe provided with a separate disposable catheter and a glove. WITHDRAWAL PERIOD Meat & offals : 24 hours Milk :0 (Zero) hours

ANTI-INFECTIVE

Floxidin™ LA (Vet)

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains: Enrofloxacin IP (Vet) : 100 mg Benzyl Alcohol : 2% v/v	• **Systemic Infections** - Mastitis, Metritis, Pneumonia, Gastro-intestinal infections • **Soft Tissue infections** - Wounds, Post Surgical recovery, supportive treatment in cases of FMD	Administer at the dose rate of 7.5-12.5 mg per Kg bw (1 ml per 8-13 Kg bw) IM or SC as a single dose. If required repeat after 48-72 hrs.	Available in 50 ml WITHDRAWAL PERIOD: Milk : 84 hrs. Meat : 14 days

YELINTRA*™

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Per syringe of 8 gm contains : Tetracycline HCL 200 mg Neomycin base (as sulphate) 250 mg Bacitracin 2000 IU Prednisolone 10 mg	Intramammary administration to lactating cows for therapeutic treatment of clinical mastitis caused by sensitive microorganisms *(S. aureus, Streptococci, E.coli, Klebsiella spp., A. pyogenes)*	Intramammary administration of one syringe per infected quarter every 12 hours. Maximum treatment is four administrations.	Box of 1 sachet of 4 intramammary syringes & cleaning towel WITHDRAWAL PERIOD Meat and offal : 14 days, Milk : 96 hours (8 milkings)

*TM under registration

Cepravin®

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 3 gm syringe contains 250 mg Cefalonium dihydrate as active ingredient	• For routine dry cow therapy to treat existing sub-clinical infections • Prevent new infections during dry period	One syringe should be infused into the teat canal of each quarter immediately after the last milking of lactation	3 gm syringe and each box contains 20 units WITHDRAWAL PERIOD: Milk : 54 days after last treatment plus 96 hours after calving. Meat & offals : Zero days

PARASITE CONTROL

OUT LINE™ POUR ON

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Amitraz I.P. 2.0% w/v, Deltamethrin 0.5% w/v, Piperonyl Butoxide (PBO)2.0% w/v	For the control of Ticks, Mites, Flies and Lice.	**Cattle :** For control of Ticks, Mites, Flies and Lice- 1 ml / 10 Kg B. wt.	40 ml HDPE bottle with measuring cup and hand glove WITHDRAWAL PERIOD Milk : 2 days, Meat : 20 days

MSD Animal Health

PARASITE CONTROL

butox® Vet

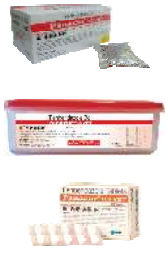
Highly effective & safe ectoparasiticide only for external use.
Ideally suited for control of ticks, mites, lice & flies of livestock, poultry, dogs & farm houses.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Deltamethrin I.P. 12.5mg	To control the ectoparasites in cattle, sheep, goats, horses, camels, dogs & farm houses.	Spray or dip : Ticks : 2 ml/lit Mites : 4 ml/lit Flies : 2 ml/lit Lice : 1 ml/lit	Aluminium container of 5 ml, 15ml, 50 ml, 250 ml and 1 lit with plastic measuring cup WITHDRAWAL PERIOD Milk : 0 (Zero) day Meat : 20 days

Taktic® 12.5% EC

Broad spectrum ectoparasiticide effective against ticks, mites, lice & keds

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Amitraz I.P. (Vet) 125 mg	1. For prevention & control of ectoparasitic infestation like ticks, mites, lice & keds in cattle, sheep, goat, camel & pig. 2. Taktic kills organochlorine, organophosphate & pyrethroid resistant strains of ectoparasites.	Taktic 12.5%/lit of water for ticks : Cattle/Buffaloes/Camel: 2.0 ml Sheep/Goat : 4.0 ml Pigs : 4.0 ml Taktic 12.5%/L of water for mites and keds : Cattle / Camel : 2.0 ml Sheep/Goat : 4.0 ml Pigs : 4.0 ml	Tin Container of 6 ml, 15 ml, 50 ml & 250 ml with plastic measuring cup. WITHDRAWAL PERIOD : Milk : 4 milking/2 days Meat : 1 day for cattle & goat 7 days for sheep & pig



Panacur® VET

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
The active ingredient of Panacur is Fenbendazole which is the research molecule of Intervet/Schering-Plough Animal Health. Each 1.5 g Bolus contains 1.5 g of active Fenbendazole. I.P. Each 150 mg tablet contains 150 mg of active Fenbendazole. I.P.	Infestation of cattle, buffaloes, sheep, goat & horses with gastro-intestinal nematodes, lungworms & tapeworms such as *Haemonchus spp., Ostertagia spp., Trichostrongylus spp., Cooperia spp.* and *Nematodirus spp.*	Recommended for cattle, sheep, goat, horses & pigs. Panacur 150 mg tablet per 30 kg body weight & Panacur 1.5 gm bolus per 300 kg body weight (5 mg Fenbendazole per kg body weight). Dose for horses : 7.5mg/kg bw	Box of 15x2'-1.5 gm bolus Box of 5 x 2'- 3 gm bolus Box of 5 x 10'- 150 mg tablets. WITHDRAWAL PERIOD Milk : 4 days Meat : 8 days for large animals 14 days for sheep & Goat

Panacur® 25% Wettable powder (vet)

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each gram contains Fenbendazole I.P 250 mg	Infestations of cattle, buffaloes, Sheep & goats with gastro-intestinal nematodes, lungworms & tapeworms such as *Haemonchus spp., Ostertagia spp., Trichostrongylus spp., Cooperia spp., Nematodirus spp., Neoascaris vitulorum, Oesophagostomum spp., Chabertia spp., Bunostomum spp., Gaigeria pachyscelis, Capillaria, Trichuris spp., Strongyloides spp., Dictyocaulus filaria, Dictyocaulus viviparus, Moniezia spp., Infestation of dogs with Ancylostoma spp., Infestation of horses with strongyles, Ascarids, Ascarids (Parascaris), Oxyuris & Strongyloides Infestation of pigs with Hyostrongylus rubidus, Oesophagostomum spp., Ascaris suum, Trichuris suis & Metastrongylus spp.*	Recommended for cattle, sheep, goat & pigs. Infestation with gastrointestinal nematodes & lungworms : (5 mg Fenbendazole per kg body weight) Suspension to be made by mixing clean water as: 6 g with 100 ml 60 g with 1 lit. 120 g with 2 lit.	6 g sachet, 60 g & 120 g container WITHDRAWAL PERIOD Milk : 4 days Meat : 8 days for large animals 14 days for sheep & Goat

PARASITE CONTROL

Panacur® 2.5% Suspension (VET)

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains 25 mg of Fenbendazole I.P.	Infestation of cattle, buffaloes, sheep & goats with gastrointestinal nematodes lungworms & tape worms such as *Hoemonchus spp., Ostertagia spp., Trichostrongylus spp., Cooperia spp., Nematodyrus spp.,*	Dose recommended for cattle, buffaloes, sheep, goats & pigs' infestation with gastrointestina nematodes & lungworms: (5 mg Fenbendazole per kg body weight)	450 ml and 1 lit HDPE bottle pack of Panacur 2.5% suspension. WITHDRAWAL PERIOD Milk : 4 days Meat : 8 days for large animals 14 days for sheep & Goat

Tolzan® Plus - L

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Oxyclozanide I.P. - 3.4% w/v Levamisole Hydrochloride I.P. - 2.5% w/v	• Tolzan Plus-L treats the round worms and liver flukes in cattle, sheep and goats • Tolzan Plus-L controls adult and immature stages of conical flukes also (Paramphistomum spp.) Tolzan Plus-L can be used safely in pregnant animals during all stages of pregnancy. • Tolzan Plus-L can be safely given to all cattle, sheep and goats without any pre-dosing, starving or change of diet.	Cattle: 90 ml for 300 kg live mass PO Sheep and goats: 9 ml for 30 kg live mass PO	120 ml HDPE bottle, 1 Ltr can WITHDRAWAL PERIOD Milk : 7 days Meat : 14 days

Tolzan® F VET

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml of suspension contains Oxyclozanide I.P suspension of 3.4% w/v	1) Tolzan -F is used in the treatment of acute & chronic Fascioliasis in cattle, buffaloes, sheep & goats. The important species are : a) *Fasciola hepatica* b) *Fasciola gigantica* 2) Tolzan -F is also used to treat paramphistomiasis. The species involved are : *P. microbrothriodes, P. microbrothridium, P. gotal, P. orthocoelium* 3) Tolzan -F also acts on *Monezia* tapeworm in sheep.	Cattle & Buffalo : Orally 10-15 mg/kg body weight Sheep & Goat: Orally 15 mg/kg body weight	90 ml HDPE bottle & 1 ltr jerry can. WITHDRAWAL PERIOD Milk : 7 days Meat : 14 days

Berenil® VET 7% RTU

As treatment & control therapy of Babesiosis, Trypanosomiasis and Theileriosis

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Diminazine Aceturate 70 mg Phenazone B. P. 375 mg	Babesiosis & Trypanosomiasis, Tenacious Trypanosomiasis, Theileriosis & mixed infections, Pyrexia of Unknown Origin	Babesiosis and Trypanosomiasis at 5-10 ml per 100 kg b.w. Resistant strains of Trypanosomiasis at 10 ml per 100 kg b.w. Theileriosis & Mixed infections at 5 -10 per ml 100 kg b.w. along with antibiotic (3-4 antibiotic injections on alternate days)	Amber coloured vials of 20 ml, 30 ml and 90 ml WITHDRAWAL PERIOD Milk : 3 days Meat : 20 days

MSD Animal Health

SUPPORTIVES

Tonophosphan® VET

Injectable phosphorus preparation for improving metabolism, milk production & fertility in livestock. Its content of organically bound phosphorus is 20%.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Sodium salt of 4-dimethylamine, 2-methylphenyl-phosphinic acid 0.2 g	As a tonic in general metabolic disorders, debility, exhaustion, repeat breeding & infertility due to phosphorus deficiency. For disorders of bone formation as in rickets & osteomalacia. To promote callus formation in fractures in combination with calcium & vitamin D. For treatment of tetany & paresis resulting from calcium, magnesium & phosphorus imbalance (as in milk fever).	Large Animals : 5-20 ml. Small Animals : 1-3 ml. In chronic conditions- Large Animals : 2.5-5 ml Small Animals : 1-2 ml.	Vial of 10 ml and 30 ml Now also available 100 ml vial

VM^{all}™

CONTENTS PER KG	BENEFITS	DIRECTIONS FOR USE	PRESENTATION
Each Kg contains a nutritional value of : Cobalt 120mg, Copper 1000mg, Magnesium 5000mg, Iron 2500mg, Potassium 100mg, Manganese 2000mg, Flourine 60mg, Calcium 150g, Selenium 10mg, Vit A 1200000 IU, Vit D3 120000 IU, Sulphur 0.70%, Vit E 1200 IU, Iodine 300mg, Zinc 5000mg, Phosphorus 60g, Niacinamide 4g, Vit K 200mg, Sodium 8mg.	To improve on fertility. To safeguard health and growth. To optimize milk yield and fat.	Ruminants Mix 100-200 g per 10 kg of feed depending on the availability of other fodder/feed. For direct feeding, Cow and Buffalo: 25-30 g/head/day Calf, Sheep and Goat: 15-20 g/head/day Aqua: Mix 100g to 10 kg of fish feed.	1 kg Zip-Locked pouch with measuring spoon. 5 Kg & 25 Kg bag

VM^{all}™ - P

CONTENTS PER KG				BENEFITS	DIRECTIONS FOR USE	PRESENTATION
Each KG contains a nutritional value of (When packed):				• To improve on fertility • To safeguard health and growth. • To optimize milk yield and fat.	Ruminants Mix 100-200 g per 10 kg of feed depending on the availability of other fodder/feed. For direct feeding, Cow and Buffalo: 25-30 g/head/day Calf, Sheep and Goat: 15-20 g/head/day Aqua: Mix 100g to 10 kg of fish feed.	25 kg Sealed bag Now also available 5 Kg bag
Cobalt	150 mg	Vit A	1200000 IU			
Copper	2200 mg	Vit D3	120000 IU			
Iodine	325 mg	Vit K	200 mg			
Iron	2500 mg	Vit E	500 IU			
Magnesium	6000 mg	Calcium	225 g			
Manganese	2200 mg	Phosphorus	90 g			
Potassium	100 mg	Niacinamide	1000 mg			
Sodium	8 mg	Biotin 2%	500 mg			
Sulphur	1%	Bioactive				
Zinc	9000 mg	chromium	65 mg			

SUPPORTIVES

Rumicare® (Vet)

Normalises milk production by restoring ruminal activity.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each gm powder contains : Calcium Propionate 480.00 mg Methionine 40.00 mg Picrorhiza Dry Extract 2.00 mg Cobalt Gluconate 0.32 mg Vitamin B_6 IP 0.32 mg Dextrose Anhydrous IP 428.00 mg	Bloat, digestive disorders caused by decreased activity of reticulum & rumen or sudden dietary changes &/ or intoxication. As a supportive therapy in diseases caused by foreign bodies & hypo-glycaemic conditions in cattle, calves, sheep & goats.	Adult Cattle : 125 gm sachet twice daily, (once in 12 hours Young Animals : 65 gm (approx) once or twice daily Sheep & Goat : 32 gm once or twice daily	125 g sachet

Avilin® Vet

For quick relief from allergic manifestations.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains: Pheniramine maleate IP 22.75 mg.	Itching due to eczema, dermatitis, urticaria, skin oedema, insect bites, photo-dermatitis, rhinitis, tail eczema in horses, stomatitis & inflammation of the hooves of cattle, serum sickness, paresis during pregnancy, toxaemia & retention of placenta, pulmonary oedema in cattle, pulmonary emphysema in horses.	Large animals : 5-10 ml. Small animals : 0.5-1 ml. or more. By IM or IV route	Amber coloured vial of Avil 10 ml and 33 ml WITHDRAWAL PERIOD Milk : 2 days Meat : 7 days

Prednisolone Acetate Injection

For quick relief from ketosis.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Prednisolone acetate I.P. 10 mg	Prednisolone is indicated in ketosis in dairy cattle, shock, inflammations (especially rheumatic arthritis, dermatitis, bursitis) and allergic conditions of livestock	Cattle, horses : 5-20 ml. Calves, pigs : 2.5-5ml. Piglets, dogs, cats :1-3 ml. or as recommended by Veterinarian.	Vial of 10 ml WITHDRAWAL PERIOD Milk : 3 days Meat : Cattle Sheep & Goat : 5 days Pig : 28 days

Vetalgin® VET

Highly effective analgesic, antispasmodic, antirheumatic & antipyretic agent.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Analgin I.P. 0.5 g Chlorbutol (as bacteriostat) 0.4% w/v	For relief from pain, fever, labour, spastic condition of cervix during parturition, rheumatic conditions, neuritis, neuralgia, retention of placenta, dysentry, bloat & gastritis in domestic animals.	Preferably intravenous, otherwise intramuscular or combination of IV/IM injection. Horse : 20-60 ml Cattle : 20-40 ml Foal, Calf : 5-15 ml Sheep, Goat : 2-8 ml Pig : 10-30 ml Dog : 1-5 ml	Vial of 33 ml WITHDRAWAL PERIOD Milk : 2 days Meat : Cattle 12 days/Pig 3 days & Horse IV 5 days

MSD Animal Health

SUPPORTIVES

Transmix™

COMPOSITION	BENEFITS	DIRECTIONS FOR USE	PRESENTATION
Gluconeogenic precursors fortified with vital organic substances and essential elements. Contains highly bio-available calcium.	• Eases the calving stress • Improve immunity and waning the chances of retained placenta and metritis • Optimises milk production	Drench 500 ml after parturition & repeat same quantity 48-72 hours after first drench	Available in 500 ml bottle

VM$^{all™}$ Chelated

COMPOSITION	BENEFITS	DIRECTIONS FOR USE	PRESENTATION
Nutritional value per kg : Vit A 20,00,000 IU, Vit D_3 2,00,000 IU, Vit E 50% 3,000 IU, Vit B_3 (Niacin) 1,000 mg, Calcium 230 mg, Phosphorus 115 g, Zinc 9,600 mg, Manganese 3,900 mg, Iron 1,500 mg, Iodine 500 mg, Cobalt 200 mg, Selenium 20 mg	• Timely uterine involution • Timely onset of estrus • Showing proper signs of estrus • Proper follicular development & timely ovulation • Improving conception rates	After calving : from day 5 to day 60 Feed VM $^{all™}$ Chelated 25g to 50g/day/cow Or mix 100g VM $^{all™}$ Chelated per 10kg feed	Available in 1 kg & 5 kg

Finadyne®

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains: Flunixin Meglumine IP 83 mg, Equivalent to Flunixin 50 mg	• **In Cattle, Sheep, Goat, Camel:** For the control of inflammation and pyrexia associated with mastitis, respiratory disease and metritis. • **In Horse:** For the alleviate of inflammation and pain associated with musculo-skeletal disorders. • **In Dogs:** For use to alleviate Fever, Inflammation, endotoxemia or Sepsis.	**Cattle, Sheep, Goat and Camel:** 1.1 mg to 2.2 mg Flunixin per kg body weight or 1 to 2 ml of Finadyne injection per 45 kg body weight given by slow intravenous or intramuscular administration. **Horses:** by slow intravenous injection for Musculo-skeletal disorder at rate of 1 ml per 45 kg bodyweight (1.1 mg Flunixin/kg) one daily for up to 5 days. **Dog:** by Intramuscular or slow intravenous at dose of 0.5-1 mg/kg body weight as a single dose or necessary once a day for not more than 3 days.	Available in 20 ml & 100 ml bottle WITHDRAWAL PERIOD Cattle - Milk: 24 hours after last treatment Meat: 5 days from the last treatment Horse - Meat: 7 days from last treatment Pig - Meat 22 days from last treatment

Chelated LactAid® Forte

COMPOSITION	BENEFITS	DIRECTIONS FOR USE	PRESENTATION
Nutritional value per 100 ml : Calcium 3500 mg. Phosphorus 1750 mg. Vit D_3 15000 I.U. Vitamin B_{12} 200 mcg. Carbohydrates 20000 mg. Chelated Zinc 320 mg. Chelated Copper 150 mg. Chelated Manganese 130 mg. Biotin 2 mg. Chelated Chromium 9 mg. Enriched with herbal galactogogues.	• Helps in strengthening udder defense system • Helps in maintaining good health and optimum performance • Helps in Bone development • Helps in improving milk production	For Large animals : 25 ml to 40 ml twice For Small animals : 10 ml to 20 ml twice	Available in1 Lit. and 5 Lit.

COMPANION ANIMAL

Nobivac® KC

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each (0.4 ml) dose Contains Brodetella bronchiseptica strain B-C2 $\geq 10^{8.0}$ CFU and canine para influenza virus stain Cornell $\geq 10^{3.0}$ $TCID_{50}$	Active immunization of dogs against Kennel Cough.	Nobivac KC aims to make administration as easy as possible: ● Low 0.4 ml dose ● Single nostril only Can be used with or without applicator	One box contains 5 vials of dose and 5 vials of diluent along with one applicator

Nobivac®: Puppy DP

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 1 ml dose contains : live infectious canine distemper virus strain Onderstepoort minimum 5.0 log_{10} $TCID_{50}$ Live infectious canine parvo virus strain 154 minimum 7.0 log_{10} $TCID_{50}$	Active immunization of dog against CDV and CPV.	Reconstitute one vial of Nobivac® Puppy DP in one vial of Nobivac® Solvent & inject subcutaneously.	One box contains 10 vials of 1 dose.

Nobivac®: DHPPi

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 0.5 ml dose contains : Live infectious canine distemper virus (CDV) strain Onderstepoort at least 4.0 log_{10} $TCID_{50}$ Live infectious canine adeno virus type 2 (CAV_2) strain Manhattan LPV_3 at least 4.0 log_{10} $TCID_{50}$ Live infectious canine parvo virus (CPV) strain 154, at least 7.0 log_{10} $TCID_{50}$ Live infectious canine para-influenza virus (CPI) strain cornell at least 5.5 log_{10} $TCID_{50}$	Vaccination against CDV, CAV2, CPV & CPi. Besides providing protection against CAV2 disease entities such as respiratory tract infections, the vaccine also protects against infectious canine hepatitis (ICH) caused by CAV1.	Reconstitute the contents of one vial of Nobivac DHPPi in one vial of Nobivac Solvent, Nobivac Lepto, Nobivac Rabies or Nobivac RL immediately prior to use & inject subcutaneously.	One box contains 10 vials of 1 dose.

Nobivac®: Lepto

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each dose contains inactivated strain of: Leptospira interrogans serotype canicola strain Ca-12-000≥957units/ml and Leptospira interrogans serotype icterohaemorrhagiae strain 820K≥625 units/ml	Active immunisation against Leptospirosis caused by *L.icterohaemorrhagiae* & *L.canicola of Leptospira interrogans.* Animals are protected against clinical disease, & also against becoming renal carriers after challenge.	Inject 1 ml of Nobivac Lepto subcutaneously. Nobivac Lepto can also be used to reconstitute Intervet's freeze dried vaccines Nobivac Puppy DP & Nobivac DHPPi.	One box contains 10 vials of 1 dose

Nobivac®: Rabies

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 1 ml dose contains rabies virus (Pasteur RIVM Strain) inactivated ≥ 3 IU	For the active immunisation of healthy dogs, cats, cattle, sheep, goats, horses and in principle all healthy mammals against Rabies & can be used for both (prophylactic immunisation & post bite therapy.	1 ml by subcutaneous or intramuscular injection. Shake well before use.	One box contains 1 ml x 10 vials or one box contains 10 ml x 10 vials

MSD Animal Health

COMPANION ANIMAL

Nobivac®:RL

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 1 ml dose contains : Rabies virus inactivated antigen suspension ≥ 3.0 IU Leptospira interrogans sero group Canicola ≥ 40 hamster PD_{80} Leptospira interrogans sero group icterohaemorrhagies ≥ 40 hamster PD_{80}	For the active immunisation of dogs against rabies, and canine leptospirosis caused by *L.interrogans* serogroups *canicola* and *icterohaemorrhagiae*.	1 ml by subcutaneous injection. Can be used to reconstitute Nobivac DHPPi. Intended for dogs from 8 weeks of age onwards.	One box contains 1 ml x 10 vials.

Scalibor®

COMPOSITION	BENEFITS	DOSAGE	PRESENTATION
Scalibor® protective band 65 cm contains 1 g of deltamethrin Scalibor® protective band 48 cm contains 0.76 g of deltamethrin	Scalibor® protection band has unique release technology to ensure sustained release and continuous efficacy against Ticks, Fleas and Sand flies. It is effective through its anti-feeding effect repellent effect, knockdown effect and lethal effect. Duration of efficacy is six months against ticks and four months against fleas	The collar with the length of 48 cm is to be used on small and medium sized dogs, The collar with the length of 65 cm is to be used on large sized dogs.	One collar is packed into a sachet made of polyethylene-aluminum-Kraft paper

Taktic® 5% EC

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Amitraz I.P. 50 mg	It is indicated for the topical treatment of Demodectic & Sarcoptic Mange, ticks & lice in dogs.	Mixing Rate / lit of water: Ticks & lice - 6 ml Mites - 10 ml 3-5 applications for mange and 2 applications for ticks & lice at weekly intervals. Taktic to be used as dip or spray	Glass bottle of 25 ml with plastic measuring cup

Taktic® 12.5% EC

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Amitraz I P 125 mg	It is indicated for the topical treatment of Demodectic & sarcoptic Mange, ticks & lice in dogs	Mixing Rate/ lit of water Demodectic Mange – 4 ml Sarcoptic Mange – 2 ml Ticks & Lice – 2 ml In severe cases of infestation a second treatment is recommended 5-10 days after the first.	Glass bottle of 25 ml with plastic measuring cup

San Coat®

NUTRITIONAL VALUE	BENEFITS	DIRECTIONS FOR USE	PRESENTATION
Essential Fatty Acids (Linoleic Acid, Alpha Linolenic Acid, Gamma Linolenic Acid, Eicosapentaenoic Acid and Docosahexaenoic Acid) Vitamins (Vitamin A and E, Biotin and Pyridoxine) Zinc and Inositol Omega 6 and Omega 3 fatty acids in 6:1 ratio	San Coat is indicated as an aid in the management of allergic and inflammatory skin conditions like alopecia, dull and dry hair coat, pruritis, atopic dermatitis, *Malassezia pachydermatis*, pyoderma, mange etc. in dogs.	Pour measured dose on food once daily according to the following schedule. 0.3 to 1.0 ml per kg body weight. Under 7 kg - 3.75 ml 7 - 23 kg - 7.5 ml Over 23 kg - 15.0 ml	Container of 150 ml (bettix shape)

COMPANION ANIMAL

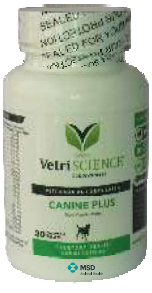
DELVOSTERON®

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains proligestone Injection 100 mg	Suppression & postponement of oestrus in the bitch, treatment of pseudo pregnancy in the bitch, suppression and postponement of oestrus in the queen and suppression and postponement of oestrus in the ferret.	Dogs Body weight — Dosage < 3 kg — 1.0 ml 3-5 kg — 1.0-1.5 ml 5-10 kg — 1.5-2.5 ml 10-20 kg — 2.5-3.5 ml 20-30 kg — 3.5-4.5 ml 30-45 kg — 4.5-5.5 ml 45-60 kg — 5.5-6.0 ml > 60 kg — 1 ml/ 10 kg	20 ml Vials

DERMA STRENGTH

NUTRITIONAL VALUE		BENEFITS	DIRECTIONS FOR USE	PRESENTATION
Active Ingredients per 1 tablet :		• Collagen production • Skin texture • Circulation • Immune system response and circulation • Tissue recovery • Normal histamine levels • Provides support during allergy season	Directions for use or as directed by a veterinarian : Give 1 tablet per 10 kg of body weight daily. If giving more than 1 tablet daily, divide between AM and PM.	30 tablet
Methylsulfonylmethane (MSM)	75 mg			
N, N-Dimethylglycine Hcl (DMG	50 mg			
DL-Methionine	50 mg			
L-Cysteine	50 mg			
Grape Seed (Vitis vinifera) Extract	30 mg			
Ascorbic Acid (Vitamin C)	25 mg			
L-Proline	25 mg			
Perilla (Perilla frutescens) seed Extract	20 mg			
dl-alpha Tocopheryl Acetate (VitaminE)	10 IU			
Zinc (Zinc Citrate)	5 mg			
Hyaluronic Acid (HA)	5 mg			
Niacinamide (Vitamin B3)	4 mg			
Retinyl Acetate (Vitamin A)	37 IU			

CANINE PLUS



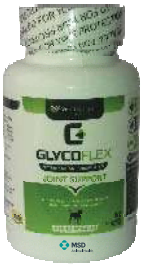
NUTRITIONAL VALUE		BENEFITS	DIRECTIONS FOR USE	PRESENTATION
Guaranteed Analysis Represents Minimum Levels per Tablet Unless otherwise Specified :		• Enhances immunity, support bone formation. Blood formation • Nerve formation, skin health, general health, antistress and antioxidant function	Directions for use or as directed by a veterinarian : Under 20 kg : 1 tablet daily Over 20 kg : 2 tablets daily When more than one tablet per day is required, dividing between AM and PM is optional.	30 and 60 tablet presentation
Moisture (max	5.655%			
Methionine	3.75 mg			
Calcium (6.25%)	37.5 mg			
Phosphorus (3.13%)	18.75 mg			
Potassium (0.03%)	0.187 mg			
Magnesium (3.13%)	18.75 mg			
Iron (3750 ppm)	2.25 mg			
Copper (3.33 ppm)	0.002 mg			
Zinc (1250 ppm)	0.75 mg			
Iodine (10 ppm)	0.006 mg			
Selenium (3.33 ppm)	0.002 mg			
Vitamin A	450 IU			
Vitamin D3	37.5 IU			
Vitamin E	3.75 IU			
Thiamine (Vitamin B1)	3.75 mg			
Riboflavin (Vitamin B2)	1.875 mg			
Panthothenic Acid	3.75 mg			
Niacin	3.75 mg			
Vitamin B6	1.875 mg			
Folic Acid	0.001 mg			
Vitamin B12	0.001 mg			
Choline	3.75 mg			
Biotin	0.001 mg			
Ascorbic Acid (Vitamin C)	9.375 mg			
Bromelain (Pineapple)	0.675 GD Units			

COMPANION ANIMAL

CARDIO STRENGTH

NUTRITIONAL VALUE		BENEFITS	DIRECTIONS FOR USE	PRESENTATION
Active Ingredients per Capsule : L-Carnitine HCl L-Taurine N, N-Dimethylglycine HCl d-alpha Tocopheryl Succinate (Vitamin E) Coenzyme Q10 Folic Acid Magnesium (as Magnesium Citrate) Potassium (as Citrate/Malate) Selenium (as Sodium Selenite)	 125 mg 125 mg 25 mg 30 IU 10 mg 0.9 mg 0.5 mg .01 mg 0.007 mg	• Dogs and cats with pre-existing sub-optimal cardiovascular functions • Breeds of dogs and cats that are predisposed to cardiovascular stress • Support of geriatric patients	Directions for use or as directed by a veterinarian : Cat : Give 1 capsule daily. Dogs : Give 1 capsule, per 10 kg of body weight, daily. If giving more than 1 capsule, divide between AM and PM.	30 and 60 tablet

GLYCOFLEX



NUTRITIONAL VALUE		BENEFITS	DIRECTIONS FOR USE	PRESENTATION
Active Ingredients per Tablet : Glucosamine HCl (Shrimp and Crab) Pena Canalicus (Glycomega™ brand Green Lipped Mussel) Methylsulgonylmethane (MSM) N, N-Dimethylglycine HCl (DMG) Manganese (as Mn Proteinate)	 375 mg 300 mg 250 mg 50 mg 5 mg	• Glyco FLEX Canine represents our comprehensive support for dogs needing moderate joint support. • These delicious chewable tablets are also recommended for adult and maturing dogs, sporting and working breeds as well as support normal recovery after orthopedic surgery.	Directions for use or as directed by a veterinarian : Up to 15 kg :½ tablet daily 15.5 kg-30 kg : 1 tablet daily 30.5 kg-45 kg : 2 tablet daily 45.5 kg & over : 2 ½ tablets daily If giving more than 1 tablet, divide between AM and PM.	30 and 60 tablet presentation

RENAL ESSENTIALS

NUTRITIONAL VALUE		BENEFITS	DIRECTIONS FOR USE	PRESENTATION
Active Ingredients per Tablet : Astragalus Root Powder Rehmannia glutinosa Root Extract Nettle (Urtica dioica) Seed Extract Cordyceps sinensis Extract Lecithin L-Arginine N, N-Dimethylglycine HCl (DMG) Potassium (K Gluconate) Inositol Pyridoxal 5-Phosphate (Vitamin B6) Thiamine (Vitamin B1) Riboflavin (Vitamin B2) Choline Folic Acid Methylcobalamin (Vitamin B12)	 60 mg 50 mg 50 mg 50 mg 50 mg 50 mg 25 mg 8.25 mg 8 mg 8 mg 4 mg 4 mg 4 mg 0.15 mg 0.05 mg	• Renal circulation • Immune and antioxidant defense system function • Homocysteine balance • Normal fluid retention • Stress management • Kidney and liver function • Normal detoxification	Directions for use or as directed by a veterinarian : Give 1 tablet per 10 kg of body weight, day For dogs less than 7 kg, give 1/2 tablet daily If giving more than 1 tablet, divide between AM and PM.	45 tablets presentation

POULTRY PRODUCTS

Live Vaccine

Nobilis® Gumboro 228E

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Live Gumboro disease virus strain 228E at least 2.0 log_{10} EID_{50}	The vaccine is recommended for active immunization of chicken against Gumboro Disease (IBD)	One dose per bird through drinking water	1000 ds 2500 ds

Nobilis® Gumboro D78

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Live Gumboro disease virus strain D78 at least 4.0 log_{10} $TCID_{50}$	The vaccine is recommended for active immunization of chicken against Gumboro Disease (IBD)	One dose per bird through drinking water	1000 ds 2500 ds

Nobilis® ND Clone 30

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Live Newcastle Disease strain Clone 30 at least $10^{6.0}$ ELD_{50}	The vaccine is recommended for active immunization of chicken against Newcastle Disease	One dose per bird through drinking water, spray, intranasal/intra ocular	1000 ds 2500 ds 5000 ds

Nobilis® Ma5 + Clone 30

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each vial contains per dose at least 3,0 log_{10} EID^{50} live Avian Infectious Bronchitis Virus strain Ma5 and at least 6,0 log_{10} ELD_{50} of live Newcastle Disease Virus strain Clone 30 in stabilizer	Vaccination of chickens against infectious Bronchitis and Newcastle Disease. Vaccine can be used for primary as well as secondary vaccination.	Compatible with inactivated NDV vaccines (e.g. ND Broiler). Further, an extensive vaccination program has been tested involving live vaccines against Marek's disease, NDV, IBDV and IBV. The use of these vaccines did not affect the safety and efficacy of the individual products.	1000 ds 2500 ds 5000 ds

Nobilis® MG 6/85

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Live Mycoplasma gallisepticum strain MG 6/85 minimum $10^{6.9}$ CFU	The vaccine is recommended for active immunization of chicken to reduce the clinical signs of Mycoplasma gallisepticum infection.	One dose per bird through intraocular	1000 ds

Nobilis® IB Ma5

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Vaccine contains per dose at least 3,0 log^{10} EID^{50} of live Avian Infectious Bronchitis Virus strain Ma5 in stabilizer.	Nobilis IB Ma5 is used against Infectious bronchitis virus infection in Broiler, Breeder and Layers.	One dose per bird through Drinking water, spray or Occulonasal route	1000 ds 2500 ds 5000 ds

MSD Animal Health

Cell Associated Vaccine

InnoVax™ ND-SB1

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each lyophilised ampoule per dose (1 ml) contains : Live Turkey Herpes virus strain HVT/NDV-F at least 1534 PFU/bird Marek's disease virus serotype 2 strain SB-1 at least 1514 PFU per bird dose	The vaccine is recommended for active immunization of chicken against Marek's Disease (MD) and Newcastle Disease (ND)	0.2 ml injection subcutaneously per chick in the neck	2000 ds 4000 ds

Inactivated Vaccine

Nobilis® MG inac

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated Mycoplasma gallisepticum strain MG 6/85 NLT 0.23 units	The vaccine is recommended for active immunization of chicken against infections caused by Mycoplasma gallisepticum.	0.5 ml S/C	500 ml (1000 ds)

Nobilis® E. coli inac

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each 0.5 ml dose contains : F11-antigen Suspension containing 100 µg F11-68.3 mg FT-antigen Suspension containing 100 µg FT-68.3 mg	The vaccine is recommended for passive immunization of broilers against colibacillosis by vaccination of broiler breeders	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® Salenvac T

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each ml contains, Formalin killed cells of Salmonella Enteritidis (phage type 4 strain 109) : 2 x 10^9 cells inducing $\geq$ 2 RP*, Formalin killed cells of Salmonella Typhimurium DT104 : 2 x 10^9 cells inducing $\geq$ 2 RP* (*relative potency)	The vaccine is recommended for active immunization of chickens against S. enteritidis and S. typhimurium and to give passive immunity against these agents in the progeny	0.1 ml for day-old chicks and 0.5 ml for older birds I/M	500 ml (1000 ds)

Nobilis® Newcavac

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each 0.5 ml dose contains: Inactivated ND virus (Clone 30) inducing $\geq$ 4 $\log_2$ HI Unit per 1/50th of a dose or $\geq$ 50 PD_{50} units/dose	The vaccine is recommended for booster vaccination of layers and breeding stock for protection against Newcastle Disease throughout the laying period	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® ND Broiler

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each 0.1 ml dose contains: Inactivated Newcastle Disease virus (Strain Clone 30) cantoning $\geq$ 20 PD_{50} units/dose or inducing $\geq$ 4 $\log_2$ HI Unit per 1/50 dose	The vaccine is recommended for the vaccination of Newcastle Disease in day-old chicks in areas where ND is endemic	0.1 ml S/C or I/M	200 ml (2000 ds)

Nobilis® Corvac

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each 0.5 ml dose contains: Inactivated Avibacterium paragallinarum Strain 083 (serotype A), at least 1 CPD_{70}*, Strain Spross (serotype B), at least 1 CPD_{70}, Strain H-18 (serotype C) at least 1 CPD_{70}. (*CPD_{70} : 70% chicken protective dose)	The vaccine is recommended for protection against Avibacterium paragallinarum infections in chicken	0.5 ml S/C	500 ml (1000 ds)

Nobilis® Coryza

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each 0.25 ml dose conrains : Inactivated Avibacterium paragallinarum Strain 083 (serotype A) at least 1 CPD_{70}, Strain Spross (serotype B) at least 1 CPD_{70}, Strain H-18 (serotype C) at least 1 CPD_{70}	The vaccine is recommended for protection against Avibacterium paragallinarum infections in chicken.	0.25 ml I/M or S/C	250 ml (1000 ds)

Nobilis® Reo inac

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated Reovirus strains 1733 and 2408, inducing $\geq$ 7.4 log_2 ELISA units/dose per 1/50th dose	The vaccine is recommended for booster vaccination of breeding stock against Avian Reovirus to protect their offspring against Avian Reovirus infections	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® G + ND

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated infectious Bursal Disease virus (Strain D78) inducing $\geq$ 14.5 log_2 VN units/dose, Inactivated Newcastle disease virus (Strain Clone 30) inducing $\geq$ 4 log_2 HI units per 1/50th of a dose or containing $\geq$ 50 PD_{50} Units/dose	The vaccine is recommended for booster vaccination of future breeders to protect against Newcastle Disease throughout the laying period, and to induce high maternal antibody levels against infectious Bursal Disease in their offspring.	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® IB + ND

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains: Inactivated Infectious Bronchitis virus (strain M41) inducing $\geq$ 6.0 log_2 HI units/dose, Inactivated Newcastle Disease Virus (Clone 30) inducing 4 log_2 HI units per 1/50th of dose or $\geq$ 50 PD_{50} units/dose	The vaccine is recommended for the booster vaccination of layers and breeding stock for protection against Newcastle Disease and the Massachusetts type of Infectious Bronchitis.	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® IB multi + ND

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated Infectious Bronchitis virus (Strain M41) inducing $\geq$ 4.0 log_2 VN units/dose, IB virus (Strain D249G) inducing $\geq$ 4.0 log_2 VN units/dose, Inactivated Newcastle Disease virus (Strain Clone 30) inducing $\geq$ 4.0 log_2 HI units per 1/50th dose or containing $\geq$ 50 PD_{50} units/dose	The vaccine is recommended for booster vaccination of layers and breeding stock for protection against the Massachusetts and D207/D274 (and related nephropathic) serotype of Infectious Bronchitis and Newcastle Disease.	0.5 ml S/C or I/M	500 ml (1000 ds)

MSD
Animal Health

Nobilis® IB + G + ND

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated Injections Bronchitis virus (strain M41) inducing $\geq$ 6.0 $\log_2$ HI units, Inactivated Injections Bursal Disease virus (Strain D78) inducing $\geq$ 14.5 $\log_2$ VN units, Inactivated Newcastle Disease Virus (Strain Clone 30) inducing $\geq$ 4 $\log_2$ HI units per 1/50th of a dose or Containing $\geq$ 50 PD_{50} units/dose	The vaccine is recommended for breeding stock: as a booster vaccination to protect against Newcastle Disease and the Massachusetts serotype of Infectious Bronchitis, and to induce high maternal antibody levels against Infectious Bursal Disease in their offspring	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® Reo + IB + G + ND

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated Injections Bronechitis virus (Strain M41) inducing > 6.0 $\log_2$ HI units Inactivated Injections Bursal Disease virus (strain D78) inducing > 14.5 $\log_2$ VN units Inactivated NDV (Strain Clone 30) > 4 $\log_2$ HI units per 1/50th of dose containing > 50 PD_{50} units/dose Inactivated Reo virus (Strain 1733 & 2308) inducing > 7.4 $\log_2$ ELISA.	For vaccine of Chicken against disease caused by Reo-virus, infectious Bronchitis virus of Massachusetts type Newcastle Disease virus & injections bursal disease virus.	0.5 ml S/C or I/M	500 ml (1000 ds)

Feed Supplement

Enradin®

CONTENTS PER KG	BENEFITS	INCLUSION RATE	PRESENTATION
Each 1 Kg of Enradin contains 80 gm of Enramycine HCL	Helps in ease the incidence of sub-clinical necrotic entritis in chicken	5-10 ppm (63-125 gm) per ton of feed	20 Kg Withdrawal period - 7 days Avoid use in laying hens

Amnovit®

CONTENTS PER KG	BENEFITS	INCLUSION RATE	PRESENTATION
Scientifically Balance formulation of vitamins and amino acids	Helps in relieving the stress conditions by supporting vitamins and minerals	Through water 1gm/lit for 5-7 days Through feed 500gm/ton for 5-7 days	1 Kg

CHIKVIT Liquid

COMPOSITION	BENEFITS	DOSE & ROUTE	PRESENTATION
Consists of Vitamin A, Vitamin B complex and Vitamin D along with Essential Trace minerals. It also contains sorbitol as an instant energy source	Helps in relieving the stress during transport	Regular Supplementation 0.5ml/lt for 3 to 7 days through drinking water In stress condition 1 ml/lt through drinking water	1 lt

Pharma Product

Floxidin™

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Enrofloxacin 10% oral solution	The product is recommended for treatment of the common infections caused by gram-positive, gram-negative, anaerobes and mycoplasma species	10 mg per kg BW for 3-5 days	5 Lt Withdrawal period - Meat - 8 days Eggs - Stop using 14 days before laying

VAC-SAFE®

CONTENTS	BENEFITS	INCLUSION RATE	PRESENTATION
An effervescent tablet that dilutes easily and neutralizes the chlorine in the water	Helps in improving the quality of drinking water during vaccination	1 tablet /100 Lt water	Box of 30 tablet

Disinfectant

FARMQUAT®

COMPOSITION	INDICATION	DOSE & ROUTE	PRESENTATION
Didecyl dimethyl ammonium chloride.....9.2% w/v Alkyl Dimethyl benzyl ammonium chloride.....9.2% w/v Alkyl Dimethyl Benzyl ammonium chloride.....4.6% w/v Bis-n-Tributyltin oxide.....1.0% w/v	• For Disinfection in presence of Bird. Effective against Bacteria, Virus and Fungus. • Effective under Hard water condition also. • EPA Registered Product	4 ml/lt - General disinfection 8 ml/lt - Foot bath disinfection	Pack of 1 L and 5 L.

FARMPHENE®

COMPOSITION	INDICATION	DOSE & ROUTE	PRESENTATION
Combination of Natural and Synthetic Phenol along with Cresylic acid	• Terminal Disinfection • Also works under presence of high Organic matter conditions • Spore killing action and excellent fumigating agent.	0.5% or 5 ml/L of water	Pack of 1 L and 5 L.

MSD Animal Health

A trusted source for comprehensive animal health solutions

Today's Merck is a global healthcare leader working to help the world be well. MSD Animal Health, known as Merck Animal Health in the United States and Canada, is the global animal Health business unit of Merck. MSD Animal Health offers veterinarians, farmers, pet owners and Governments the widest range of veterinary pharmaceuticals, vaccines, health management solutions and services. MSD Animal Health is dedicated to preserving and improving the health, well being and performance of animals. It invests extensively in dynamic and comprehensive R & D resources and a modern, global supply chain. MSD Animal Health is present in more than 50 countries, while its products are available in some 150 markets.

For more information,

visit www.msd-animal-health.co.in

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