# Vets Review

January 2017 / Vol II / Issue II

*Progressive Veterinary Doctors Association*

Dr. Bidhan Chandra Roy

# Vets Review

Official Publication of the Progressive Veterinary Doctors Association

January 2017 Vol II Issue II

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# Editorial Message

*Dear Doctor,*

*It gives me immense pleasure to wish you all our readers/ members and veterinary professionals, A Happy and Prosperous New Year 2017.*

*The livestock sector in India plays a major contributor to the agricultural economy of our country, not merely in terms of income but also in terms of livelihood and employment. It is usually said that livestock wealth is more equitably distributed than agricultural land. There is an upwards flow of demand for livestock products due to increase in population, growing per capita income and better living standards.*

*More livestock population means more wealth and more income to the nation and it is one of the major financial supports to the small and marginal farmers in India. "Vets Review" has been an instrumental of knowledge dissemination and sharing up to the field label. I think this is an opportunity for us to renew its usefulness and the value that it will try to provides our readers. I therefore encourage you to write to us with suggestions on how to make it better.*

*On this hopeful note, we were in our happy journey and let us try to convert it into a National Journal.*

*Editors.*

# WEST BENGAL UNIVERSITY OF ANIMAL AND FISHERY SCIENCES

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**Prof. Purnendu Biswas**, Ph.D.
Vice-Chancellor


No. : VCS/WBUAFS/ M-5/08
Date : 16.01.2017

## MESSAGE

It gives me immense pleasure to learn that the Progressive Veterinary Doctors' Association is going to organize its 2nd Biennial State Conference during 21-22nd January, 2017 at West Bengal Veterinary Council Hall, Belgachia, Kolkata.

I am also delighted to learn that a Scientific Seminar on "Application of stem cell on animal Health & production" has also been organized to commemorate the said conference.

Stem cell applications provide potential opportunities for therapy of a wide variety of acute and chronic conditions for which there are no efficient surgical or pharmacological treatments. The choice of the most suitable disease condition as a target for intervention is determined by many factors, including the availability of reproducible and predictable model systems providing measurable outcomes that can be applied to human trials. Owing to the large number of diseases for which stem cell therapies are applied in animal models, current progress in stem cell biology and the results of preclinical investigations of stem cell-based therapy provide new prospects for regenerative medicine. Application of the therapy on the Animal folk has been considered as a unique effort and effective implementation of the same will ensure good animal health and enhance livestock production thereby.

I highly appreciate the endeavour of the organizers to focus on such an important theme of Conference and wish that the scientists, veterinary surgeons and other participants will have enchanting and rich deliberations which will pave the way for development of some ideas and mechanisms for the application of stem cell on animal health and production.

I extend my best wishes for every success of the programme. I am happy to learn that a Technical Bulletin entitled "Vets Review" will be published on this occasion and I wish the publication to be worthy.

16.01.17.
(Purnendu Biswas)

**Dr. Subal Chandra Patra**
**General Secretary,**
**Progressive Veterinary Doctors' Association,**
**37, Belgachia Road, Kolkata – 700 037**

**B. P. Gopalika,** IAS

सत्यमेव जयते

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No. Secy/ARD/ 657/2017 Dated: Kolkata, the 10th January.2017

## Message

I am glad to learn that the Progressive Veterinary Doctors' Association has taken an initiative to publish the 2nd edition of Technical bulletin titled "Vets Review "on 21.01.2017 in a befitting manner.

I hope, this bulletin having good quality scientific publications, will be very helpful for all veterinarians in promoting their professional efficiency.

I convey my best wishes for every success of "Vets Review".

(B. P. Gopalika)

Dr. Subal Chandra Patra,
General Secretary
Progressive Veterinary Doctors' Assosn.

পশ্চিমবঙ্গ সরকার
প্রাণী সম্পদ ও প্রাণী স্বাস্থ্য অধিকার
দূরভাষ ঃ (০৩৩) ২৩৩৫-১১৪৫
মোবাইল ঃ ৯৩৩১২৭৫৫২২
ফ্যাক্স ঃ (০৩৩) ২৩৩৫-১১৮৭
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# MESSAGE

It is a matter of great pleasure to learn that the Progressive Veterinary Doctors' Association is going to publish the second edition of their technical bulletin, namely VETS REVIEW to commemorate their second biennial conference on 21.01.2017 at West Bengal Veterinary Council Hall, Belgachia.

I earnestly look forward to it being a good quality scientific publication & having a focus on field oriented problems which would enrich the professional knowledge and efficiency of the veterinarians & in turn, contribute to the development of the existing animal resources of our state.

I take this occasion to extend my best wishes for the success of the second edition of the VETS REVIEW, published by the Progressive Veterinary Doctors' Association.

10.1.17

[Dr. (Capt.) Anand Gopal Bandyopadhyay]
Director of Animal Husbandry &
Veterinary Services, West Bengal

To
The General Secretary
Progressive Veterinary Doctors Association

কার্য্যালয় ঃ প্রাণী সম্পদ ভবন, তৃতীয় তল, এল.বি.-২ ব্লক, সেক্টর-৩, লবণ হ্রদ, কলকাতা-৭০০ ০৯৮
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# WEST BENGAL UNIVERSITY OF ANIMAL AND FISHERY SCIENCES

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**Prof. Shyam Sundar Dana**
**Ph. D. (IVRI)**
**Registrar (Acting)**


## Message

It is my profuse privilege to convey the message for the **Souvenir and Technical Bulletin *(VETS REVIEW),*** which is being published by 'Progressive Veterinary Doctors' Association' for giving a comprehensive glimpse of the advanced and latest technical and clinical aspects of animal production and health. This publication, backed by latest reviews on clinical issues, would definitely be a handy resource to veterinary practitioners, doctors, interns and others field level stakeholders for ease of treating animals in light of latest medical innovations in Veterinary Sciences. My best wishes to all the members, whose tireless efforts have made this publication a relevant one.

06.01.2017

**S. S. Dana**
(Registrar)
*Registrar*
W. B. University of Animal & Fishery Sciences
**68, K. B. Sarani, Kolkata-700 037**

PROGRESSIVE VETERINARY DOCTORS' ASSOCIATION
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*(Estd. 2015 , Reg. No. S/2L/33080)*

# PREFACE

*Our State vis-a-vis our Country has large populations of various species of livestock and poultry and majority of which are suffering from different diseases and among these diarrhoeal diseases play an important role and impose a huge national loss by way of morbidity and mortality. The losses due to diarrhoeal diseases can be drastically reduced by adopting appropriate and timely measures for accurate diagnosis and treatment.*

*Under the changed global scenario the veterinarians have to be fully equipped, knowledgeable and skilled in latest disease situation and diagnostic methodologies. During recent past calf diarrhoea got manifested into the state due the several aetiological factors and global climatological changes.*

*The primary objective of our Technical Bulletin* ***"Vets Review"*** *is to upgrade the knowledge and skill of veterinarians towards efficient and effective diagnosis and treatment.*

*Considering this perspective, we are going to publish our second issue of Technical Bulletin* ***"Vets Review"*** *for providing information to policymakers, scientists, veterinarians, students and general public and which ultimately boost up the knowledge of veterinarians towards development of rural economy.*

*We feel and believe that our beloved veterinarians holding different responsible chairs including laboratories, dispensaries, administration, teaching, research and development and extension activities will be able to disseminate their knowledge properly.*

*All are cordially welcome for constructive criticism.*

*With thanks*

Subal Chandra Patra
**(Dr Subal Chandra Patra)**
**General Secretary**
**Progressive Veterinary Doctor's Association**

# ROLE OF ANIMAL BIOTECHNOLOGY IN ACHIEVING SUSTAINABLE DEVELOPMENT IN LIVESSTOCK SECTOR

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## ABSTRACT

Biotechnologies have played pivotal role in the development of livestock enterprise which in turn has significant contribution in achieving sustainable development goals. In recent years the "modern biotechnologies" of molecular biology and gene technologies have gained a momentous role in the animal health issues such as serological surveillance, detection of pathogens, recombinant vaccine productions. These technologies have principal application in development of simpler, cheap and dependable diagnostic kits. Molecular markers are increasingly being used to identify and select particular genes with desirable traits. In animal breeding aspect, marker assisted selection (MAS) can be considered to select superior germplasm. In addition, biotechnology should be considered one tool in a larger portfolio of technological options, to be applied in the area of assisted reproductive technologies. Artificial insemination, multiple ovulation and embryo transfer (MOET), in vitro embryo production, animal cloning, embryo and semen sexing, transgenic animal production are the major areas of reproductive technologies which aid in escalation of reproductive and productive efficiency of animals. Nonetheless, biotechnology options can be used judiciously in nutrition and feed utilization of livestock which promotes in augmenting productivity. Sustainable development goals are United Nation's 17 aspiritonal goals which has been defined as people's need in terms of no poverty, zero hunger, good health and education, gender equality and peace and justice. The review covers the role of biotechnology in the area of animal health, production and reproduction, animal nutrition towards achieving these goals, particularly in developing countries.

Key words: Biotechnology, livestock, sustainable development goals

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## INTRODUCTION

Biotechnology is the “technological application that uses biological systems, living organisms or derivatives thereof to make or modify products or processes for specific use.” Animal biotechnology has potential role in 'Livestock revolution' through improved animal production (Delgado et al., 1999). In developing countries, biotechnology developments in livestock sector such as livestock health, nutrition, breeding and reproduction are improving with a reasonable pace (Onteru et al., 2010).

Livestock contributes significant role in human development for the past 8,000 to 10,000 years when pigs, chicken, cattle, goats and sheep were first domesticated (Rothschild and Plastow, 2008). Livestock production is growing than any other sector and by 2020. Livestock is predicted as significant contributor in agriculture sector in terms of added value. Livestock production currently accounts for about 5.3% of gross value of total agriculture (ICAR, 2012). Animal biotechnology has immense scope to increase the animal productivity resulting in distinct shift in economic returns from livestock sector, particularly in developing countries.

Livestock contributes significant role in the growth of agriculture by augmenting income and employment and reducing the incident of rural poverty. Sustainable development goals are UN initiative seventeen aspirational global goals with 169 targets covering a broad range of development issues. The major initiatives include ending poverty and hunger, improving health and education, gender equality, climate change issues etc. (FAO, 2016). The growing demand of livestock products in developing countries, driven by population growth, higher income and urbanization, represents a huge opportunities for poor smallholder livestock farmers to meet market demand and rise out of poverty. As a consequence of increase demand of milk, meat and egg as essential source of animal proteins and deterioration of agricultural land, there is pressure to utilize the potential for biotechnology in livestock sector.

The biotechnology in livestock sector is used to manufacture value added products, explore new drugs, vaccines or to improve our farming techniques with increase production parameter. There are large numbers of technologies that have been developed for or adapted to the livestock of both developed and developing countries. In developing worlds, the major technologies adapted include conservation of genetic resources by genetic marker based selection of bulls,

augmenting reproduction by artificial insemination and related technologies, controlling and improving nutrient availability by manipulation of rumen microbes and diagnosis of disease. Assisted reproductive technology such as embryo transfer technology, in vitro fertilization, and animal cloning has been predicted to adapt in near future. Application of stem cell technology also provides a new dimension in animal health and production (Madan et al., 2005). Genetic engineered poultry, swine, goats, cattle and other livestock also are beginning to be used as generators of pharmaceuticals and other products. With gradual progress of biotechnology, livestock are predicted to use as potential source of replacement organs for humans and models for human diseases. The technology is used to produce foreign proteins in milk by expressing novel genes in the mammary glands of livestock. Additionally, biotechnological options are exploited through better feeds and more efficient livestock production practices to reduce green house gases emitted from livestock. The present review explores what role biotechnology may play to sustainable livestock and rural development. It focuses on different biotechnology developments of livestock sector including the areas of livestock health, nutrition, breeding and reproduction in developing countries towards attainment of SDGs.

## Livestock and SDGs

The position of livestock is at the interface of world's human and natural system. Since the dawn of the agriculture, humans have been shaping their environment. Humans have utilized the natural and environmental resources such as land, water, biodiversity, forests, fish and nutrients and transform them into agricultural products food, feed, fiber and fuel. Likewise animals are also biological converter that use the natural resources and transform them into in to high valued proteins in terms of milk, meat and egg. These agricultural and animal products provide economic and social services like food security, growth and poverty reduction, health and cultural value. Thus approaches to sustainability must address the interaction and trade-offs between human and natural systems as a result of farm production. The sustainable development goals come at a time when the world is sinking in a myriad of 21-st century problems such as environmental degradation, extreme poverty, famine, disease, etc. Therefore, 17 goals of SDGs has been defined and categorized as people's needs and aspirations in terms of no poverty, zero hunger, good health and education, gender equality, reduced overall inequality, and peace and justice (Figure 1).


Figure1: Interaction between Livestock and 17 goals of SDGs (Courtesy: FAO-AGAL, 2016)

## Implication of Animal Biotechnology in Developing Countries

Livestock shares one third to the global agriculture in developing countries. Because of population growth, urbanization, change in dietary habits and increasing the disposable income, the demand for livestock product in developing countries is increasing day by day. In Indian scenario, the annual growth rate of milk production, egg production and chicken production are 3.7%, 5.9% and 11.8% respectively, in the last ten years. In developing countries, the annual per capita meat consumption doubled between 1980 and 2002 and this trend is likely to continue in foreseeable future. As per Food and Agriculture Organization (FAO) estimation, global meat and milk production must doubled by 2050 to ensure the food security by rising population. Thus, the fast growing demands for livestock products open huge opportunity as well as challenges to the livestock producers in developing countries. "Livestock revolution" (Delgado et al., 1999) through implication of biotechnology in livestock sector is one of the major avenues to meet these needs in developing countries. Increased livestock productivity through the use of technology leads to make significant difference in other areas such as nutrition, prevention of diseases, healthcare and other management practices. However the major technologies that show promise and currently being applied in livestock sector of developing countries include conservation of genetic resources, augmenting reproduction using assisted reproductive technologies, technologies related to animal health issues as well as controlling and improving nutrient availability.

## Biotechnology in livestock health

Animal should have sound health for sustainable production. Different diseases of livestock lead to animal sufferings, reduced performances and even death of the animals. Nonetheless, the infected or diseased animals are potential source of transmitting diseases to other animals and in certain cases to humans (zoonotic diseases). In developing countries, improper management and less sophisticated livestock production system expose livestock to a variety of pathogens resulting in occurrence of number of animal diseases. Thus, improving conventional means of control livestock diseases becomes the everlasting challenge in the developing world. The major areas of Biotechnology approaches in animal health include transgenesis, disease prevention, diagnosis, treatment and control. Molecular diagnostic techniques such as RTPCR, real time PCR, ELISA are the advancement of conventional techniques that enable the agents causing disease to be identified more precisely than previous methods.

Recently, molecular epidemiology has been emerged as new technique to identify the origin of pathogens by using sequence analysis. This has importance in controlling epidemic diseases by pinpointing the source of the infection Molecular characterization of infectious pathogens is used for vaccination and disease control programme. In diagnosis of hereditary weakness, DNA testing can be used to identify carrier animals and subsequently can be eliminated from breeding herds. For example, pigs with porcine stress syndrome gene produce pale poor-quality meat. DNA testing technique helps to identify the carrier pigs that can be excluded from the breeding programmes.

Vaccination is one of the most effective and sustainable means of animal diseases control. Recombinant DNA technology has been used for production of several novel vaccines (Soetan and Abatan, 2008) (Figure 2). The genetically engineered vaccines are formed against coccidiosis, New Castle virus, Bovine Papillomma virus, Brucellosis, Rinderpest, Swine parvo virus, Equine influenza etc.

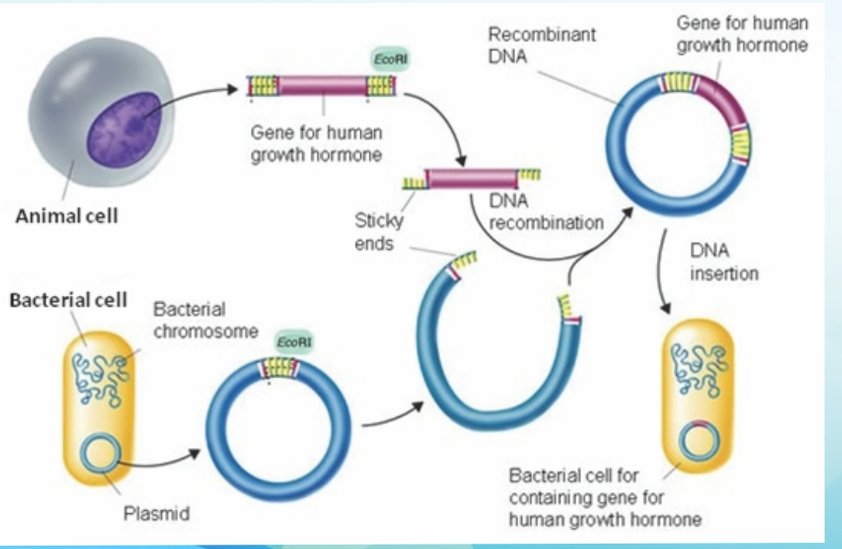


Figure 2: Pictorial presentation of recombinant DNA technology

Subunit vaccines have been used now-a days where protein subunits of pathogens with immunogenic property are being exploited for development of vaccines. This approach is used to develop a vaccine against Theileria parva, the parasite that causes East Coast fever in African cattle.

Recently, DNA vaccines are developed based on delivery of gene in the form of plasmid DNA that can stimulate the immune response to the respective gene products (Figure 3). DNA vaccines are safe as these vaccines contain only genetic code of pathogens, not the whole organism. The DNA vaccines are thermo stable reducing the need for maintaining cold chain.

Biotechnology in animal breeding

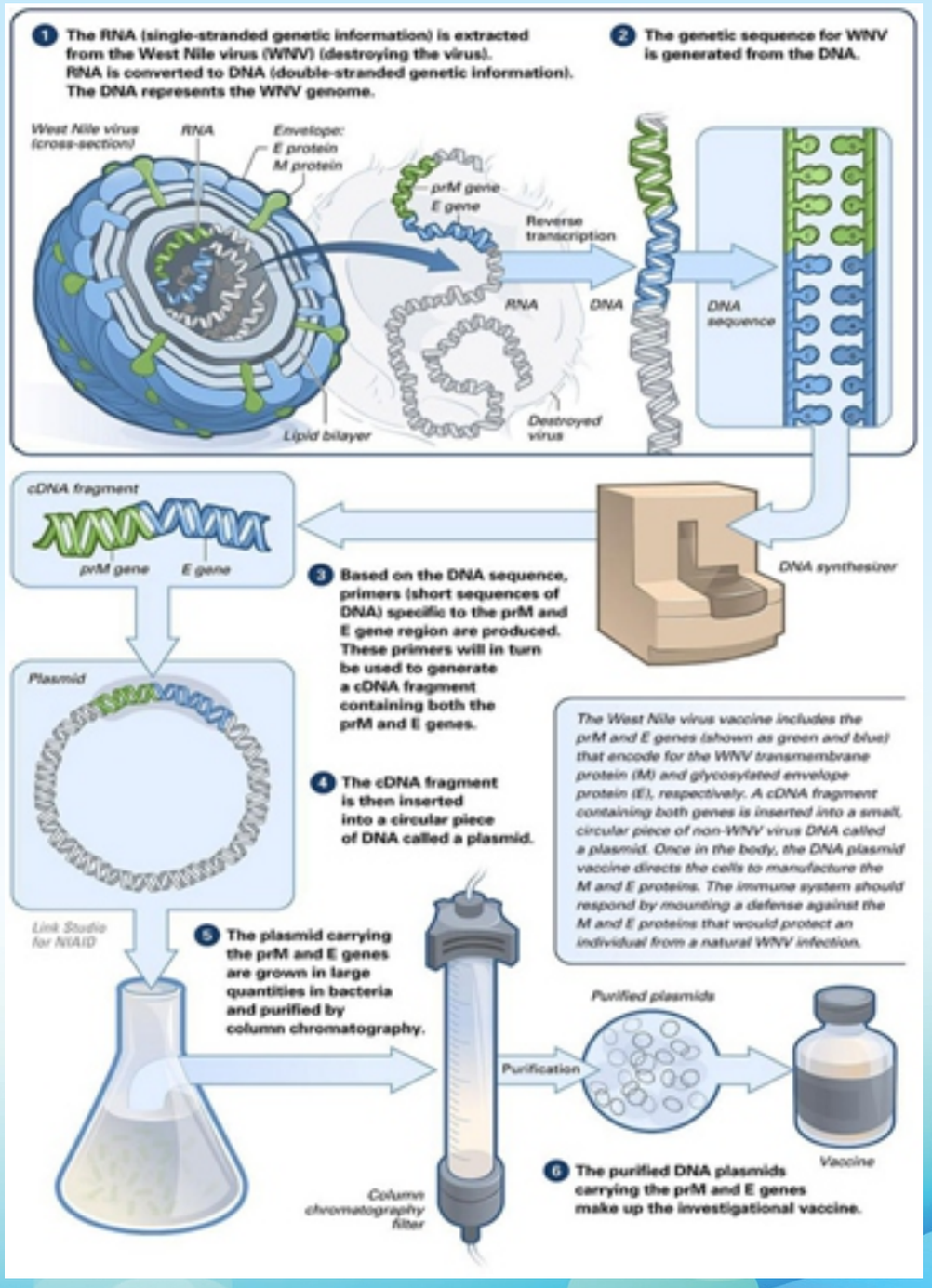


Figure3: Pictorial presentation of DNA vaccine production

Since the time of animal domestication, livestock genetic improvement with preservation of superior genetics is the key note in animal breeding practice. Selection of elite animals followed by crossbreeding is the strategic tool for livestock breeding in both the developed and developing countries. Artificial insemination using superior sires is one of the most effective tools for implementing crossbreeding programs to meet the requirements milk consumption. The local deshi breeds with special adaptive traits for disease resistance can be upgraded by breeding with high yielding milch breeds. Further, crossbreds for improved milk yield developed between upgraded breeds and exotic breeds are better adaptive to disease and environmental conditions in developing countries. Therefore, sustainable livestock development depends on judicious implementation of breeding strategy.

The advancements in molecular genetics and the sequencing technology extend the opportunities to use the marker assisted selection (MAS) methods over traditional phenotype selection methods. Different livestock genome projects have been employed by developed countries to explore the genetic maps of individual species. To promote genomics research in developing countries, recently the Bovine Hap Map analysis included two African and some Bos indicus breeds. Several genetic markers such as causative mutations (e.g., MC4R for feed intake and growth rate), linkage disequilibrium (LD) markers (e.g., ESR for litter size) and linkage equilibrium (LE) markers (e.g., polled) are in commercial use in developed countries. It was stated that there were no MAS programs delivered to farmers in developing countries; they are still in the evaluation stage at research institutes. The implementation of MAS is difficult in developing countries due to lack of proper infrastructure, recording and management of livestock production systems and equipped laboratories to carry out the genetic testing.

## Biotechnology in Animal Reproduction

Reproductive biotechnology facilitates to improve the reproductive performances of livestock by modifying reproductive processes in number of ways. The prime objectives of assisted reproductive technologies are genetic improvement with increased production and reproductive efficiency. Artificial insemination and preservation of semen are the main technologies used under field condition. Additionally, sperm function tests to determine fertilization potential of semen, sperm sexing, oestrous synchronization, multiple ovulation and embryo transfer technology, in vitro embryo production, animal cloning are important techniques that can improve reproductive efficiency and pregnancy rate. These technologies can be used to control the transmission of venereal diseases.

## Artificial Insemination:

AI is the one of the earliest technologies where new breeds are produced through introduction of male sperm from one superior male to the female reproductive tract without mating. AI reduces transmission of venereal disease, lessens the need of farms to maintain breeding males, facilitates more accurate recording of pedigrees, and minimizes the cost of introducing improved genetics.

The conception rate in field AI programmes in developing countries is very low, and therefore the desired effect in terms of animal improvement has not been achieved. Most semen banks still evaluate semen on the basis of sperm motility, even though significant advances have been made in techniques for semen evaluation. In developing country like India the AI programme has been fully implemented in most of the states. The high intensity and accuracy of selection arising from AI can lead to a four-fold increase in the rate of genetic improvement in dairy cattle relative to that from natural mating (Van Vleck 1981).

## Embryo transfer

One of the major reproductive technologies that can facilitate genetic improvement in cattle is embryo transfer (ET). Unlike artificial insemination, in embryo transfer superior genetics of female is utilized to increase the reproductive and productive performance of females of agriculturally important species such as cattle, horse, sheep and goat. Embryos are collected from donor female with superior genetic merit and transferred to recipient females which serve as surrogate mother. Non-surgical embryo recovery and transfer procedure allowed exploitation of cattle recovery in farm (Figure 4).

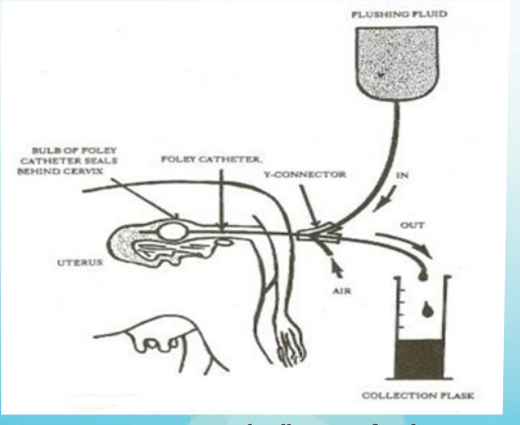


Figure 4: Non-surgical collection of embryos

The main potential advantage of MOET for developing countries is that the elite females of local breeds can be identified, and bulls can be produced from them for use in a field programme of breed improvement.

Zebu cattle and buffaloes in developing countries exhibit less consistent follicular dynamics after superovulation than Bos taurus in the developed world. The use of ET has been less successful than envisaged for several reasons. The low reproductive efficiency, poor superovulatory responses, very low primordial follicle population and high incidence of atresia all contribute to low embryo production. In buffaloes, embryo recovery was initially less than one, but has subsequently improved to 2.6 with 1.4 transferable embryos per flush.

## In Vitro Embryo Production (IVEP)

Commercial production of superior quality embryo by using in vitro fertilization technology facilitates to produce superior genetic merit animals, serving as a source of embryos for embryo sexing, cloning, nuclear transfer, transgeneis, stem cell research etc. Moreover, it also allows analyzing developmental potential of embryos, gene expression pattern and epigenetics.

The efficiency of in vitro embryo production is still low with 30-40% blastocyst development after in vitro maturation, in vitro fertilization and embryo culture (Figure 5). However the rate of progress in in vitro embryo production has been intensified by using defined and semi defined media for different species. Recovery of oocytes has been eased by development of low invasive ultrasound guided transvaginal oocytes retrieval (TVOR) or ovum pick up technology. This ovum pick up technology assists for repeated collection of oocytes from livestock of high economic importance and endangered species which helps in propagation of such genetics in much faster way. However, the practical implication of IVEP is limited by high production cost and low efficiency under field condition (Verma et al., 2012).

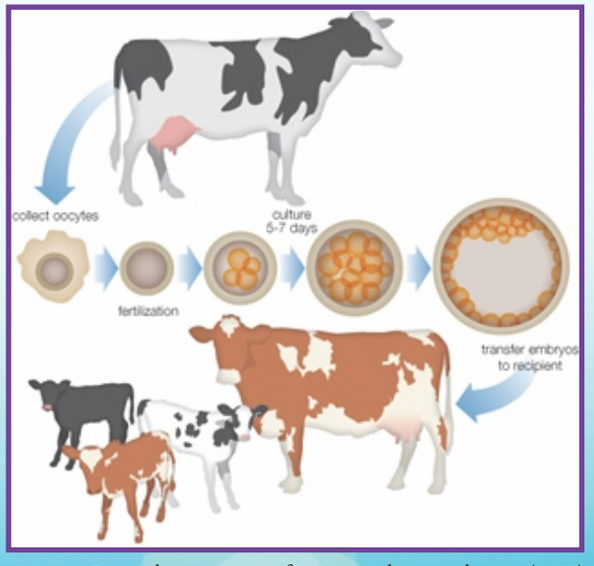


Figure 5: Pictorial presentation of In vitro embryo production (IVEP)

## Animal Cloning

Animal cloning is another important technology which is used for multiplication of elite animals as well as conservation and propagation of endangered species. First cloned animal by somatic cell nuclear transfer (SCNT) was a sheep, "Dolly". Later on SCNT technique is successfully used for cloning cattle, pig, goat and horse. Through introducing a simpler 'hand guided cloning technique' world's first buffalo calf 'Garima' was born at NDRI, Karnal, India. Farm animal cloning has also been used for to produce stem cells, modify the genetic make up of domestic animals for production of human pharmaceuticals as well as human organs (regenerative medicines) (Verma et al., 2012) (Figure 6).

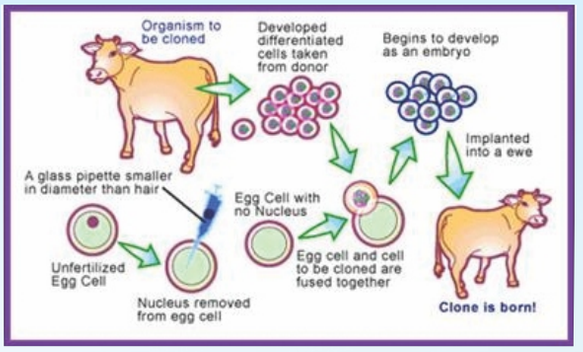


Figure 6: Pictorial presentation of animal cloning

## Transgenic animals

A transgenic animal is an animal whose hereditary DNA has been augmented by addition of DNA from a source other than parental germplasm through recombinant DNA techniques. Transfer of genes or gene constructs allows for the manipulation of individual genes rather than entire genomes (Figure 7). There have been dramatic advances in gene transfer technology in the last two decades since the first successful transfer was carried out in mice in 1980. To date there are three basic methods of producing transgenic animals which includes a) DNA microinjection, b) Retro-virus mediated gene transfer and c) embryonic stem cell mediated gene transfer. The technique has now become routine in the mouse and resulting transgenic mice are able to transmit their transgenes to their offspring thereby allowing a large

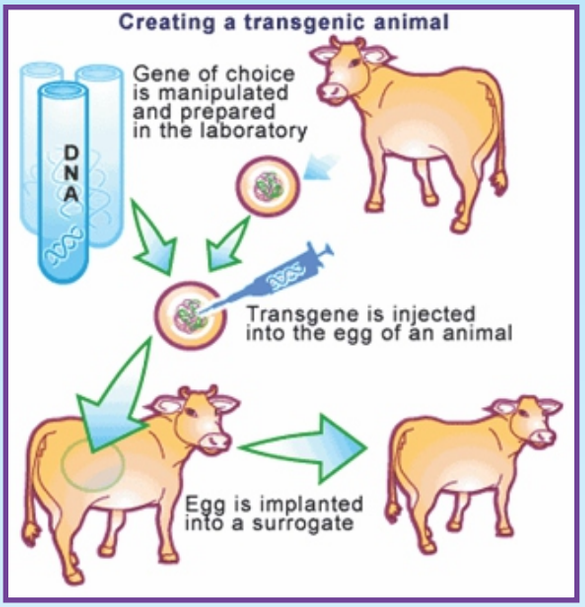


Figure 7: Pictorial presentation transgenic animal production

number of transgenic animals to be produced. The majority of gene transfer studies in livestock have, however, been carried out in the pig. Although transgenic cattle and sheep have been successfully produced, the procedure is still inefficient in these species (Verma et al., 2012)

## Semen and Embryo Sexing

Predetermination of sex of embryos can increase the production efficiency. The sextual differentiation of embryo is determined by some commercially employed techniques including

a) chromosomal analysis of demi embryos, b) immunological detection of embryonic H-Y antigen, c) use of Y-specific probes, d) Fluorescence in situ hybridization, e) rapid sexing method for pre-implantation embryos of bovine using Loop-Mediated Isothermal Amplification (LAMP) reaction. The bovine

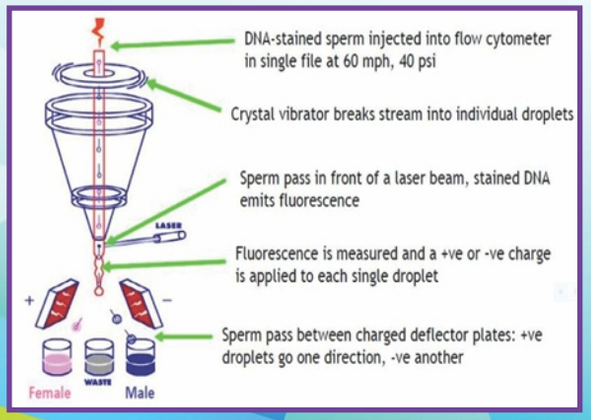


Figure 8: Pictorial presentation semen and embryo sexing

Y chromosome specific primer could be used to determine sex of Indian zebu and taurus cattle embryos. In recent advances of semen sexing, fluorescence activated cell sorter (FACS) has been successfully used to produce sexed sperm in different mammalian species such as cattle, goat, pig and sheep (Figure 8). Sexed sperm is commercially available in several developed countries. However, in developing countries these technologies are developed and refined in number of research institution (Verma et al., 2012).

## Nutrition and Feed Utilization

The shortage of feed in most developing countries and the increasing cost of feed ingredients lead to improve feed utilization methods. Aids to animal nutrition, such as enzymes, probiotics, single-cell proteins and antibiotics in feed, are already widely used in intensive production systems worldwide to improve the nutrient availability of feeds and the productivity of livestock.

Gene-based technologies are being increasingly used to improve animal nutrition, either through modifying the feeds to make them more digestible or through modifying the digestive and metabolic systems of the animals to enable them to make better use of the available feeds. Feeds derived from GM plants (a quarter of which are now grown in developing countries), such as grain, silage and hay, have contributed to increases in growth rates and milk yield. Genetically modified crops with improved amino acid profiles can be used to decrease nitrogen excretion in pigs and poultry. Increasing the levels of amino acids in grain means that the essential amino acid requirements of pigs and poultry can be met by diets that are lower in protein.

Metabolic modifiers have also been used to increase production efficiency (weight gain or milk yield per feed unit), improve carcass composition (meat-fat ratio), increase milk yield and decrease animal fat. The use of recombinant bovine somatotropin (rBST) in dairy cows increases both milk yield and production efficiency and decreases animal fat. Although trials conducted in developing countries have reported a similar percentage increase, this increase is not significant because of the low milk yields and the high cost-benefit ratio.

Furthermore, the potential production capacity and contribution of livestock to the economy are still not being achieved in developing countries because the transfer, adaptation and adoption of technology is hampered by the lack of a clear policy for livestock development that is conducive to the introduction of new proven technology and by the lack of information flow from and to decision makers

## Constraints on Applying the Biotechnology

The application of new molecular biotechnologies and new breeding strategies to the livestock breeds used in smallholder production systems in developing countries is constrained by a number of factors. In the developing world, poverty, malnutrition, disease, poor hygiene and unemployment are widespread, and biotechnologies must be able to be applied in this context. Over the last few decades, the green revolution has brought comparative prosperity to farmers with land, but the majorities of farmers, who are landless or marginal farmers and subsist only on livestock, have been neglected and remain poor. The major constraints on applying biotechnologies have been enumerated by Madan M.L. (2005). These include the absence of an accurate and complete database on livestock and animal owners, the biodiversity present within species and breeds in agro-ecological systems, the fact that models of biotechnological intervention differ distinctly between developed and developing economies , the fact that many animal species and breeds are unique to the developing world; each has its own distinct developmental, production, disease resistance and nutrient utilization characteristics , the lack of trained scientists, technicians and fieldworkers, the absence of an interface between industry, universities and institutions, the inability to access technologies from the developed world at an affordable price in order to make a rightful, positive and sustainable contribution to livestock production and the economic welfare of farmers , the high cost of technological inputs such as materials, biologicals and equipment, the failure to address issues of biosafety and to conduct risk analyses of new biologicals, gene products, transgenics and modified food items, and, the negligible investment in animal biotechnology.

## Conclusions

Although animal production is being changed significantly by advances made in thousands of biotechnology laboratories around the world, benefits are reaching the developing world in only a few areas of conservation, animal improvement, healthcare (including diagnosis and control of disease) and the augmentation of feed resources. Adopting biotechnology has resulted in distinct benefits in terms of animal improvement and economic returns to the farmers. Over the past decade, the ILRI has focused on biotechnological applications, especially in developing countries now have multi-institutional programmes to develop and apply biotechnology. Based on such comprehensive perspective on animal biotechnology, the key to addressing livestock sector development within an SDG framework lies in developing integrated tools and actions that address the specific priorities and development needs of countries and locations.

### *References:*


- Delgado C., Ros egrant M., Steinfeld H., Ehui S., Courbois C. (1999) "Livestock to 2020 -The Next Food Revolution". Food, Agriculture and the Environment Discussion Paper 28. IFPRI/FAO/ILRI.
- FAO (2016). Synthesis – Livestock and the Sustainable Development Goals, Panama.
- ICAR (2012). Livestock technologies way to diversified agriculture, Pusa, New Delhi.
- Madan ML. (2005) Animal biotechnology: applications and economic implications in developing countries. Rev Sci Tech Off Int Epitz 24(1): 127-139.
- Onteru SK, Ampaire A, Rothschild MF (2010) Biotechnology developments in the livestock sector in developing countries. Biotechnology and Genetic Engineering Reviews 27: 217-228.
- Rothschild, MF, Plastow, GS. (2008) Impact of genomics on animal agriculture and opportunities for animal health. Trends in Biotechnology 21-25.
- Soetan KO, Abatan MO (2008). Biotechnology: A key tool to Breakthrough in Medical and Veterinary Research- A Review. Biotechnol. Mol. Biol. Rev., 3(4): 088-094. Available online at http://www.academicjournals.org/BMBR.
- Van Vleck LD (1981) Potential genetic impact of artificial insemination, sex selection, embryo transfer, cloning and selfing in dairy cattle. In: Brackett B.G., Seidel Jr G.E. and Seidel S.M. (eds), New Technologies in Animal Breeding. Academic Press, New York, USA. pp. 221-242.
- Verma OP, Kumar R, Kumar A and Chand S (2012) Assisted Reproductive Techniques in Farm Animal – From Artificial Insemination to Nanobiotechnology, Vet. World. 5(5):301-310

# KETOSIS IN CATTLE - a REVIEW

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## Introduction:

Ketosis is a common disease of adult cattle. It typically occurs in dairy cows in early lactation and is most consistently characterized by ketonaemia, ketonuria and hypoglycemia. Rarely, it occurs in cattle in late gestation, at which time it resembles pregnancy toxemia of ewes. In addition to in-appetence, sweet smell of acetone in the breath, signs of nervous dysfunction, including pica, abnormal licking, wandering-staggering-in-coordination and abnormal gait, bellowing, and aggression are occasionally seen. The condition is worldwide in distribution but is most common where dairy cows are bred and managed for high production.

Etiology and Pathogenesis:

The pathogenesis of bovine ketosis is incompletely understood, but it requires the combination of intense adipose mobilization and a high glucose demand. Both of these conditions are present in early lactation, at which time negative energy balance leads to adipose mobilization, and milk synthesis creates a high glucose demand. Adipose mobilization is accompanied by high blood serum concentrations of nonesterified fatty acids (NEFAs). During periods of intense gluconeogenesis, a large portion of serum NEFAs is directed to ketone body synthesis in the liver. Thus, the clinicopathologic characterization of ketosis includes high serum concentrations of NEFAs and ketone bodies and low concentrations of glucose. In contrast to many other species, cattle with hyperketonemia do not have concurrent acidemia. The serum ketone bodies are acetone, acetoacetate, and □-hydroxybutyrate (BHB).(fig 1 ).

There is speculation that the pathogenesis of ketosis cases occurring in the immediate postpartum period is slightly different than that of cases occurring closer to the time of peak milk production. Ketosis in the immediate postpartum period is sometimes described as type II ketosis. Such cases of ketosis in very early lactation are usually associated with fatty liver. Both fatty liver and ketosis are probably part of a spectrum of conditions associated with intense fat mobilization in cattle. Ketosis cases occurring closer to peak milk production, which usually occurs at 4–6 wk postpartum, may be more closely associated with underfed cattle experiencing a metabolic shortage of gluconeogenic precursors than with excessive fat mobilization. Ketosis at this time is sometimes described as type I ketosis. (fig.2).

The exact pathogenesis of the clinical signs is not known. They do not appear to be associated directly with serum concentrations of either glucose or ketone bodies. There is speculation they may be due to metabolites of the ketone bodies.

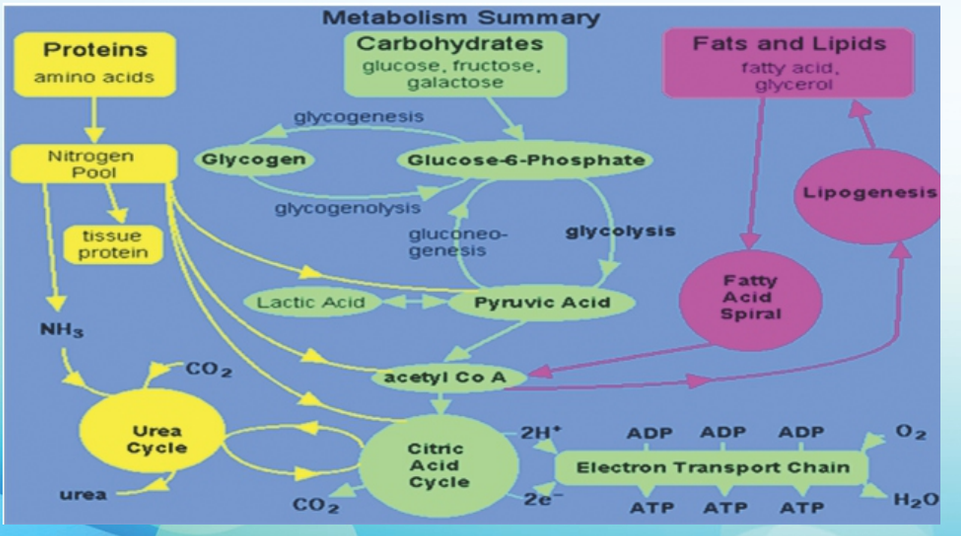



Fig 1: Metabolism Summary

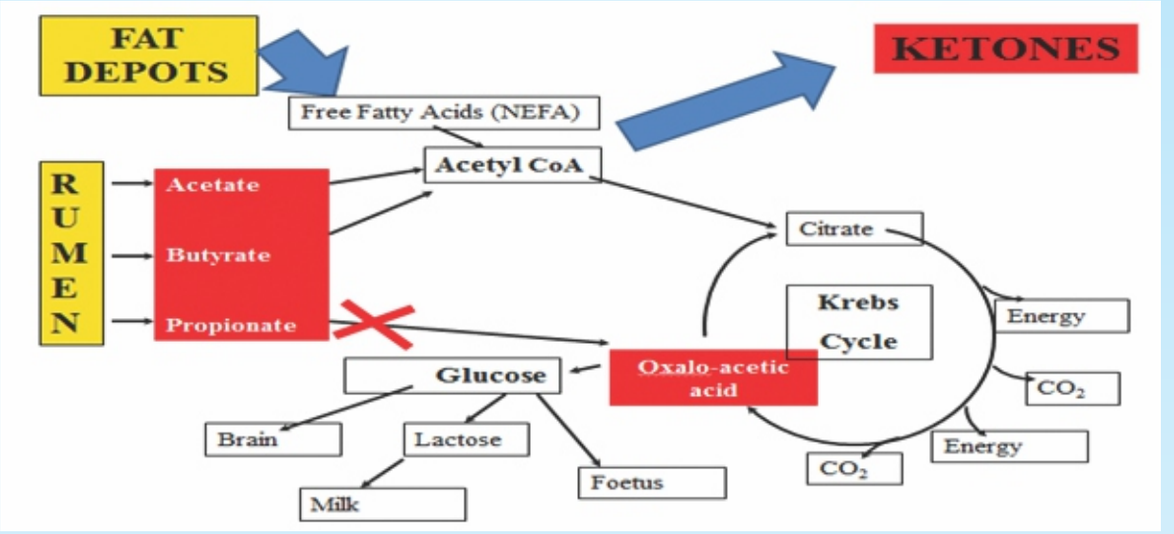
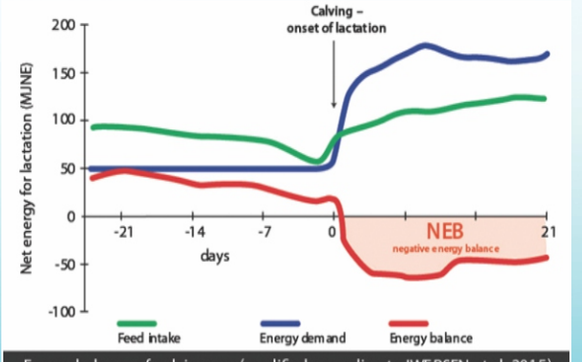



Fig 2: Ketosis Cycle

Epidemiology: All dairy cows in early lactation (first 6 wk) are at risk of ketosis. The overall prevalence in cattle in the first 60 days of lactation is estimated at 7%–14%, but prevalence in individual herds varies substantially and may exceed 14%. The peak prevalence of ketosis occurs in the first 2 wk of lactation. Lactational incidence rates vary dramatically between herds and may approach 100%. Ketosis is seen in all parities (although it appears to be less common in primiparous animals) and does not appear to have a genetic predisposition, other than being associated with dairy breeds. Cows with excessive adipose stores (body condition score ≥3.75 out of 5) at calving are at a greater risk of ketosis than those with lower body condition scores. Lactating cows with subclinical ketosis are also at a greater risk of developing clinical ketosis and displaced abomasum than cows with lower serum BHB concentrations.




Energy balance of a dairy cow (modified according to IWERSEN et al, 2015)

## Clinical Findings:

In cows maintained in confinement stalls, reduced feed intake is usually the first sign of ketosis. If rations are offered in components, cows with ketosis often refuse grain before forage. In group-fed herds, reduced milk production, lethargy, and an "empty" appearing abdomen are usually the signs of ketosis noticed first. On physical examination, cows are afebrile and may be slightly dehydrated. Rumen motility is variable, being hyperactive in some cases and hypoactive in others. In many cases, there are no other physical abnormalities. CNS disturbances are noted in a minority of cases. These include abnormal licking and chewing, with cows sometimes chewing incessantly on pipes and other objects in their surroundings. Incoordination and gait abnormalities occasionally are seen, as are aggression and bellowing. These signs occur in a clear minority of cases, but because the disease is so common, finding animals with these signs is not unusual.

## Diagnosis:

The clinical diagnosis of ketosis is based on presence of risk factors (early lactation), clinical signs, and ketone bodies in urine or milk & sweet smell of acetone in breath. Biochemical test like Rotheras test could be done at laboratory. When a diagnosis of ketosis is made, a thorough physical examination should be performed, because ketosis frequently occurs concurrently with other peripartum diseases. Especially common concurrent diseases include displaced abomasum, retained fetal membranes, and metritis. Rabies and other CNS diseases are important differential diagnoses in cases exhibiting neurologic signs. (Table 1).

Cow-side tests for the presence of ketone bodies in urine or milk are critical for diagnosis. Most commercially available test kits are based on the presence of acetoacetate or acetone in milk or urine. Dipstick tests are convenient, but those designed to detect acetoacetate or acetone in urine are not suitable for milk testing. All of these tests are read by observation for a particular color change. Care should be taken to allow the appropriate time for color development as specified by the test manufacturer. Handheld instruments designed to monitor ketone bodies in the blood of human diabetic patients are available. These instruments quantitatively measure the concentration of BHB in blood, urine, or milk and may be used for the clinical diagnosis of ketosis.

In a given animal, urine ketone body concentrations are always higher than milk ketone body concentrations. Traces to mildly positive results for the presence of ketone bodies in urine do not signify clinical ketosis. Without clinical signs, such as partial anorexia, these results indicate subclinical ketosis. Milk tests for acetone and acetoacetate are more specific than urine tests. Positive milk tests for acetoacetate and/or acetone usually indicate clinical ketosis. BHB concentrations in milk may be measured by a dipstick method that is available in some countries, or by the electronic device mentioned above. The BHB concentration in milk is always higher than the acetoacetate or acetone concentration, making the tests based on BHB more sensitive than those based on acetoacetate or acetone..

Treatment

Treatment of ketosis is aimed at reestablishing normoglycemia and reducing serum ketone body concentrations. Intravenous administration of 500 mL of 50% dextrose solution is a common therapy. This solution is very hyperosmotic and, if administered perivascularly, results in severe tissue swelling and irritation, so care should be taken to ensure that it is given IV. Glucose therapy generally results in rapid recovery, especially in cases occurring near peak lactation (type I ketosis). However, the effect frequently is transient, and relapses are common. Administration of glucocorticoids, including dexamethasone or isoflupredone acetate at 5–20 mg/dose, IM, may result in a more sustained response, relative to glucose alone. Glucose and glucocorticoid therapy may be repeated daily as necessary. Propylene glycol administered orally (250–400 g/dose, [8–14 oz]) once per day acts as a glucose precursor and is effective as ketosis therapy. Indeed, propylene glycol appears to be the most well documented of the various therapies for ketosis. Overdosing propylene glycol leads to CNS depression.

Ketosis cases occurring within the first 1–2 wk after calving (type II ketosis) frequently are more refractory to therapy than cases occurring nearer to peak lactation (type I). In these cases, a long-acting insulin preparation given IM at 150–200 IU/day may be beneficial. Insulin suppresses both adipose mobilization and ketogenesis but should be given in combination with glucose or a glucocorticoid to prevent hypoglycemia. Use of insulin in this manner is an extra-label, unapproved use. Other therapies that may be of benefit in refractory ketosis cases are continuous IV glucose infusion and tube feeding.

Prevention of ketosis is via nutritional management. Body condition should be managed in late lactation, when cows frequently become too fat. Modifying diets of late lactation cows to increase the energy supply from digestible fiber and reduce the energy supply from starch may aid in partitioning dietary energy toward milk and away from body fattening. The dry period is generally too late to reduce body condition score. Reducing body condition in the dry period, particularly in the late dry period, may even be counterproductive, resulting in excessive adipose mobilization prepartum. A critical area in ketosis prevention is maintaining and promoting feed intake. Cows tend to reduce feed consumption in the last 3 wk of gestation. Nutritional management should be aimed at minimizing this reduction. Controversy exists regarding the optimal dietary characteristics during this period. It is likely that optimal energy and fiber concentrations in rations for cows in the last 3 wk of gestation vary from farm to farm. Feed intake should be monitored and rations adjusted to meet but not greatly exceed energy requirements throughout the entire dry period. For Holstein cows of typical adult body size, the average daily energy requirement throughout the dry period is between 12 and 15 Mcal expressed as net energy for lactation (NEL). After calving, diets should promote rapid and sustained increases in feed and energy consumption. Early lactation rations should be relatively high in non-fiber carbohydrate concentration but contain enough fiber to maintain rumen health and feed intake. Neutral-detergent fiber concentrations should usually be in the range of 28%–30%, with non-fiber carbohydrate concentrations in the range of 38%–41%. Dietary particle size will influence the optimal proportions of carbohydrate fractions. Some feed additives, including niacin, calcium propionate, sodium propionate, propylene glycol, and rumen-protected choline, may help prevent and manage ketosis. To be effective, these supplements should be fed in the last 2–3 wk of gestation, as well as during the period of ketosis susceptibility. In some countries, monensin sodium is

approved for use in preventing subclinical ketosis and its associated diseases. Where approved, it is recommended at the rate of 200–300 mg/head/day.

Subclinical Ketosis:Subclinical ketosis is defined as high serum ketone body concentrations without observed clinical signs. Subclinically affected cows are at increased risk of clinical ketosis and displaced abomasum and are also less fertile than those with normal serum ketone body concentrations. Furthermore, they appear to have reduced milk production. Determination of serum ?-hydroxybutyrate (BHB) concentrations is considered the best way to detect and monitor subclinical ketosis, because the cow-side tests mentioned above are insufficiently sensitive and specific in detecting subclinical increases in serum BHB concentrations. Serum concentrations may be determined spectrophotometrically by traditional clinical laboratory means. The BHB concentrations in blood or serum samples are reasonably stable; thus, rigorous sample handling precautions are not necessary to transport the specimens to the laboratory. The test is sensitive to hemolysis, however, so hemolysis should be avoided during sample collection, and serum should be separated from the clot before shipment to the laboratory.(fig 3).

In addition to laboratory determination by spectrophotometry, handheld devices manufactured to monitor blood ketone body concentrations in human diabetic patients have been evaluated for use in monitoring subclinical ketosis in cows. These instruments use whole blood rather than serum for BHB determination, making them particularly practical for on-farm use. The whole blood BHB concentration is very close to the serum concentration, so the interpretation of results obtained from either the handheld device or laboratory analysis is similar.

Diagnosis of subclinical ketosis requires definition of a concentration above which cows are considered to be subclinically ketotic. Concentrations between 1,000 µM (10.4 mg/dL) and 1,400 µM (14.6 mg/dL) are used. Recommended strategies for herd-level testing are to test at least 12 animals in the first 60 days of lactation. If >10% are subclinically ketotic, it should be considered evidence of a herd-level problem and prompt a review of nutritional management. Some farms use the handheld BHB meters to test all cows in early lactation. Cows diagnosed with subclinical ketosis are treated with propylene glycol. Such an approach is labor intensive but has been demonstrated to reduce further disease occurrence in subclinically ketotic animals and to improve milk production in treated animals. Such an approach should not replace sound nutritional management procedures.

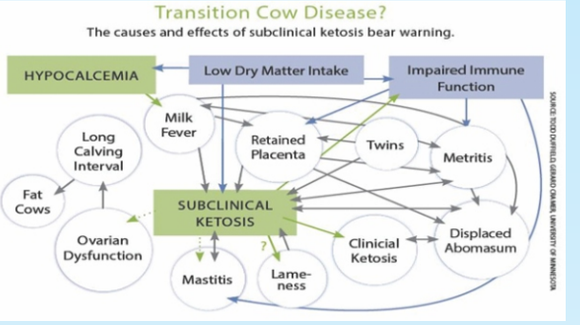



Fig 3: Subclinical Ketosis

**Table 1: Comparison of biochemical parameters between ketotic with normal Cattle**

| Parameters | Ketotic Cows (n=21) | Healthy Cows (n= 21) |
|---|---|---|
| BHBA (m mol/litre) | 1.76 ± 0.6 | 0.88 ± 0.04 |
| T4(n mol/ litre) | 18.69 ± 2.30 | 46.12 ± 4.44 |
| Cortisol (nmol/ litre) | 7.71 ± 1.27 | 15.48 ± 1.33 |
| Glucose (nmol/litre) | 1.24 ± 0.39 | 2.82 ± 0.60 |
| Ca (m mol/litre) | 1.79 ± 0.41 | 2.93 ± 0.16 |
| P (mmol/litre) | 0.79 ± 0.28 | 1.95 ± 0.31 |
| AST (UL/litre) | 166.00 ± 18.24 | 94.85 ± 10.63 |
| ALT (UL/litre) | 68.66 ± 11.71 | 29.57 ± 6.32 |
| ALP (UL/litre) | 465.57 ± 193.26 | 122.71 ± 59.89 |
| GGT (UL/litre) | 55.95 ± 25.08 | 22.75 ± 31.05 |
| Vitamin A (µg/dl) | 73.69 ± 29.48 | 84.33 ± 14.04 |
| Vitamin E (µg/dl) | 555.42 ± 16.28 | 641.42 ± 82.75 |
| WBC (× 106 m/litre) | 12.81 ± 4.09 | 9.77 ± 3.18 |
| RBC (× 106 m/litre) | 6.76 ± 0.97 | 6.66 ± 0.88 |
| Blood Ketone Bodies (mg/100ml) | 40 ± 1.2 | 7 ± 0.02 |
| Milk Ketone Bodies (mg/100ml) | 40 ± 2.2 | 7 ± 1.0 |
| Urine ketone Bodies (mg/100ml) | 500-1000 ± 1.02 | 30 ± 2.02 |

## References:


1. Radostits OM, Blood DC, Gay GC (2000) Veterinary Medicine. A Textbook of the Diseases of Cattle, Sheep, Pigs, Goats an Horses. W.B. Saunders. PP: 1452-1462. Veterinary Medicine. 9th Edn. ELBS, Bailliere and Tindall, London.
2. Foster LA. Clinical ketosis. Veterinary Clinics of North America: Food Animal Practice, 1988; 4: 253-265.
3. McArt JAA, Nydam DV, Oetzel GR (2012) Epidemiology of sub-clinical ketosis in early lactation dairy cattle, Journal of Dairy Sci-ence, 95 :5056–5066http://dx.doi.org/ 10.3168/jds.2012-5443.

# CLIMATE RESILIENT LIVESTOCK FARMING : TOOLS TO OVERCOME THE THREATS IN INDIAN AGRICULTURE

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## Introduction:

India ranked 1st in Milk production by producing 140 million ton in 2014. Per capita availability of Milk is 302 g /day when the ICMR recommendation is 280 g/day. Majority (55%) of milk is produced by Buffaloes, followed by (42 %) by Cattle and small ruminants (3%). In India, livestock sector contributes about 4.11% of the total GDP and 27.25% of total output of agriculture sector in 2012-13 and around 62-65 % of the population is still dependent on agriculture for their livelihood. In West Bengal, livestock sector is also crucial not only in terms of its contribution towards protein supplementation, rural income, employment generation but also for the section of population to which this income goes. Livestock sector contributes 3.89% of the State Domestic Product (SDP) and nearly 20.34% of its agricultural production. The gross value output from livestock sector at current price is Rs. 32940 crore (NABARD, 2016). In West Bengal 70% of rural households keep some animals or the others and earn 40% of their average income. Livestock activity is concentrated among landless households and those with marginal holdings of less than 1 hector of land. About 70% of the livestock and poultry belong to the resource-poor part of population in the state. Women constitute about 71% of the labour force in livestock farming.

Climate change is considered as one of the serious challenges to be faced by the farmers and livestock owners throughout the world. In India, where the small and marginal farmers are contributing the maximum share in milk production belongs to the resource poor category, and therefore they are more prone to face the brunt of adverse effects of climate change.

## Climate change and its impact on livestock

Climate change or in other words global worming during recent years prose a threat to Indian agriculture and allied sector. It is estimated that Global temperature has increased @ 0.70 C in the last century 1906 to 2005 and it may be accelerating at a much faster rate during the current century. According to Inter Governmental Panel on Climate Change (IPCC), it is anticipated that Global temperature may rise between 1.8 – 60 by the end of 2100 which may extinct 20-30 % of global bio-mass. It was also reported that due to rapid change in climate environmental extreme will be more, incidence of flood, draught, etc. will be frequent, both quantity and quality of ground water will be depleted. IPCC indicated that developing countries including India will be more vulnerable to extreme climatic events as they largely depend on Agriculture, Livestock & forestry. Green House Gases (GHGs) emission is said to be one of the important factor for global warming.

The climate stress particularly heat stress will adversely affect the production (20-35 %) & reproduction performance (10 %) of the Livestock. Effect will be more pronounced in coastal and alpine region of the country. In general, the crossbred cattle reared by small, medium and progressive farmers and sheep and goats, which serves as major source of livelihood and reared by weaker segments of the society under diverse agro-climatic regions, are more sensitive to climatic stress in the country (Chakravarty, 2015).

The negative impact of climate change on livestock production is reported to be occur in different ways such as –

1. Changes in feed-grain availability and price.
2. Changes in availability of natural pastures, forage, crop production both quality and quantity.
3. Changes in distribution pattern of livestock diseases and pest. Incidence of vector born diseases will increase.
4. Direct effect of weather and extreme events on animal health, production and reproduction.

## Effect on milk production

The negative impact of temperature rise on total yearly milk production in India has been estimated production loss of 3.4 million tonnes in 2020 accounting Rs. 5000.00 crores at current price rate and more than 15 million tons in 2050 (Upadhyay et al.,2009). The Northern India is likely to experience more negative effect of temperature rise on milk production of cattle and buffaloes. The association

between production performance of livestock and THI (Temperature Humidity Index) above threshold level is found negative. Under Indian condition, it has reported that milk yield was reduced by 0.89 litter and 0.16 litter per day per cow per unit increase of THI above the threshold level i.e., 72 to 82 in Crossbred and Sahiwal cow (Chakravarty, 2015). Reduction in production performance was observed in heat stressed sheep and goats also.

## Effect on reproduction

Fertility traits such as service period, conception rate, pregnancy rate etc., in dairy animal shows a very low heritability value which indicates that most of the variation in fertility traits of animal is determined by the environmental effects. It was found that the cows calved during summer months had longest service period of 159+-- 3 days. High temperature with a high humidity in summer and rainy season results in physiological disorders, affecting hormone secretion responsible for reproduction and therefore resulting in longer service period in cows. Analysing the data over a period of 1993 to 2012, it was found that the service period of Murrah buffaloes increased by 19 days in THI above 75.39 to 81.60 (Chakravarty, 2015). In another study at NDRI, Karnal it was reported that the lowest average pregnancy rate in Murrah buffaloes was 0.25 in the month of July with the corresponding THI 80.88 and highest pregnancy rate was obtained as 0.58 in the month of November with THI 66.09 (Chakravarty, 2015).

## Climate resilient livestock farming

To overcome the adverse effect of climate change adoption of climate resilient livestock farming is considered to be the most promising mitigation strategy. It may be defined as the ability of a community to resist, absorb and recover from the effects of climate change in a timely and efficient manner. Climate resilient livestock farming means implementation of sound practices on livestock farms to maintain the level of production and reproduction ensuring regular income from the farms in the wake of climate change. Under Indian condition, it involve strategies for reducing effect of heat stress mainly by the way of shelter management, nutritional management and breeding management.

## Shelter management to overcome heat stress

Modifications of micro-environment to reduce thermal stress of livestock that may be used under tropical condition are provision of proper shed or shelter that reduced the incoming solar radiation as much as 30% and thus reduces thermal loads (Wiersma et al., 1984). A tree shed is a simple and ideal choice under tropical and sub-tropical condition. Other managemental practices which may be adopted to reduce the heat stress in livestock are:

1. Arrangement of heat insulated, well ventilated animal shed. Provision of exhaust fan, sprinkler etc. may be used.
2. Plantation of tree in and around livestock farms is very effective to reduce solar radiation (environmental temperature is lower upto 40 C under tree shed) for the livestock.
3. Provision of wallowing for buffaloes is a cheap and effective means to reduce heat load.
4. Cooling of animals at night when the environmental temperature is comparatively in the lower side is more beneficial than day time.
5. Avoiding night shelter inside animal house during heat stress is considered to be a good managemental practice. The animal should be kept under open sky to disseminate heat.
6. In organized farms, required floor space as per recommendation is to be provided to avoid overcrowding inside the shed.
7. Arrangement of false ceiling is also beneficial to reduce heat load inside the animal house.
8. Animal shed should be constructed in East-West Direction and use of semi-open RCC as roof material is more beneficial in most part of the country.
9. Kachha floor is better in comparison to others to reduce heat stress in livestock.
10. Arrangement of water tank inside the animal shed is an effective means for supplying cold water to the animal during hot summer months.

Pictures: Different ways of shelter management to reduce heat stress.

## Animal feeding and nutritional management

Feed intake of livestock is decreased during the period of heat stress which ultimately affects the production of livestock. Therefore, some simple modification of feeding and nutritional strategies can be implemented to reduce the negative effect of heat stress on livestock production. The first nutritional approach to cope up the effect of heat stress is to decrease dietary fibre intake to the level where the rumen can function properly. Other important feeding and nutritional management recommendations to mitigate the heat load in livestock are:

1. Increase digestible energy density of ruminants diets in intensive management system.
2. Feeding high quality forage to lactating cows in hot summer is always beneficial.
3. Promotion of good quality silage feeding during hot summer month is a good alternative.
4. Feeding of dietary fat remains an effective and common practice for providing extra energy. Provision of oil @ 150-200 ml per cow per day is beneficial for high yielders producing 15 lit or more milk per day.
5. Minerals supplementation to fulfil the daily requirement is important during heat stress period to maintain the production performance of animals specially, addition of Sodium, Potassium, Magnesium, Vitamin-E , Vitamin-A , Selenium, Zinc etc. Buffers like Sodium Bicarbonates to maintain the Ph of rumen is very crucial to cope up acidosis in ruminants.
6. During heat stress water requirement is increased by 1.2 to 2 times and providing enough access to cold, clean and fresh water during summer is essential.
7. Alteration in feeding time is also advocated to mitigate heat stress. Feeding of animals during cooler hours of the day (Early morning &Late evening) can be practiced.
8. Distribution of the total amount of required concentrate evenly throughout the day and feed with forages is beneficial to reduce heat load producing during the process of digestion. Avoid feeding more than 1 kg concentrate at a time which in turn will create additional heat increment.
9. Supplementation of MMB (Molasses-Mineral-Block) is an easy practice to ensure energy and mineral supplementation.
10. Soaking of concentrate and dry roughages in water for 20-30 minutes before feeding is beneficial.

## Breeding management

Developing new breeds and genetic types, improving animal reproduction and animal health that would support adaptation measures in long term is always the desire of a breeder. In India many local breeds are already adapted to harse climatic condition under different agro-climatic condition. These indigenous livestock breeds have co-evolved in agro-climatic conditions over several thousand years and have adapted to the prevalent climate and disease environments. But in recent times these multi utility animals are under substantial pressure arising from the need for increased production as well as land-use pattern changes. In long term perspective to mitigate the effect of climate change following breeding management can be suggested:

1. Strengthening breeding intervention in favour of Indigenous breeds of Livestock: Selective breeding of defined indigenous breeds of livestock which are adopted to local climate and feed resources, having high milk yield, fertility, draft power, meat and wool production ability will be strengthened in their respective breeding tract to improve production and reproduction performance.
2. Selection of animals in respect to adopt heat stress condition: The identification and selection of heat tolerant animals is useful to sustain both productivity and survivability when exposed to heat stress conditions. Therefore inclusion of THI (Temperature Humidity Index) covariate in the selection strategy should be targeted for genetic evaluation of dairy animals and other livestock with more adaptability in adverse climatic condition.

3. Genetic improvement of local non-descript and low-producing animals may be achieved through up-gradation with heat and disease tolerant defined indigenous breeds. Government policy may be framed towards promotion of rearing good quality local breeds of livestock. For instance, Government of Haryana provides up to 50 % subsidy towards farmers having dairy units with Murrah Buffalo and or Haryana breed of cattle which give up remarkable result during last decade in that particular state.
4. Reduction of unproductive animal population to reduce the competition among livestock for scares feed and fodder. States like West Bengal may explore the advantage of Slaughter Control Act, 1950 for this purpose.
5. Area specific approach would be adopted by strengthening breeding intervention of indigenous sheep, goat and pig breeds. Main focus will be to produce and distribute good quality breedable ram or buck or boars of defined indigenous breeds which can thrive well in changing agro-climatic condition. For example, buck exchange programme may be implemented in large scale to regain the genetic merit of Black Bengal Breed of goat.
6. Strengthening of livestock early-warning system: FAO Domestic Animal Diversity Information System, a global databank for animal genetic resources, is the most comprehensive global information source on livestock genetic diversity. A total of 7616 no of breeds are recorded in Global perspective out of which 1491 are classified as being "at risk". Similarly the information system on animal genetic resources in India should be strengthened and monitored through national institutes like National Bureau of Animal Genetic Resources (NBAGR). Appropriate action is to be taken through early warning system so that the endangered breeds which are at risk but contributing to food, nutrition and livelihood security of millions of people, can be saved from climate stress in time through sustainability breeding intervention.

## Other managemental practices

Following strategies would be helpful to extension agencies and policy makers while planning to orient the Indian farmers towards adopting climate resilient livestock farming practices:

1. Farmers awareness regarding importance of pre and post calving period: It is well established that 3 weeks before and after parturition is the most vital period to maintain production and reproduction performance of dairy animal. Therefore, proper management and care during this period is essential for optimization of production performance.
2. High quality Milch animal especially with exotic inheritance are to be maintained for business purpose only. Common farmers should not be encouraged to maintain high producing exotic or crossbreed animal particularly in regions where marketing channels are not well developed.
3. Strengthening of animal disease surveillance and control measures: Incidence of vector born diseases like Babesiosis, Thieleriosis, Anaplasmosis and Trypanosomiosis are reported to be more and more due to change in climatic condition throughout the country. Climatic stress will make the animal more susceptible to other diseases like FMD, Brucellosis, Mastitis, PPR, Goat Pox etc. Therefore, early reporting system and implementation of sound control measures may be carried out for all the diseases affecting production and reproduction performance of livestock and poultry.

## Conclusion

Climate change is a phenomenon being experienced by the farmers over last two decades. It can no longer be denied. Changes in climate are posing both direct and indirect effects on farm and animal production which ultimately affect livelihood. Although mitigation strategy to cope up the effects of climate change may not be a feasible option at individual level, but attempt has to be made for enhancing the capacity of livestock farmers to overcome the effects of climate change. This will build up the resilience in livestock farms for maintaining and increasing productivity levels in changing climatic situation. Strengthening of extension and capacity building measures involving all stakeholders including farmers, government departments, livestock farms , agriculture and veterinary universities , PRIs etc. to build up climate resilient village/farm is also very important.

## References:


1. Chakravarty, A.K. 2015.Building resilience through breeding intervention in livestock production. In:Compendium on Model Training Course on Capacity building of extension functionaries on climate resilient livestock farming. Organised by Dairy Extension Division, ICAR- National Dairy Research Institute, Karnal, Haryana during 26th November – 3rd December, 2015. P: 5-8
2. NABARD. 2016. State focus paper 2016-17. Potential credit outlays. Chapter-IV. P: 33.
3. Upadhyay, R.C., Ashutosh., Raina, V.S and Singh, S.V. 2009. Impact of climate change on production and reproduction of cattle and buffaloes. In: Global Climate Change and Indian Agriculture, P.K. Aggarwal (Editor), ICAR New Delhi. P:107-110
4. Wiersma, F., Armstrong D.V., Welchert W.T. and Lough O.G. 1984. Housing system for dairy production under warm weather conditions. World Animal Review. 50.P: 16

# AZOLLA: A SUSTAINABLE FEED SUBSTITUTE FOR LIVESTOCK

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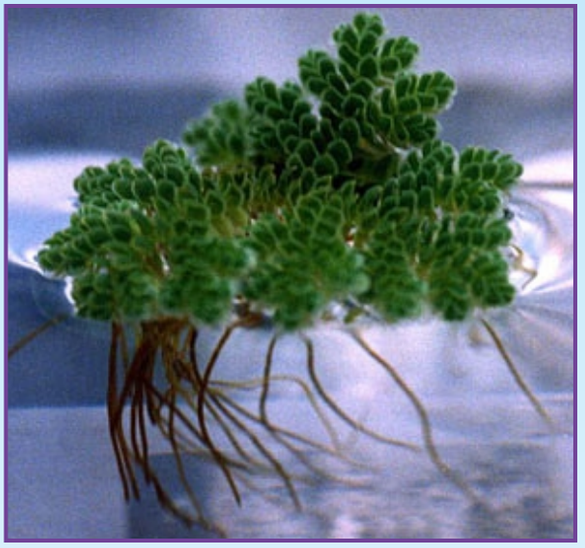

## Introduction:

Azolla is a floating fern and belongs to the family of "Azollaceae". Azolla hosts symbiotic blue green algae, Anabaena azollae, which is responsible for fixation and assimilation of atmospheric nitrogen. Azolla , in turn, provides nutrient and a protective cavity in each leaf to the algae for its growth and development. It is this unique relationship that makes azolla a wonderful plant with protein (30%), Vitamin (A, B12), and minerals. Azolla is easy to cultivate and can be used as an ideal feed for cattle, sheep, goat, pig, rabbit, ornamental bird, poultry, duck, fish etc. It is also used as a biofertilizer for waterlogged paddy.

It is widely cultivated in other countries like China, Vietnam, Philipines, Bangladesh, Nigeria, and Egypt. Dairy farmers in south Kerala and Kanyakumari have started to take up low cost production technology.The demand for milk and meat in India is creating new potential in the potentiality of animal husbandry as an occupation.Yet there is substantial decline in fodder availability. The shortage of fodder is compensated with commercial feed resulting in increased costs in milk and meat production. The search for alternatives to concentrate led us to wonderful plant " Azolla", which holds the promise of providing a sustainable feed for livestock.

Nutrient content and its impact on growth: Azolla is very rich in protein (30%), essential amino acids (7-10%), Vitamin (A, B12, beta Carotene), growth promoter, minerals (10-15%) like Calcium, Phosphorous, Potassium, iron, Copper, Magnesium etc. Carbohydrate and fat content of azolla is very low. Its nutrient composition makes it a highly efficient and effective feed for livestock. Livestock easily digest it due to high protein and low lignin content. It is easy and economic to grow. The Natural Resources Development Project (NARDEP), Vivekananda Kendra, carried out trials in Tamil Nadu & Kerala on "Azolla" as a cattle feed substitute. The trials on dairy animal showed an overall increase in milk yield of about 15% when 1.5-2 kg of azolla was combined with regular feed. The increase in quantity of milk yield was higher due to its nutrient content as well as component like carotinoid, biopolymers, probiotics etc. Feeding of azolla to poultry improve the weight of broiler chickens & increase the egg production of layers.Azolla can also be fed to cattle, buffalo, sheep, goat, pig, rabbit, ornamental bird, turkey, quails etc. In China, cultivation of azolla along with paddy and fish is said to have increased rice production by 20% & fish by 30%.

### Table 1: Nutrient content comparative:

| SL | Fodder crops | Production (Ton/hectare) | Dry Matter % | Protein % |
|---|---|---|---|---|
| 1 | Hybrid Napier | 250 | 50 | 9 |
| 2 | Lucern | 80 | 16 | 20 |
| 3 | Cow pea | 35 | 7 | 1.4 |
| 4 | Jowar | 40 | 3.2 | 0.6 |
| 5 | Azolla | 730 | 56 | 30 |

## Table 2: Nutritive value of Azolla:

| Main analysis | Unit | Percent |
|---|---|---|
| Dry Matter | % feed | 56 |
| CP | % DM | 25-30 |
| Crude Fibre | % DM | 16 |
| Lignin | % DM | 8 |
| Ash | % DM | 19 |
| Gross energy | MJ/ Kg DM | 16 |
| Calcium | g/ kg DM1 | 2.5 |
| Phosphorous | g/ kg DM | 6.7 |
| Potassium | g/ kg DM | 12.5 |
| Sodium | g/ kg DM | 0 |
| Magnesium | g/ kg DM | 3.5 |
| Mangnese | mg/ kg DM | 174 |
| Zinc | mg/ kg DM | 88 |
| Copper | mg/ kg DM | 17 |
| Iron | mg/ kg DM | 756 |
| Amino acid | %Protein | 7-10 |

## AZOLLA PRODUCTION & PIT MAKING:

A pit size 6 ft x 6 ft x 0.6 ft is made with plastic sheet as per picture above. Pit can also be made of concrete. About 10-15 kg of fertile soil and 2 kg cow dung is uniformly spread over the sheet. The water is poured onto the sheet to raise the water level to about 2-3 inches.About 0.5 kg of fresh azolla culture is placed in the water. This will grow rapidly & fill the pit within 10 days. From then on, 500-600 g of azolla can be harvested daily. An azolla pit will continue to produce azolla for about 6 months. After 6 months, the pit is dried up and a new pit is made as per above procedure.Periodic application of cow dung slurry will keep the azolla multiply rapidly.For optimum production of azolla , it is advisable to make 7-8 pits so that there is minimum disturbance in the pit resulting in better production of azolla.

## Table 3: Pit Table

| 1st pit | 2nd pit | 3rd pit | 4th pit | 5th pit | 6th pit | 7th pit | 8th pit |
|---|---|---|---|---|---|---|---|
| 1st day harvest | 2nd day harvest | 3rd day harvest | 4th day harvest | 5th day harvest | 6th day harvest | 7th day | 8th day |
| 9th day harvest | 10th day harvest | 11th day harvest | 12th day harvest | 13th day harvest | 14th day harvest | 15th day harvest | 16th day harvest |

In this way, azolla can be harvested continuously throughout the year.


Fig.1 AZOLLA PIT AT BLDO OFFICE FALTA, S 24 PGS

FIG.2 AZOLLA PIT OF IRA MISTRY, CHALUARY, FALTA, S 24 PGS

## Important points to be kept in mind for making azolla pit:

- Periodic application of cow dung slurry will keep the fern multiply rapidly.
- Temperature to be kept below 25°C. If the temp goes up, the light intensity should be reduced by providing shade.
- PH should be between 5.5- 7
- About 5 kg of bed soil to be replaced with fresh soil once in 30 days to avoid nitrogen built up and prevent micro nutrient deficiency.
- 25% of water to be replaced with fresh water once in every 10 days, to prevent nitrogen built up in the bed.
- The pit should be cleaned, the water and soil to be replaced and new azolla inoculated once every 6 months.
- A fresh pit is to be prepared and inoculated with pure culture of azolla when contaminated by pest and disease.
- Azolla should be washed in fresh water to remove the smell of cow dung.
- Azolla should be harvested with plastic tray having holes of 1 sq. Cm size to drain the water.

## Feeding Azolla to Live stock:

When introducing azolla as feed, the fresh azolla should be mixed with concentrate feed in 1:1 ratio to feed live stock.After a fortnight of feeding on azolla mixed with concentrate, live stock may be fed with azolla without added concentrate.For poultry, azolla can be fed to layers and broilers.

## Table 4: Quantity of fresh Azolla to be fed:

| Cattle | Shee & goat | Fowl & duck | Turkey | Quail | Ornamental bird | Rabbit | Pig |
|---|---|---|---|---|---|---|---|
| 1.5-2 kg/d | 250 g/d | 70 g/d | 150 g/d | 20 g/d | 10-15 g/d | 150 g/d | 250 g/d |

Fig.3 SHG Member showing Egg size increased after feeding azolla, Chaluary, Falta

fig.4 a cow feeding on Azolla

Fig.5 pig feeding on azolla

Fig.6 Turkey feeding on Azolla, ATMA DC, Falta

## Why Azolla cultigation as animal feed:

- Due to increase agricultural activity for essential food crops like paddy, wheat, pulse etc, practically no land is available for fodder cultivation.
- Azolla can be cultivated under the shade of tree, on non agricultural land, or even on roof top.
- It can also be cultivated in multiple layer
- Lack of green fodder can be compensated with Azolla.
- Azolla is a good substitute for green fodder
- It has high nutritive value
- Cost of production is very low @ Rs 0.50/ kg azolla
- Azolla feeding improves the quality & quantity of milk
- It increases the egg production in number and size in layers
- Azolla feeding improves the weight of broiler chicken.
- It has been observed that azolla supresses the growth of some aquatic weeds by forming a thick mat that deprives weed seedlings of sunlight while mechanically preventing them from emerging.
- Shelf life: In tropical condition, it spoils in 2 days where as in cold climates its shelf life is 7 days.

## Table 5: Trial Report with Azolla pinnata:

| Animal | Trial | Result | Reference |
|---|---|---|---|
| Cross bred cow, mid lactation | 2 kg/d fresh azolla replacing 50% of concentrate for 3 months | Azolla maintained good performance while decreasing feed+labour cost by 16.5% & milk production cost by 18.5% | Murthy et al, 2013 |
| Black Bengal goat | Replacing concentrate with 50% dried azolla | Up to 20% maintained good growth with no adverse effect | Tamang et al, 1993 |
| Dairy buffalo | 1.5 kg fresh azolla for 120 days | Higher milk yield & milk fat | Kumar, 2008 |
| Broiler 1 to 14 d | 10% dried azolla | Could replace maize and soybean meal on an equal igestible protein basis | Ali et al, 1995 |
| Leghorn chicken, 5 wks | 20% dried azolla | Can replace about 20% of commercial feed | Subudhi et al, 1978 |
| Rabbit , 6 wks | 24% dried azolla | Beneficial effects on most production traits | Abou-Zeid et al, 2001 |

## Distribution:

Azolla occurs in ponds, ditches and rice field of warm, temperate and tropical regions throughout the world. It has 5-7 species. Each species has specific nature range.

## Table 6: Different Species Azolla & Region

| Species | Regions |
|---|---|
| Azolla caroliana | Eastern North America, Carribbean |
| Azolla filiculoides | South America |
| Azolla microphylla | Tropical & subtropical America |
| A. mexicana | North South America |
| A. nilotica | Nile to Sudan |
| A. pinnata | Asia & cost of tropical Africa |

## Process of feeding Azolla:

Azolla can be fed either in a fresh or dried form. It can be given directly or mixed with concentrate to cattle, sheep, goat, poultry, rabbit, ornamental bird, quail, turkey etc.It takes a few days for the animals to get used to the taste of azolla, therefore it is better to feed it with concentrate in the initial stages. Azolla should be washed thoroughly with fresh water to remove the smell of cow dung.

As azolla is highly perishable, it is advisable to dry it immediately when there is a surplus. It usually dried in the shade or stored dry in a plastic bin for later use.

Yield: 37.8 ton fresh azolla /hectare (2.78 ton DM/ha)

## Environmental impact:

Azolla can form dense mat on water surface. It is classified as a water weed in many areas. It is reported to disrupt fishing, access to water by live stock, impede water flow in ditches, clog pipes, pumps & flood gates. Azolla grown for bioremediation should not be fed to animals. Bioremediation is a process of purifying waste water & effluents using azolla which can accumulate excess amount of heavy metals, dyes, pesticide etc from waste water. Azolla improves soil fertility by providing nutrient rich humus through its decomposition.

**Field Trial report Azolla in Falta block, South 24 Parganas district:** Azolla was supplied from the pit of BLDO Office, Falta to different farmers including farmers of milch cattle, poultry, goat, ornamental bird, duck, turkey etc.

## Table 7: Effect of Azolla in different species of Animal.

| Animal | Items | Quantity | Result |
|---|---|---|---|
| Milch cow | Fresh Azolla mixed With concentrate | 1 kg/d | ■ milk yield increased significantly<br>■ reduced cost of feed resulting in increased profit<br>■ no adverse effect on digestion. |
| Goat | Fresh azolla mixed with concentrate | 250g/d | ● improve weight gain<br>● reduce cost of feed<br>● increase profit |
| Poultry (RIR) | Fresh azolla + rice /wheat broken | 50-70g/d | ■ increase no. of egg production<br>■ increase in size of egg<br>■ increase disease resistance<br>■ reduce cost of feed resulting in increased profit<br>■ no adverse effect on digestability |
| Turkey | Fresh azolla + rice /wheat broken | 100-150 g/d | ● increase in weight gain<br>● reduce cost of feed<br>● no adverse effect on digestability |

## Conclusion:

In animal husbandry, 80-90% cost of production is due to feed. Our aim is to reduce cost of production thereby increasing profitability. Animal owners are reluctant to rear animal due to increased cost of production. Azolla cultivation involves very little cost of production. It is also good source of protein & other nutrients including vitamin, minerals etc.

Feeding azolla to livestock will reduce cost of production significantly resulting in increased profit.

Azolla holds the hope of bringing cheer to the face of millions of animal owners in West Bengal in particular as well as in world in general.

## References:

1. National Institute of Animal Nutrition and Physiology, Adugodi, Bangalore – 560030

2. NABARD

# EMERGING-1- FISH BORNE PARASITIC ZOONOSES IN INDIA AND ABROAD

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## INTRODUCTION

Zoonoses can be defined as the diseases/infections that are transmitted between man and lower vertebrates. Fish-borne parasitic zoonoses are the parasitic diseases which are transmitted to man or animals through consumption of raw or undercooked fish containing infective stages of parasites. Emerging zoonoses have been defined as zoonoses that are newly recognized or newly evolved or that have occurred previously but show an increase in incidence or expansion in geographical, host or vector range (Report of WHO/FAO/OIE Joint consultation on Emerging Zoonotic Diseases, WHO, Geneva, May. 3-5, 2004). Most of the food borne or water borne parasitic zoonoses have received less attention and is generally under recognized but is probably on the increase due to the globalization of the food supply. The common fish-borne zoonotic parasites are Clonorchis sinensis, Opisthorchis spp., Heterophyes heterophyes, Paragonimus westermanii (trematode), Diphyllobothrium latum, Spirometra spp. (cestode), and Angiostrongylus cantonensis, Anisakid worms, Gnathostoma spinigerum (nematode). In developing countries, the problem of fish-borne parasitic diseases are much more than actually realized due to socio-economic and socio-cultural factors including food habits etc. Other factors that may explain the emergence of some fish-borne zoonotic parasitic diseases are mal nutrition and changes in life style such as eating fish prepared in restaurants, canteens and fast food outlets as well as streets food vendors who do not always respect food safety and the increase of eating raw or undercooked fish. Traditionally, these parasitic zoonoses are most common in Asia because of the particular food practices and the importance of aquaculture.

## FACTORS BEHIND FISH-BORNE ZOONOSIS

- Tradition of consuming raw or undercooked or half roasted fish
- Socio-economic and socio-cultural condition
- Poverty
- Lack of education/or illiteracy
- Unhygienic living conditions
- Increase in the number of reservoir hosts
- Climate change and associated food/feed insecurity

## FISH-BORNE ZOONOTIC CESTODES

Sparganosis is a zoonosis with larval stage of the species of the genus Spirometra of dogs and cats. Infections are acquired through drinking contaminated water or eating fish or frog meat. The spargana in man migrate subcutaneously resulting in inflammation, urticaria, oedema and eosiniphilia. This infection is reported in many countries but is must common in Eastern Asia. A case of human sparganosis was reported from Jodhpur, Rajasthan.

Diphyllobothriosis, a pasitosis caused by flatworm Diphyllobothrium latum is contracted by consuming raw or undercooked fish. It is commonly known as broad fish tape worm of man, dog, cat, pig etc. About 20 million people are infected worldwide. This parasite is found in Europe, North & South America and Asia. The infection has shown to re-emerge in some countries such as Russia, South Korea, Japan and South America. More than 100 cases of human infections were reported in the last decade in French, Swiss and Italian regions. It was also reported from India but there is no report of D. latum infection in India in recent years. In man, the infection is mostly asymptomatic. In about 20% of the infections diarrhea, abdominal pain, discomfort and pernicious anaemia (Vit. $B_{12}$ deficiency) are found.

## FISH-BORNE ZOONOTIC NEMATODES

Angiostrongylus cantonensis is a zoonotic parasite that causes eosinophilic meningitis in human after ingestion of infective larvae in freshwater and terrestrial snails & slugs, fresh water fish, shrimps as paratenic host. Rats are the natural final hosts. With the increase of income and living standards and pursuit of exotic & delicate foods, populations around the world, particularly in Asia have seen angiostrongyliosis become an important fish-borne parasitic zoonosis. In India, two human cases have been reported from Mumbai infected with A. cantonensis including the sign of eosinophilic meningitis (Fig. 3).

The consumption of raw or undercooked sea-fish may lead to infection with several nematodes belonging to Anisakidae family. The worm species most commonly involved in human infections is Anisakis simplex causing herring worm disease. The other species which cause human infection are Phocanema spp. (codfish worm), Contracaecum spp.

but they have been reported in only few cases. These nematodes actually occurred in different birds. Fish dishes from various parts of the world that are considered to pose high risk of infection include sushi, sashimi, pickled or smoked herring, dry cured salmon etc. The clinical symptoms of acute anisakiosis include epigastric pain, nausea, vomiting, diarrhea and frequent urticaria. Onset of symptoms is usually rapid and may persist for 1-5 days.

Gnathostomosis caused by Gnathostoma spinigerum, stomach worm of dog and cat is an important zoonotic disease. Human infection is acquired by eating raw or undercooked fish or frogs. The worms migrate under the skin, mucous membrane (creeping eruption, Fig. 4), eyes and brain where they cause eosinophilic meningitis (visceral migrans). The digits and the breasts are also frequently affected. Gnathostomosis in man has been reported from India but its incidence is highest in Thailand, Japan, Myanmar and other South-East Asia. It is regularly reported in travelers returning from endemic areas where they have eaten undercooked fresh water fish.

## FISH-BORNE ZOONOTIC TREMATODES

The liver flukes, Clonorchis sinenis and Opisthorchis spp. Are considered an emerging public health problem. C. sinensis was first reported by McConnell, 1877 in bile duct of a Chinese carpenter in Calcutta Medical College Hospital. It has been estimated that about 600 million and 80 million people are at risk for infection with C. sinensis and Opisthorchis spp. Respectively. The Oriental liver fluke, C. sinensis is of major socioeconomic important in parts of Asia including China, Japan, Korea, Vietnam etc. It is believed that clonorchiosis is having an increased human health impact due to greater consumption of raw fresh water fish. The closely related Opisthorchis sp. Has different geographic distributions including Kazakhastan, Russian Federation, Ukrain, Germany and Thailand. In heavy infections of both cases, the symptoms include diarrhea, ascitis, jaundice, formation of gallstones, gastrointestinal bleeding. There is strong evidence that both parasites are associated with cholangiocarcinoma (Cancer of bile duct-Fig. 2) and adenosarcoma (Tumour in adipose tissue) in human beings. But human infection with these two parasites has not been reported so far in India.

Another important zoonotic fish-borne trematode is Paragonimus westermanii, commonly known as lung fluke. The infection is acquired by eating raw or inadequately cooked fresh water crabs or crayfish containing the metacercariae. The symptoms are characteristically referable to the chest, abdomen, lymph nodes or brain. In pulmonary form, the clinical features are coughing, blood tinged sputum and less frequently haemoptysis, dyspnoea, chest pain and some times this form can be confused with tuberculosis. When migrating to brain, the worms are responsible for epilepsy as occurs in Neuro-cysticercosis. Paragonimiosis in human is one of the major socioeconomic public health problem in China, Japan, Korea and other Far East countries including Thailand but the lung fluke has also been found in some African countries such as Nigeria, Liberia etc. In India, paragonimiosis in human has been reported from Madras, west Bengal, Assam and Manipur. In recent past, 39 cases of young persons in 11-30 years of age group were reported from Manipur state showing symptoms of recurrent haemoptysis having P. westermanii flukes.

Heterophyes heterophyes is another zoonotic trematode where man gets infection by eating raw or undercooked fish containing metacercariae. In heavy infection, there is abdominal pain and diarrhea. This infection is widely distributed in China, Japan, Korea, Philippines. Although H. heterophyes infection in dog and cat in India is common, human cases have not been reported so far.

## PREVENTION AND CONTROL

Control and prevention of fish-borne parasitic zoonoses are complex tasks that require an integrative and multidisciplinary approach. Reduction of parasite burden is certainly a major objective but cannot be implemented alone. Therefore, environmental and ecological modifications need to be implemented to reduce not only the parasitic load, but also the risk of parasite transmission. Finally, education and behavioral changes are essential for the success of both control and prevention of these diseases. However, financial resources specifically allocated to prevention and control of emerging fish-borne parasitic diseases need to be contributed by local and national authorities as well as through international cooperation in order to successfully control and prevent these infections.

## CONCLUSION

The future impact of fish-borne zoonotic parasites may be linked closely to the expected growth of aquaculture in Asia where nearly 90% of the world's fresh water production is centered. The rise in general public concern over security of the food chain and food safety has helped to focus more attention on zoonotic parasites. However, for many of the zoonotic parasites, the systems for routine diagnosis, monitoring or reporting are inadequate or even non-existing. The increasing demand for animal proteins in

developing countries will lead to an increase of livestock and fish production and then increase the risk of fish-borne parasitosis. Among the options for a better monitoring and control of fish-borne zoonotic parasites are using new risk assessment tools such as awareness amongst people about these infection, proper education, hygienic living conditions, habits of eating properly cooked and freezed fish, social and economic development. Before going for effective control measures, the knowledge of various factors responsible for transmission and occurrence of parasitic fish-borne zoonoses is necessary.

## REFERENCES


1. Pathak KML. 2004. Fundamentals of parasitic zoonoses. Kalyani Publishers.
2. Chomel BB. 2008. Control and prevention of emerging parasitic zoonoses. Int J Parasitol. 38: 1211–1217.
3. Chai JY, Darwin Murrell K, and Lymbery AJ. 2005. Fish-borne parasitic zoonoses: status and issues. Int J Parasitol. 35(11-12):1233-54.
4. Adams AM, KD Murrell and JH Cros. 1997. Parasites of fish and risks to public health. Rev. sci. tech. Off. int. Epiz., 16(2): 652-66


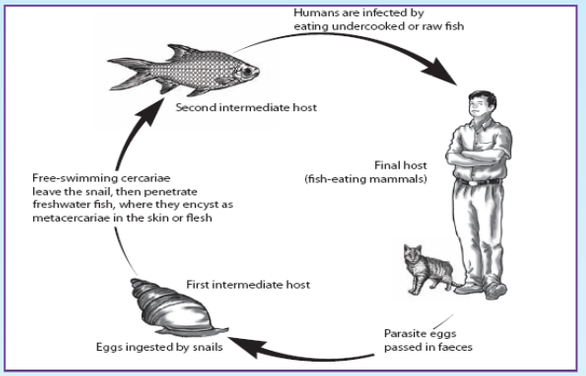


Fig. 1 : General route of transmission of fish-borne parasites

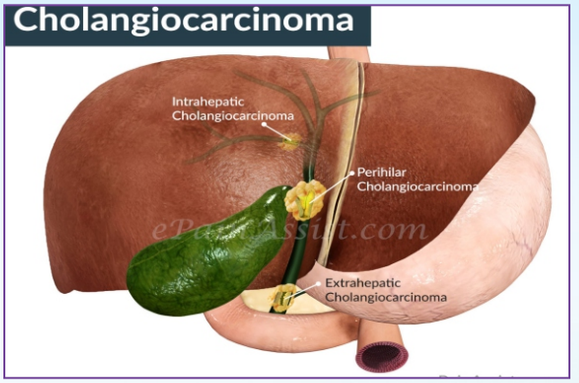


Fig. 2 : Cholangiocarcinoma

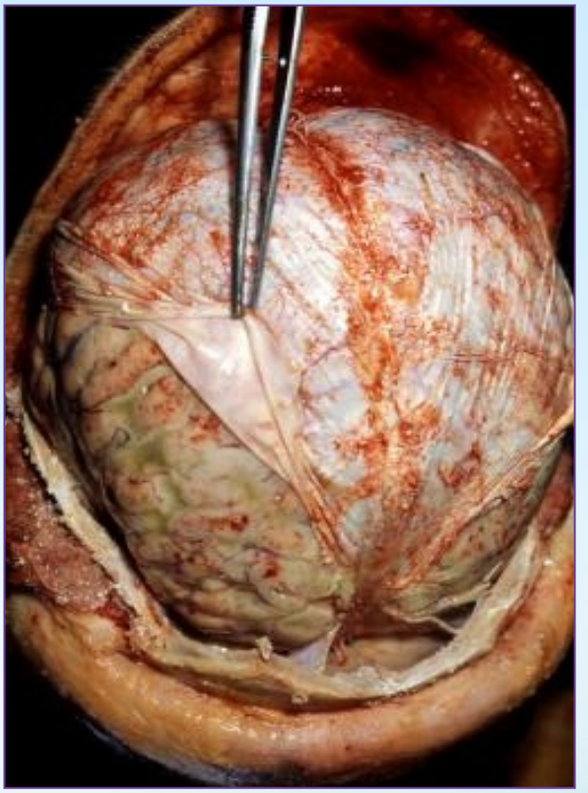

Fig. 3 : Eosinophilic meningitis

Fig. 4 : Creeping eruption: migration of larvae

# TREATMENT AND MANAGEMENT OF CORNEAL OPACITY OF A GOAT –A CASE REPORT

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Fig. 1 Corneal opacity of a goat.

The cornea is the thin transparent tissue which covers the surface of eye. It has two functions. One is to protect the eye from dust, debris, dirt, UV rays and infectious germs and second is it blends light rays onto the retina so that images appear in focus a pathway of light..Though cornea is very thin, it has five layers, damage any of the layers can cause corneal clouding. Corneal disorder like corneal opacity is a very common disease in caprine family.The causes of corneal opacity is complex and multifactorial in nature.

## History and clinical observation: -

A total four does and one buck of different age group were presented to ABAHC, Ghugudanga ,SadarBloc in Jalpaiguri district, West Bengal with a history of dull, depressed and weakness .All the affected goats showed milky and cloudy area on the cornea, irritation, and watery secretion from both eyes(Fig). They were totally blind. There was no history of infection, injury or inflammation of eyes. Other parameter like body temperature, pulse rate and respiration rate was normal.

## Diagnosis:-

Diagnosis of this case was done on the basis of clinical observation and correlation of history.

## Treatment and Discussion:-

The affected animals were treated with tablet fenbendazole @ 10mg/Kg. Body weight, orally, stat, Injection vitamin A @ 2 ml ,IM for 5 days, and eye drops containing chloramphenicol with dexamithasone 1 drop two times daily for 14 days. All the goats responded to the treatment after 3rd days onwards which were indicated by thinness of white coloration coating on cornea. Complete clinical recovery took place after 2 weeks. No side effect was observed during the courses of treatments. In this present clinical study, treated by combination of anthelmintic, Vitamin A therapy parenterally an antibiotic along with steroid locally resulted in 100% recovery rate in goats affected by corneal opacity. So it may be concluded that anthelmintic therapy by orally, inj.Vitamin A by parenterally and chloramphenicol and dexamithasone locally is very effective in treating corneal opacity in goat.

# A20 AND AUTOIMMUNITY

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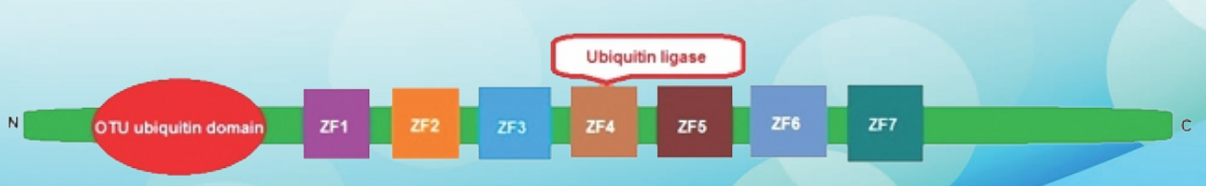
Autoimmunity can be described as an inappropriate response of body's immune system against self component. In the part of last century the condition was first described by Paul Ehrlich. He coined the term 'horror autotoxicus' to describe the condition where body's immune system instead of reacting only against foreign antigen could focus its attack on self antigen. This condition can lead to number of chronic and acute diseases including Rheumatoid Arthritis (RA), Multiple Sclerosis (MS), Lupus Erythematosus, certain type of diabetes, psoriasis, myasthenia gravis etc.

Several factors like- antigens generated by molecular changes [Rheumatoid Factor (RFs) and immuno-conglutinins (IKs)], molecular mimicry, cross reaction of B cell between foreign epitope and autoantigen, receptor editing, alterations of antigen processing, genetic predisposing factors have been proposed to regulate autoimmunity in body. Among them genetic factor A20 is now widely accepted as key regulator based on its function in the fine tuning of NF-κB signaling and apoptosis. A20 acts as a crucial gatekeeper for maintaining tissue homeostasis.

A20 also known as Tumor Necrosis Factor-κ Induced Protein 3 (TNFAIP3) is ubiquitin modifying enzyme and acts as negative regulator of NF-κB. This protein was first identified in 1990 in the endothelial cells of human umbilical vein. Aberrant activation of NF-κB has been shown to contribute chronic inflammation and development of cancer, thereby, A20 acts as classical tumor suppressor by its negative regulatory mechanism. Studies show that A20 deficient mice are hypersensitive to Tumor Necrosis Factor (TNF) and die prematurely due to severe multi-organ inflammation and cachexia. Moreover Single Nucleotide Polymorphism (SNP) and mutation of A20/ TNFAIP3 has been identified to participate in development of autoimmune disease of the intestinal tract, systemic lupus erythematosus, RA, diabetes mellitus type 1 and several others.

A20 is a cytoplasmic protein having seven zinc finger domains in its molecule. It is identified as dual inhibitor of NF-κB activation and cell death. Normally in most cell types A20 expression is very low but its transcription is rapidly induced upon NF-κB activation and acts as negative feedback regulator of NF-κB transcription factors by its ubiquitin editing process. NF-κB transcription factors play central role in broad range of cellular activities including cell activation, development and differentiation, regulation of protective as well as self directed immune response and pathogenesis of disease including neuro-degenerative disease and aging. NF-κB signaling is initiated by antigen specific B and T cell (BCR /TCR) receptor, toll like receptor (TLR) and other pattern recognition receptor. The process is regulated by post translational modification such as phosphorylation and polyubiquitination of several NF-κB intermediate molecules like TRAF-6, RIP1, NEMO/ IKKκ and MALT1 collectively result in NF-κB activation.

Ubiquitin being 76 amino acid conserved protein can covalently attach to other protein in a highly regulated process involves the stepwise activity of E1 ubiquitining activity enzyme, E2 conjugate enzyme and E3 ubiquitin ligases. This E3 confers substrate specificity and enable the attachment of ubiquitin to a specific lysine in the target substrate. Each 7 lysine in ubiquitin can themselves also be coupled to another ubiquitin thus leading to a polyubiquitin chain on the original target protein. Pollyubiquitin chain formation through K48 of ubiquitin directs proteosomal degradation of modified protein. In contrast, K63 polyubiquitination do not lead to degradation of the substrate but mediate a low affinity binding to other protein that contain specific ubiquitin binding domain which stabilize protein–protein interaction and recognized as fundamental regulatory mechanism of signal transduction.




Schematic representation of A20 protein structure

A20 acts as dual function protein for NF-κB inhibitory mechanism, a deubiquitinating enzyme (DUB) activity mediated by N terminal ovarian tumor (OTU) domain and E3 ubiquitin ligase activity mediated by C terminal zinc finger containing domain. As mentioned earlier that receptor interacting protein 1 (RIP1) is an essential factor for NF-κB signaling is polyubiquinated by E3 ubiquitin ligase with cellular inhibition of apoptosis is protein 1 and 2 (CIAP1 and 2). A20 by its DUB activity removes K63 linked polyubiquitin chains from RIP1 preventing its interaction. Furthermore A20 E3 ubiquitin ligase activity then promotes RIP1 K48 linked polyubiquitination which triggers the proteasome mediated degradation of RIP1.

One of the most important and best characterized pathway involed in innate and adaptive immunity and tumor genes is NF-κB transcription pathway lead to proinflammatory process. A20 is induced by NF-κB itself and function as negative feedback regulator for restriction of overwhelming immune response. So it can be expected that defects in A20 expression or function could lead to chronic inflammation and tissue damage. Some recent findings (Genome Wide Association Studies-GWASs) reveal crucial link between polymorphism of A20 locus and wide spectrum of inflammatory and autoimmune disease.

## A20 and inflammatory bowel disease (IBD)

IBD occurs due to dysregulated interaction between the host immune system and its intestinal commensal microflora. NF-κB signaling in intestinal epithelial cell has crucial role in maintaining intestinal immune homeostasis and limiting chronic inflammation. Polymorphism of A20 gene locus has been shown to be related with this disease.

## A20 and rheumatoid Arthritis (RA)

Rheumatoid arthritis or erosive poly arthritis is most important immune mediated arthritis that affects about 1% of adult human population. A very similar disease is reported in domestic animal especially in dogs. Inflammatory cytokines such as TNF, IL-1, IL-6 etc. are of central importance for the chronic inflammatory state leading to disease. Among them TNF seems to have primary role in RA because it regulates the expression of all other proinflammatory cytokines found in joints. As A20 is required for termination of TNF induced signals. SNPs in the A20 locus have been identified to be predisposing factor for development of RA.

## A20 and Systemic Lupus Erythematosus (SLE)

Systemic Lupus Erythematosus is a complex disease syndrome that has been described in human and other primates like mice, horses, dogs and cats. It is characterized by development of autoantibodies against antigen located within cell nucleus. These antinuclear antibodies can combine with free antigens to form immune complexes and that may be deposited in glomeruli causing glomerulonephritis besides deposition in arterial wall & synovia causing degenerative changes. ANAs also bind to the nuclei of degenerative cells to produce round or oval structure called haematoxylin bodies in skin, kidney, lungs, lymph nodes, spleen and heart. A20 gene was recently found to be associated with this mutagenic disease.

## A20 and Type 1 Diabetes (T1D)

This disease is characterized by the infiltration of inflammatory cells into the islets of Langerhans of pancreas leading to selective destruction of insulin producing β cell, so that there is production of insufficient insulin resulting into hyperglycaemia and other complications like retinopathy, nephropathy and cardiovascular disease. One of the main causes of this β cell death is release of inflammatory mediators by activated immune cells, a process in which NF-κB is involved. Thus uncontrolled activation of NF-κB due to reduced A20 expression, participates in T1D development. A20 also acts as antiapoptotic gene in β cells. So A20 is an important cytoplasmic protein which could be a potent candidate for gene therapy in islet transformation and treatment of T1D.

## A20 and Psoriasis

Psoriasis is a common autoimmune disorder associated with multifactorial gene. It affects skin, nail and joints. Most obvious feature includes epidermal hyperplasia and altered keratinocyte differentiation. GWAS of Psoriasis patient show strong association of A20 in suspectable loci.

## A20 and Multiple Sclerosis (MS)

Multiple Sclerosis is the most prevalent of all autoimmune diseases of CNS characterized by infiltration of T lymphocyte, B lymphocyte and macrophages into the CNS and immune mediated destruction of CNS myelin and neurons. Expression of NFκB transcription factor and TLR induced cytokine production is found to be increased in MS patients' macrophages. This data would fit to the hypothesis that MS is related to diminish function of A20 in macrophages, though further study in this respect is still awaited.

## Conclusion

A20 has been firmly established as a central negative regulator of NF-κB. The large numbers of GWAS studies in last few years have uncovered A20

as a suspectability locus for multiple autoimmune and inflammatory diseases but its impact on cellular and organ function is only in the beginning stage of assessment. A20 inhibits apoptosis in several cell types, enhances cell survival and has implication on cellular aging. Impaired A20 function in Antigen Presenting Cell (APC) is shown to be associated with various autoimmune diseases as mentioned here but the underlying cellular and molecular mechanism remains to be addressed. The role of A20 in CNS autoimmune disease is largely unknown. However, indirect evidence indicates that NF-κB in astrocytes and microglia is particularly associated with inflammatory stimuli and pathogenesis of a variety of neurodegenerative diseases and A20, a key regulator of NF-κB activity may regulate these nervous system related autoimmune diseases. Further investigation must be carried out to explore the role of A20 in various day by day increasing neurodegenerative diseases like Alzheimer's disease, Parkinson's disease, TIA (Transient Ischaemic Attack) and stroke.

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## For additional information:

Abbasi A, Forsberg K and Bischof F (2015) The role of the ubiquitin-editing enzyme A20 in diseases of the central nervous system and other pathological processes. Front. Mol. Neurosci. 8:21

Catrysse L, Vereecke L, Beyaert R, and Loo GV (2009) The ubiquitin-editing enzyme A20 (TNFAIP3) is a central regulator of immunopathology. Trends in Immunol. 30:8

Catrysse L, Vereecke L, Beyaert R, and Loo GV (2014) A20 in inflammation and autoimmunity. Trends in Immunol., 35:1

Fechter K, Neumeister P and Deutsch AJA (2016) Single Nucleotide Variants and Somatic Aberrations of A20 in Immune-Related Diseases and Lymphoid Neoplasms. J. Clin. Cell. Immunol. 7:5

Onizawa M, Oshima S, Schulze-Topphoff U et al. (2015) The ubiquitin-modifying enzyme A20 restricts ubiquitination of the kinase RIPK3 and protects cells from necroptosis. Nature Immunol. 16:6

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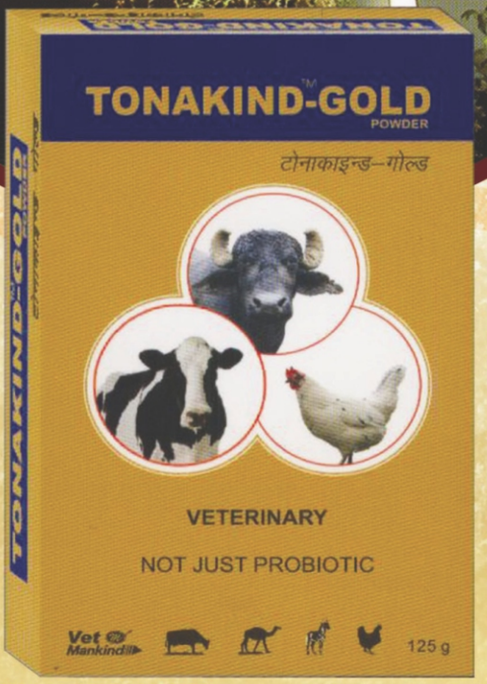



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