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The Blue Cross Book

For the advancement of the veterinary profession



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The results/ conclusions drawn and recommendations made in the article (s) are of the author (s) and not necessarily of the Editorial Board.

The Editorial Board of Blue Cross Book and MSD Animal Health, wish all the readers a happy and prosperous New Year 2012.

The bygone year 2011 marked the relaunching of Blue Cross Book with the publication of its 25th volume. The Editorial Board is happy and feel encouraged by the response of the readers to the 25th volume. With the same zeal and assurance, the Blue Cross Book shall endeavor in 2012 to provide useful knowledge to its readers.

The year 2011 also evidenced THREE important events at the global level. The FIRST was the 250th foundation day of Veterinary Education. The first Veterinary College in the world, which marked the beginning of modern Veterinary Education was established at Lyon in France in January 1761. On the initiative of World Organization of Animal Health (OIE), the year 2011 was celebrated as 'World Veterinary Year' throughout the globe. The SECOND event was the declaration of theme 'Rabies Prevention' by World Veterinary Association (WVA) on the occasion of World Veterinary Day 2011. The theme was declared to bring before the world the role of Veterinarians' in prevention and control of rabies. The WVA, OIE and Global Alliance for Rabies Control (GARC) partnered to promote the Rabies Prevention in 2011. The THIRD event was the declaration of 'Rinderpest Free Planet' by FAO in view of the complete eradication of deadly Rinderpest from the planet. Rinderpest thus became the first animal disease to be eradicated from the planet. All these Wordly events were duly celebrated throughout India by the Veterinary fraternity.

The 26th volume of Blue Cross Book contains important topics related to livestock productivity. The role of vitamins, minerals and trace elements in animals productivity, though dealt with extensively in academic curriculum, its application at farmer level is not to the desired extent. This has resulted into many deficiency disease syndromes. Parasitic gastroenteritis is another disease condition which is not properly attended to by the farmers. The study carried out in Karnataka should be an eye opener, where in, the extent of the diseases and its ill effects are well documented . The Veterinarians have a great role to play by educating farmers about the deficiency and parasitic diseases of domestic livestock.

The Editorial Board of Blue Cross Book appeals to all Veterinary academicians and research scientists, working in Universities, Research Institutes, Hospitals and Clinics, Livestock Farms etc. to communicate with us with their important findings on various aspects of health and productivity in all types of domestic livestock. The Blue Cross Book shall convey them further to the actual beneficiaries through the field Veterinarians, who are the core readers of this publication.



Prakash Khaire
Managing Director,
MSD Animal Health

Dear Colleagues,

It gives me an immense pleasure to release the 26th edition of Blue Cross Book.

MSD Animal Health is committed to the Enhancement of Scientific Knowledge of its customer that we believe will help improving the well being of Animals and Birds which influences the Economic status of those who are dependant for their livelihood on this vocation.

We are engaged in the business of translating the scientific knowledge into either products or the services for the benefit of our customers and we are continuously in look out for the inputs from the scientific community to improve our offerings.

We therefore count on your support and suggestions to improve it further.

Sincerely Yours

Prakash Khaire



Dr. Ernst Arndt
Ex-Country Head

Even though this is the 26th edition of the Blue Cross Book, it is a very special edition in that it is the 1st edition issued since our company has proudly become MSD Animal Health. With this change of name, we are entering a new era in the history of our company which will build on a proud past to do even more in our quest for excellence.

I think it is apt to share with you – our valued colleagues - the Vision and Mission of MSD Animal health:

Our vision is to be the leading force in delivering new and valuable animal health products and solutions, thus improving the health of animals. Our efforts will ensure sustainable quality food supplies, protect public health and help people and pets enjoy their lives together.

Our mission is to build on our rich science credentials and work closely with veterinary and industry partners, animal owners and animal health experts to develop and market innovative, integrated animal health products and services.

I believe that this publication will continue to make a great contribution towards living up to the above vision and mission.

Ernst Arndt
MSD Animal Health
The Science of Healthier Animals

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Role of Vitamin E and Selenium in bovine reproduction

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Introduction

The majority of livestock in India is exposed to various stresses due to high livestock population, improper nutrition and inadequate management practices as well as different environmental conditions due to tropical climate. This stress leads to production of free radicals which affect reproduction and production in many ways. In dairy production system, reproductive efficiency affects the income by influencing overall milk production, genetic gain and amount of replacement heifers. Nutrition, management and genetics play a major role in achieving maximum reproductive performance. In nutrition, the use of trace minerals and vitamins in animal feed is important. However in most of the feeding systems, the use of vitamins and trace minerals is ignored which has adverse effect on production and reproduction performance. During the last two decades, importance of vitamin E and selenium in reproduction and production for dairy cattle has been recognised.

Free radicals and its production

A free radical is an atom or group of atoms or molecules that has unpaired electron in its outer orbit which is unstable and has very short life. Oxygen is most important for aerobic organisms. During its metabolism, powerful oxidants such as free radicals are produced. As every unstable radical tends to get stability, it reacts very rapidly with any other element in its surrounding. The free radicals are generally categorized into following classes, based on the attachment of unpaired electron with an atom or molecule (Table I).

In the tissues as well as gamete cells, the production and detoxification of ROS, RNS and other free radicals are normal physiological events of the cellular metabolism. There are many stress conditions in which excessive production or accumulation of free radicals produces its undesirable effects. In regard to gamete cells, ROS form of free radical formation is common and important which has adverse effects.



Table I : Different categories of free radicals.

Sr. No.	Class of free radical	Atom or molecule unpaired with electron
1	Reactive Oxygen Species (ROS) <ul style="list-style-type: none"> • Singlet oxygen • Superoxide anion • Hydroxyl radical • Perthhydroxyl radical • Hydrogen peroxide 	Oxygen
2	Reactive Nitrogen Species (RNS) <ul style="list-style-type: none"> • Nitric oxide • Nitrous oxide • Nitrogen dioxide 	Nitrogen
3	Lipid Radicals <ul style="list-style-type: none"> • Lipid alkyl radicals • Conjugated diene radicals 	Lipid
4	Thyl Radicals	Sulfur

Importance of antioxidant mechanism

Antioxidants are molecules that can easily and harmlessly give up an electron. When free radical gains the electron from an antioxidant, it no longer needs to attack the cell and chain reaction of oxidation is broken. There are two lines of antioxidant defenses within the cell. The first one found in fat soluble cellular membrane consists of vitamin E, beta-carotene and coenzyme. Of these, vitamin E is considered the most potent chain breaking antioxidant within the membrane of the cell.

Pathological effects of free radicals in female reproductive process

ROS appears to have physiological role in female reproductive tract in different processes such as: oocyte maturation, fertilization and luteal regression. Whenever there is an imbalance in the levels of ROS and antioxidants, damage can occur to oocytes and embryos through various pathological mechanisms. It may affect the ovulation, fertilization, embryo development and implantation (Corach and Ives, 1991).

Oxidative stress appears to have a detrimental effect on the development of embryo. ROS may originate from embryo metabolism and from the surrounding environment. ROS not only alters most types of cellular molecules but also induces early embryonic developmental block and retardation (Goto et al., 1992)

Effects of free radicals on sperm cells

i) Lipid peroxidation or lipid damage

Reactive Oxygen Species (ROS) can attack polyunsaturated fatty acids in the cell membrane leading to a chain of chemical reactions called lipid peroxidation. The breakdown of fatty acids results in the formation of various oxidatively modified products, which are toxic to cells and are finally converted into stable end products. The spermatozoal membrane contains large amounts of polyunsaturated fatty acids, which maintain its fluidity. Peroxidation of these fatty acids leads to the loss of membrane fluidity, rearrangements of phospholipids, blebbing and increased permeability leading to perforability, reduction in the activity of membrane enzymes and ion channels and complete break down of membrane architecture (Riley and Behman, 1991). As a result, the normal cellular mechanisms that are required for fertilization are inhibited. Lipid peroxidation also impairs cell membrane ion exchange that is essential for normal sperm motility (Rao et al., 1989)

ii) Sperm DNA damage

Lipid peroxides formed during lipid peroxidation through ROS can damage DNA through oxidation of DNA bases. Deoxyribonucleic acid bases and phosphodiester backbones are sites that are susceptible to peroxidative damage. Other DNA abnormalities occur in sperm includes base modification, production of base free sites, deletion, DNA cross-links and chromosomal rearrangements (Cross et al., 1987).

iii) Decreased sperm motility

Excessive ROS leads to gradual drop in the flagella beat frequency of spermatozoa. The major event responsible for this is the peroxidative damage and subsequent fall in ATP (Gomez et al., 1998).

iv) Improper capacitation and acrosome reaction

The ROS affect both capacitation and acrosome reaction process. Also ROS present in the female genital tract probably stimulate unmasked hidden targets after the removal of cholesterol during capacitation process and react with these targets to activate some of the pathways eventually leading to improper capacitation and acrosome reaction (Delamirande et al., 1998).

ROS can play a negative role in the male genital tract itself by altering the substances present in the plasma that prevent sperm



from undergoing capacitation and inducing premature capacitation.

v) Apoptosis

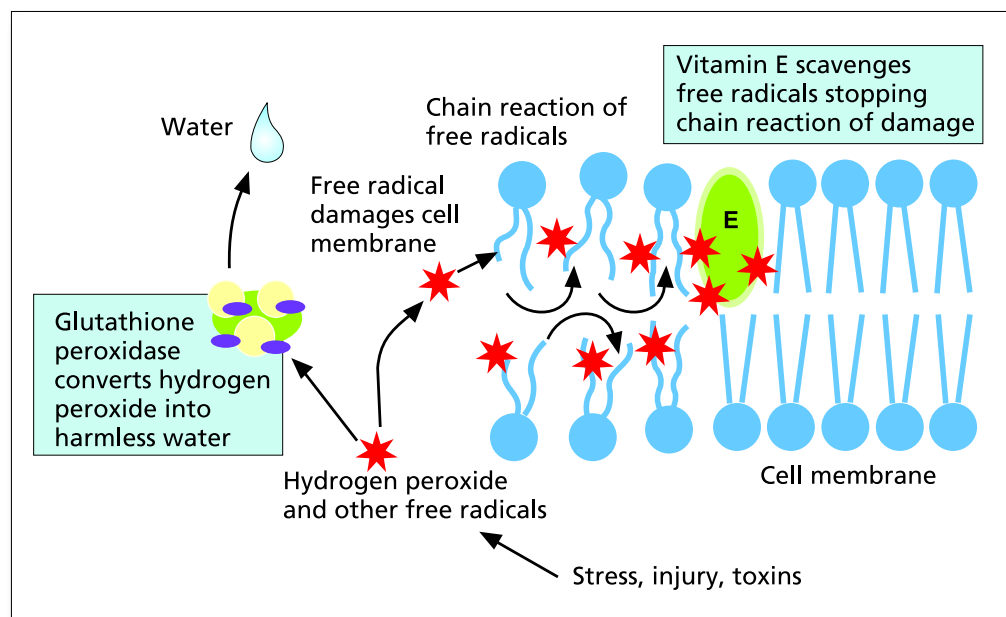
ROS may also initiate a chain of reactions that ultimately lead to apoptosis. Apoptosis is a natural process in which the body removes old and senescent cells. It is a process of programmed cell death. ROS were found positively associated with apoptosis in mature spermatozoa. The process of apoptosis may also be accelerated by ROS-induced DNA damage and ultimately may lead to a decline in sperm count (Aitken, 1999).

Vitamin E as antioxidant

Vitamin E is a generic term used for a group

of chemically-similar compounds sharing the tocopherol and tocotrienol structures, which are lipid-soluble; hence, vitamin E is known as a fat-soluble vitamin. Vitamin E was first identified as nutritionally essential for animals about 60 years ago. Rats fed purified diets without vitamin E did not reproduce. Vitamin E has long been recognized as a natural biological antioxidant. Vitamin E appears to be the first line of defense against peroxidation (oxidation by peroxides) and is important for maintaining low tissue concentrations of peroxides, which if allowed amassing or accumulating in cells can severely damage the cell and tissues. Vitamin E is a very efficient scavenger of free radicals such as peroxides in tissues (Fig. I).

Figure I : Pathway of vitamin E in breaking chain reaction of free radicals.

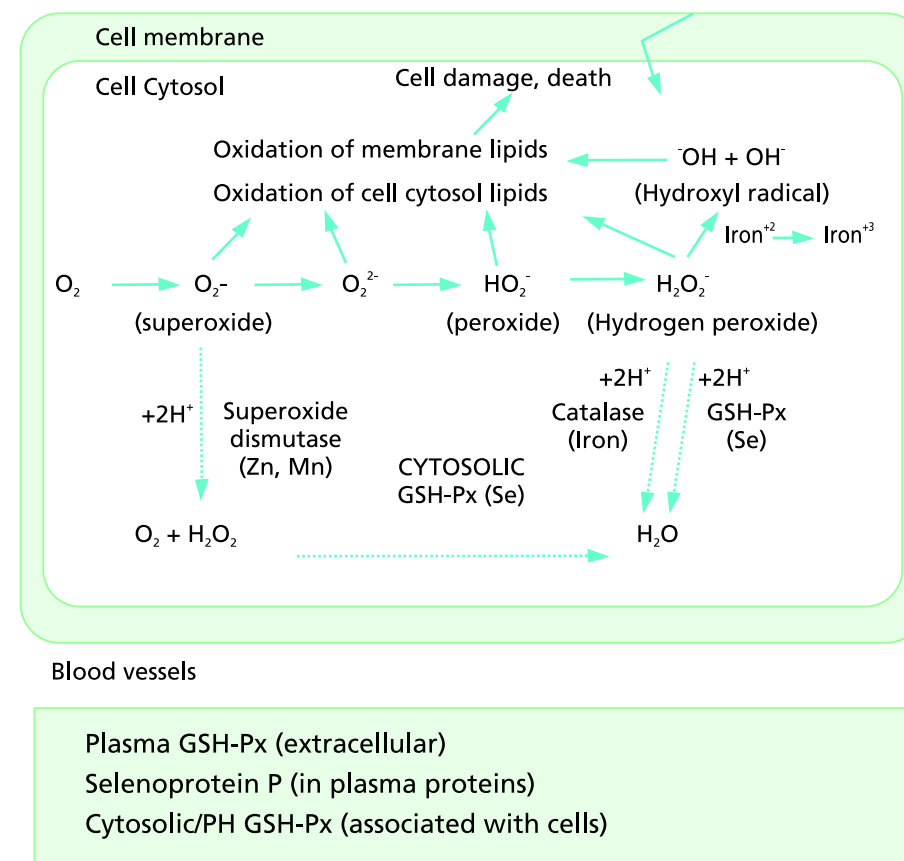


Selenium (Se) as antioxidant

Selenium was originally identified as a potentially toxic element long before it was recognized to be an essential trace mineral. Plants absorb selenium from the soil if it is available and incorporate it into several amino acids, replacing sulfur as part of the normal structure. The most important role for selenium is as an anti-oxidant because it is an essential component of the selenoprotein glutathione peroxidase. Glutathione peroxidase protects cell

membranes from damage from free radicals released from hydrogen peroxide formed during normal metabolism in the cells' mitochondria. Stress can cause excess hydrogen peroxide to be created which causes an imbalance of free radicals inside the cell. The chain reaction serves to damage the membrane causing the cell to die. Glutathione peroxidase converts hydrogen peroxide into water before it can produce damaging free radicals (Fig. II).

Figure II : Pathways of selenium in cell as antioxidant.





Selenium has also been recently found in another enzyme, 5'-deiodinase, that catalyzes the reaction of the inactive form of thyroxine to the active form. Thyroxine is a very important hormone from the thyroid that helps in regulating body temperature, metabolism, reproduction, circulation, and muscle function. It is known that Se protects the body from heavy metals such as cadmium, mercury and silver by forming unreactive complexes with them. There are theories that Se may be involved in many other processes in the body, like prostaglandin synthesis, essential fatty acid metabolism and normal immune response.

Selenium also influences uterine involution and post-partum ovarian activity through its postulated effect on immune function, uterine contractibility, thyroid hormone metabolism and synthesis of prostaglandins (Witchtel et al., 1996).

Importance of synergetic role of selenium and vitamin E

In recent years, vitamin E and selenium have been frequently discussed together because of their close relationship. Selenium spares vitamin E or reduces the requirement for vitamin E. Likewise; vitamin E appears to reduce the requirement for selenium. Selenium and vitamin E are both antioxidants because they both protect the membranes from oxidative damage. Due to this shared duty, there is a relationship between the compounds, in which one can substitute for the other in a very small way.

For instance, more Se is needed when an animal's vitamin E concentrations are low.

Selenium spares vitamin E by:

1. preserving pancreas integrity for normal fat digestion, thus normal vitamin E absorption
2. reducing the amount of vitamin E needed to maintain lipid membranes via GSH-Px
3. aiding in the retention of vitamin E in the blood

Vitamin E spares Selenium by:

1. maintaining body Se in an active form and preventing its loss from the body
2. preventing destruction of membrane lipids from within the membrane, which inhibits the production of hydroperoxides and decreases the amount of GSH-Px needed.

Pivotal role of Vit. E and Selenium in bovine reproduction

1. High lactating animals are prone to stress during transition period (i.e. 30 days before calving and 70 days post-partum). During this period there is efflux of various nutrients like glucose, proteins, calcium, phosphorus as well as micronutrient for fetal growth and regeneration and development of mammary tissue during pre-partum period. During early post-partum, all these nutrients are required for milk

synthesis, involution of uterus, regeneration of uterine epithelium, removal of lochia and establishment of reproductive cycle. Most of the time, animals may be under negative energy balance, sub clinical ketosis and hypocalcaemia. Supplementation of vitamin E and selenium during pre-partum / early post-partum period reduces stress and hasten these processes leading to early expulsion of placenta, faster uterine involution, reestablishment of reproductive cycle and improving reproductive efficiency.

2. Supplementation of Vitamin E and selenium increases immunity of the animal during post-partum by infiltration of PMN cells in uterus which reduces chances of uterine infections. Chances of clinical and sub clinical mastitis are also likely to reduce.
3. When animals are under stress (particularly summer stress) and outside the comfort zone, there is an increase in cutaneous blood flow, activate sweating, increased respiratory activity, reduced feed intake and water consumption. Animals make adjustment through panting and salivation. During this stress, free radicals are formed which affect production and reproduction. Supplementation of antioxidants like Vitamin E and Selenium reduces free radical formation during this hot climate and prevent the

animals from adverse effect of free radicals.

4. The stress produced due to change in the physiology of the animal as in disease condition, imbalance of nutrients, high production, improper environment including high temperature and humidity, leads to formation of free radicals which affects sperm cells, oocyte and developing embryo leading to fertilization failure and early embryonic mortality.
5. The free radicals formed due to various stress conditions may affect the normal rhythmic functioning of endocrine glands. Thus, there is an abrupt, inadequate or rebuff release of hormones from the endocrine glands. This leads to change in follicular wave formation, follicular atresia, improper maturation and delayed ovulation or anovulation leading to anestrus. If fertilization occurs, the embryonic signal (secretion of interferon) is weak that may not be sufficient to block PGF2 α production which in turn causes luteolysis and early embryonic losses.
6. When animals are under stress condition, there is an increased level of prolactin and cortisol. These hormones have negative feed back effect on hypothalamus and inadequate release of releasing hormones (GnRH, TRH) and subsequently less secretions of FSH, LH



and oxytocin from pituitary gland. This cascade of events leads to improper folliculogenesis and maturation or ovulation leading to infertility.

7. Free radicals formed due to oxidative stress alter normal sperm functions including capacitation, acrosomal reaction and zona binding. There is also reduction in sperm motility, decreased oocyte penetration ability, blocking of sperm egg fusion and damage to sperm DNA leading to fertilization failure and loss of conception.

8. When dairy animals are under stress due to either pregnancy or lactation, particularly in periparturient cows, inadequate dietary antioxidants may increase oxidative stress leading to production of lipid peroxides and incidence of retained placenta.

The beneficial effects of vitamin E and selenium in bovine reproduction have been demonstrated by different researchers (Table II)

Table II – Beneficial effect of vitamin E and selenium for improvement reproductive efficiency in bovines.

Sr.No.	Name of Scientist	Observation
1	Brazezinska et al., 1994	deficiency of antioxidants or excess exposure of ROS have direct effect on bovine reproductive performance.
2	Miller et al., 1993	dietary supplementation of antioxidants has reduced incidence of retained fetal membrane in dairy cattle.
3	Thomas et al., 1990	administration of vitamin E and selenium at pre-partum reduced incidence of retained fetal membrane.
4	Pavlicek et al., 1979 Trinder et al., 1973	significant reduction in occurrence of retained fetal membrane with supplementation of vitamin E and selenium before calving.
5	Kim et al., 1997	shortened calving to first service interval with vitamin E/Se @ 500IU/40 mg administered 21 days before expected calving
6	Puls 1994	Se supplementation reduces the incidence of retained placenta, cystic ovaries and metritis

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Sr.No.	Name of Scientist	Beneficial Effect
7	Ezzo 1996	duration of first post-partum heat was shorter in buffaloes given vitamin E and Se supplement.
8	Jukola et al., 1996	supplementation of vitamin E and Se reduced the incidence of anoestrus and sub estrus in cattle.

Conclusion

Majority of cattle and buffaloes are exposed to various stress conditions which may arise due to improper nutrition, inadequate management practices as well as different environmental conditions due to tropical climatic conditions. This stress leads to production of free radicals which adversely affect reproductive processes and also production potential of animals. To overcome this stress, use of antioxidants is essential. Vitamin E and selenium act as antioxidant by reducing free radical formation. Hence use of vitamin E and selenium containing mineral mixture in daily concentrate ration is very much beneficial for restoration of normal reproduction and production in bovines.

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Parasitic Gastroenteritis in ruminants

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The livestock in India has contributed towards generation of substantial revenue, providing employment, animal protein, fuel, manure and also alternative means of traction and transportation due to its large population. The health status and productivity of domesticated animals, however, requires attention. The reasons are, large population with rapidly diminishing grazing areas, consequent overstocking, poor nutritional standard, traditional husbandry practices compounded by clinical or sub-clinical multiple worm infections (Chowdhury and Tada, 1994).

Gastrointestinal helminthic infection in livestock is common and the economic losses due to parasites are enormous. Parasitic gastroenteritis is regarded as a

major impediment to profitable ruminant production. It results in poor carcass quality, condemnation of liver and gut, reduced production and reproductive failure.

The common symptoms such as anorexia, anaemia, hypoproteinaemia, submandibular oedema, reduced body weight, decrease in ruminal movements, alteration in the serum ions and minerals are the usual manifestations. However, it is not always possible to make conclusions regarding deranged physiology and the secondary manifestations of disease, such as anorexia, productivity loss, diarrhoea or haematological changes. Dietary factors are found to influence clinical symptoms and larval challenge of immune animals may cause impaired production, despite low parasite burdens. It is, therefore, vital to consider nutrition and immune status of the host in any field observation.

Parasitic gastroenteritis (PGE) is a serious helminthic infection, widespread in the subcontinent as in other parts of the world, particularly in tropical countries. PGE is a gastroenteropathy caused by mixed infections with several nematodes

belonging to three main families, namely, Ancylostomatidae, Strongylidae and Trichostrongylidae with the occasional involvement of members of Ascarididae, Strongyloididae and Trichuridae. PGE is a disease complex due to multiple helminthic infections including nematodosis, cestodosis, immature amphistomosis and hepato-intestinal schistosomosis.

Epidemiology of Parasitic Gastroenteritis (PGE)

Parasitologically, the day-to-day changes of the meteorological elements affecting a locality, expressed as seasonal or annual values, is climate, while weather includes the day to day meteorological conditions which constitute the climate. Thus, climate influences the general epidemiological pattern, while weather determines the timing and magnitude of specific events that make up that pattern.

Factors influencing epidemiology bionomics of free-living stages

The pasture which in its broadest meaning is the complex of herbage, faeces, soil and mat (the layer of organic matter on the surface of the soil) provides the microenvironment in which free living or pre-parasitic development and survival must take place. The number of infective stages which eventually become available to the host depends on the independent and interactive influences of several factors in the macro

and micro environment. These include temperature, moisture, humidity, sunlight, oxygen supply, structure of the soil, growth and composition of pasture herbage as well as size and consistency of faeces. Of these, temperature and moisture exert the dominant influence and are the most conveniently measured parameters.

The laboratory and field studies have provided valuable information, significantly contributing to the knowledge of climate-free living stage relationship and its relevance to parasite epidemiology as presented below:

1. Free-living stages of nematode parasites of grazing animals differ in their responses to environmental conditions, notably temperature and moisture. These differences exist within and between nematode species. In general, third stage larvae (L3) and embryonated eggs, are the least susceptible to adverse environmental conditions, followed by unembryonated eggs first stage (L1) and second stage larvae (L2) in that order.
2. High moisture levels, particularly surface soil moisture, which is determined by the amount and distribution of precipitation, rate of evapotranspiration from the soil as well as by vegetation and soil type are a general requirement for larval development and migration. On the other hand, excessive moisture or precipitation associated with sustained



torrential rainfall characteristic of the wet season in the tropics, adversely affects development of eggs and pasture larval densities through rapid disintegration of faeces and washing away of eggs and larvae by rain and floodwater and also possibly through reduced oxygen tension in water logged faeces. By contrast, larval development and survival, particularly in faeces of cattle and other large ruminants, may be considerably enhanced during prolonged dry weather. The smaller the faecal mass, the faster are its rate of moisture loss and the rate of mortality of free-living stages; hence, there is hardly any larval development in faecal pellets of small ruminants in unshaded pasture, during the hot dry season.



3. Warm conditions and a continuous film of moisture are required for successful translation of L3 onto herbage. In some situations, larval dispersal in pasture may be aided by various mechanical agents such as farm machinery, implements and foot wear of farm personnel. Biotic factors such as some species of fungi which have been shown to transport larvae of *Cooperia punctata* and *T colubriformis* and psychodid flies which can mechanically transport L3 of *Oesophagostomum* and *Ostertagia* sp.

may also be involved in larval dispersal in pasture in some situations.

4. Once on herbage, the longevity of L3 is extremely limited under hot dry tropical conditions. In the Trichuridae and Ascarididae, which do not have free living infective larvae, the infective egg can survive in a warm humid environment for several years but their longevity is also severely curtailed during the hot dry season and by direct sunlight. Surviving eggs in soil have been shown to be a source of infection for animals in subsequent years.

Seasonal Patterns of Infection

Two distinct patterns of pasture infestation may be encountered in the tropics, depending largely on the distribution of rainfall. One pattern is seen in the dry tropics and in subhumid zones which have clearly defined favourable and unfavourable seasons for preparasitic development. In both climatic zones, the latter season is sufficiently hot, dry and prolonged to cause complete cessation of free living development and survival.

In the less dry parts of the subhumid and wet tropics, faecal reservoirs of L3 are also a very important additional source of the early rain herbage infestation in dry season. Such larvae develop and accumulate inside faecal pats throughout the dry season, but do not

appear on herbage until adequate moisture conditions return at the start of the succeeding rainy season. A spontaneous and synchronous translation of the entire faecal larval population then takes place, usually within 24 to 48 hours of 'the first substantial rainfall of the season. In spite of the high mortality of eggs and larvae in faecal pats soon after deposition, large numbers of L3 invariably survive inside the dry faecal masses to ensure massive early rain herbage infestation. A similar phenomenon has been described in temperate and sub tropical climates where it is of considerable epidemiological importance.

A continuous cycle of infection between host and pasture is maintained when the rains return and favourable environmental conditions are re-established.

However, pasture larval densities and worm populations in animals fluctuate considerably throughout the season in response to variations in the size of contamination, grazing intensity and frequency, short-term fluctuations in weather conditions and host responses to infection.

Managemental and Husbandry Practices that influence PGE

Livestock husbandry systems and managemental practice have a major influence on the transmissibility of

helminthic infections to a susceptible host population just as meteorological and other environmental factors largely determine the size of the overall population of infective stages of nematode parasites available in the environment at any given time. While methods of livestock management are based on modern intensive practices in large Government and private commercial and institutional farms, the practices at the field level could be

- (1) permanent confinement with or without restricted grazing.
- (2) semipermanent confinement with some free grazing.
- (3) Free range system with no confinement.
- (4) Nomadic and transhumance types (Transfer to humus - transfer or pass from summer to winter and winter to summer pastures- transfer across humus-ground.)

Opportunities for acquisition of worm infections and the risk of disease outbreaks will vary according to the type of husbandry and livestock production system in the particular area. In some traditional systems, which utilize extensive grazing, faecal contamination takes place and infective stages are thinly spread over a large territory. Therefore, heavy infections rarely occur, especially where animals are able to select their feed or browse. The same is true in village herds and flocks that are necessarily permanently housed and fed on



cut fodder and foliage, which have little chance of being contaminated with infective stages. In such village production systems, infections when present are usually chronic and sub clinical in nature. On the other hand, housed animals maintained entirely on zero grazing or other cut and carry feeding regimens, sometimes acquire significant worm infections if the fodder is contaminated with infective stages and litter

is allowed to accumulate for long periods in warm humid sheds. Confinement of large numbers of young animals in unhygienic and wet environments also predisposes them to heavy infections, particularly with skin penetrating nematodes like *Bunostomum* and *Strongyloides* spp.

Young animals are unlikely to acquire significant infection with trichostrongylid nematodes from pasture for as long as they rely on their dam's milk for nourishment. As they get older and more independent and begin to graze or browse, their worm burden increases in proportion to the level of pasture infestation. As a result, calves which are weaned during the dry season acquire lighter infections than those weaned during the rainy season when pasture infestation is generally high.

Nutrition

Host nutrition influences the outcome of nematode infections. Improper feeding leads to lowered resistance and increased establishment, survival and pathogenicity of the parasite and hence there is increased morbidity and mortality of the host. Gastrointestinal nematodes, for example, exert these effects through a variety of pathogenic mechanisms as follows:

1. Anorexia and post absorptive disturbances in protein metabolism.
2. Some usually localized impairment of digestive and absorptive functions.
3. Endocrinological disorders
4. Disorder of gastrointestinal smooth muscle reactivity and gut motility.



Host age, Acquired Resistance and Genotype

Age also influences the susceptibility of the host to helminth parasites and the pathogenicity of the latter. This influence has an Immunological basis. In well established host parasite relationships, parasite populations in the host are regulated primarily by mechanisms and processes associated with either natural or acquired resistance, the latter being under

genetic control. It is as a result of natural resistance that some nematode parasites which are well adapted to one host species may be unable to establish and reproduce successfully in another host. This is the basis for using mixed and alternate grazing of different species of animals for the control of animal helminthoses. Acquired resistance, on the other hand, occurs more widely and helps to control parasite populations in field infections. Of the many manifestations, resistance to the establishment of new infections, inhibition of ovulation and worm rejection are of epidemiological significance.

In general, indigenous tropical breeds are more resistant than their exotic counterparts, while crosses between the two are intermediate in their response, particularly with regard to establishment of worms in the host, faecal worm eggs output and pathogenicity of infections, all of which are of epidemiological importance.

The control of parasitic helminths in domestic animals relies largely on the use of anthelmintic drugs. Although anthelmintics are used in all domestic species, the largest market is undoubtedly the ruminant market, especially cattle, where thousands of rupees are spent annually in an effort to reduce the effects of parasitism.

Several points should be considered where anthelmintics are used prophylactically:

First, the cost of prophylactic treatment should be justifiable economically, by increased production in food animals, or by preventing the occurrence of clinical or subclinical disease, for example, horses with strongylosis or cattle and sheep with common helminthic infections.

Secondly, the cost-benefit of anthelmintic prophylaxis should stand in comparison with the control which can be achieved by other methods such as pasture management.

Thirdly, it is desirable that the use of anthelmintics should not interfere with the development of an acquired immunity, since there are reports of outbreaks of disease in older stock, which have been overprotected by control measures during their earlier years.

Finally, prolonged prophylactic use of one drug should be avoided as this encourages the development of anthelmintic resistance.

Prevalence of Gastro – intestinal Parasitism in Karnataka (A sample study)

1. In a co-ordinated research project, the prevalence pattern of gastro-intestinal parasites in different seasons, taluks and age groups of animals was studied in the areas covered by the four Karnataka Dairy Development Corporation (KDDC) milk unions of Bangalore, Mysore,



Tumkur and Hassan. The data compiled at the 4 diagnostic laboratories over a period of 5 years on samples screened for gastro-intestinal parasitic infection was analysed statistically. An overall 52.07 and 54.61 per cent gastro-intestinal parasitic infection was recorded in cattle and buffaloes respectively in the 4 KDDC milk union areas. The analysis of variance test applied on the data revealed that the occurrence of gastro-intestinal parasitic infection was statistically significant in all the unions. Amphistome infection was the most predominantly occurring parasitic infection.

- Season played an important role in the occurrence pattern of parasitic infections, parasitism was commonly observed in the South West Monsoon season (June, September), and hence control measures were to be implemented accordingly.
- In one study, Ziauddin et al (1987) recorded observation on causes of mortality, based on necropsy finding among bovines in Mysore and Mandya districts of Karnataka. It was reported that gastro-intestinal parasitism contributed to 20.69% and 66.07% of deaths among cattle and buffaloes respectively.
- In a recent study (Mamatha, 2004), revealed a highest infection rate of strongyle in cattle (83.6%) and

buffaloes (39%). Similarly, a study in sheep and goats in seven districts of Karnataka revealed parasitic gastroenteritis of 91.33% and 78.66% in these species, respectively.

- Ten sheep flocks located in six districts of Karnataka were screened for their status of gastro-intestinal infection (Dhanlakshmi et. al, 2001). Strongyle (82.8%) and Haemonchus spp was found in majority of the farms, followed by Oesophagostomum.
- The age incidence studied in Mysore and Hassan Unions revealed significant relationship in the occurrence of parasitic infections in the 4 different age groups (0-1, 1-4, 4-8 and above 8 years) in cattle, however probably due to lesser number of observations in buffaloes, no significance was evident. The incidence of gastrointestinal parasitic infection was found to be highest in the 4-8 years age group followed by 1-4 years in the Hassan Union and in the above 8 years age group in the Mysore Union. However, for purposes of implementation of prophylactic measures it can be safely presumed that animals above 2 years of age pick up infection and remain as carriers and disseminators of infection by contaminating pastures. Although analysis indicated a lower infection rate in the animals in the age groups of 0-1 and 1-4 years, it is felt that the number of

animals screened in these age groups were less.

- A study was conducted by Jayakumar et al., (1991) to assess the incidence of amphistomes in cattle slaughtered at Bangalore. The incidence rate was 46.12% and it was maximum during October to November and minimum from January to April. A total number of nine species viz., *Gastrothylax crumenifer*, *Paramphistomum epiclitum*, *P. cervi*, *P. explanatum*, *Fishoderius elongatus*, *F. cobboldi*, *Cotylophoron cotylophorum*, *Calicophoran calicophorum* and *Ceylollococtyle scoliocoelium* were recorded.

It can thus be concluded that the prevalence of G.1. parasites in the state is considerably high and requires attention so as to check its economic impact. The findings be useful and indicative in other States of the country as well.

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Estimated losses due to various livestock diseases in India (Per annum)

Disease	Loss (Rs. in Crores)
Reproductive disorders	50,000
FMD	20,000
Mastitis	7,200
Buffalo male calves mortality	4,500
Helminth infestations	260
PPR	180



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"Rabies" - a Review

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Introduction:

Rabies is a highly fatal viral infection of central nervous system occurring in all warm blooded animals and is transmitted by the bites of affected animals. Rabies is the most unpredictable disease with variable incubation period depending upon site of bite. Disease is manifested by motor irritation with clinical signs of mania and attack complex, progressing as an ascending paralysis. The disease is communicable from infected animals to human beings and as such is known as "ZOO NOTIC DISEASE". Rabies is, therefore, an important public health problem and the disease is spread through a bite of an infected animal-usually the dog, whose saliva is rich in virus.

The rabies virus is known to be maintained in wild animals like foxes, Jackals, raccoons, squirrels, other carnivores, bats and some of them are likely to be the symptomless



carriers of virus. Bats are, however, known to be carriers of virus in fatty tissues, and spread by bites to others. Although there may be variation in pathogenicity of the rabies virus collected/originating from different species, all of them invade the central nervous system of the host within a variable incubation period (depending on the distance of brain from the site of bite) and all strains of viruses are equally pathogenic and cause death of the affected host within a period which may be variable. The duration of illness in an infected host is usually 1 to 10 days but never more than 14 days. Hence, the patient with nervous symptoms or paralytic signs need to be kept under observation for the period of 14 days to rule out rabies. Symptomless carrier of rabies virus has also been reported in dogs and as such it is extremely difficult to give or rule out diagnosis of rabies, and this increases the responsibility of Veterinarian.

ETIOLOGY & TRANSMISSION:

The rhabdovirus of rabies is truly a neurotropic and causes lesions only in nervous tissues. The virus is large in size and is very fragile. Although the saliva of the infected dog contains abundant virus, it may not necessarily always be infective, particularly if the saliva is wiped off or the



wound washed with plenty of water and use of any ordinary soap immediately within 15 to 20 minutes after a dog bite. Dried saliva may not always be infective, similarly the virus may not always be present in the saliva for a period up to 5 days before appearance of clinical symptoms. Although foxes are infected, they do not spread the disease fast as they do not bite a large proportion of a herd or a flock. A bite of a rabid dog on the part covered by cloths usually is not infective. Similarly the virus although is likely to be present in milk, is capable to transmit the disease through consumption or handling the milk, but consumption of milk after boiling is usually safe. Moreover, infection of virus through gastro intestinal tract has not been reported. However, milker, while milking process and handling, if has a small wound/scratch over his hands is definitely at a risk of getting infection. Bats as the only species are known to be symptomless carriers of the virus in their fatty tissues where the virus can multiply, and can transmit the disease through bite to susceptible host. The reason why irritation phase of symptom usually precedes the paralytic stage is that the nerve cells are destroyed after getting inflamed.

PATHOGENESIS AND CLINICAL SYMPTOMS:

The incubation period is highly variable and there are reports of occurrence of clinical symptoms usually between 1 to 6 days after the bite, but there are reports of appearance

of symptoms even after as long as 6 to 8 months or longer. Virus travels along with the nerve tissue in the site of bite and hence longer the distance to reach the brain and size of inoculum, both govern the length of incubation period. The virus if serially passaged intracranially, gets modified and becomes a "fixed" virus and gives rise to the symptoms of ascending paralysis in contrast to the "street" virus which more commonly causes the furious form of disease.

Diagnosis of rabies is one of the most difficult and important duties of a Veterinarian, as the failure to recognize the disease may place human life in jeopardy. It is not sufficient to say that if rabies, occurs in the area, one will classify every animal showing symptoms is rabid because nervous symptoms may not be evident for some days after the illness commences.

It is likely that inoculation of virus in the wound may produce initial viraemia and as a result the virus may get located in almost any organ cells and may be excreted in milk as well as saliva, urine and stools. Hence, to be on safe side, it is advisable not to use milk and meat from a cow or goat showing nervous symptoms (mania) or paralytic symptoms with or without a confirmed history of dog bite. Confirmatory diagnosis and demonstration of viral particles in blood, secretions and excretions like milk, urine and saliva is not easy or possible without support of a well organized sophisticated laboratory with experienced

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laboratory technicians. Disease invariably is fatal and death occurring within 10 to 14 days with nervous symptoms and paralysis following irritative form and as such strict isolation and observation for at least 14 days is recommended for declaring the diagnosis of rabies. Postmortem examination of brain is always advisable in every such suspected case for confirmatory diagnosis. Profuse salivation and inability to make swallowing action due to paralysis of swallowing muscles of throat, typical hoarse voice due to laryngeal paralysis and oversensitive responses giving rise to hyperexcitability, in coordination of gait and tendency of attacking an individual without any provocation are the typical clinical symptoms of rabies observed in the dogs. Excitability and mania at the sight of water due to uncontrollable thirst, gives rise to symptom as "fear of water" and hence name "HYDROPHOBIA" to the disease.

Virus from the vampire bats invariably produces a paralytic (dumb) form and following death of neurons in spinal cord or brain (hippocampus and Purkinje cells) where demonstration of cytoplasmic eosinophilic "Negree bodies" which are the inclusion bodies of virus particles is possible for confirmatory positive diagnosis of rabies.

LABORATORY CRITERIA:

One or more of the following:

1. Detection of rabies antigens by direct Fluorescent Antibody Test (FAT) or by

ELISA in clinical symptoms.

2. Demonstration of virus in brain tissue, saliva or after intracerebral inoculation in mice or suckling mice.
3. Detection of rabies neutralizing antibody titer of the serum or CSF of an unvaccinated person.
4. Detection of viral nucleic acids by PCR or tissue collected post mortem or in a clinical specimen (brain tissue, skin, urine or saliva)

PROCUREMENT OF EQUIPMENTS AND DRUGS:

1. A 1.0 ml. syringe and needle for each intramuscular/intradermal vaccination.
2. Vaccine between 2 and 5 vials depending on method used.
3. Following vaccines meeting WHO safety potency be only used for post exposure intradermal treatment of rabies.
 - a) Human Diploid cell culture (HDV) "RABIVAC"
 - b) Purified Vero cell vaccine (PVRV) "Verorab", "Imovax", "Rabies Vero". "TRC Verorab"
 - c) Purified chicken embryo cell vaccine (PCECV) "Rabipur"

OTHER SPECIAL ASPECTS:

- It is possible for person to person rabies

transmission since secretions may contain virus.

- As a precaution, the medical & nursing staff should wear mask, gloves and goggles.
- Pre vaccination of Medical, Veterinary and Nursing staff be considered.

- Do not use organs of patients with rabies or any neurological disease for transplantation.

- Intersectoral co-operation of medical and veterinary services, community involvement and participation are required for targeted response and control in animal reservoirs.

Rabies :

The Facts

- Virus secreted in all secretions and excretions
- Virus gets killed in 1% soap solution
- Virus is present in all tissues of body
- Viraemia possible at the very start or at the terminal stage of disease
- Aerosol possible in bat cave like situation
- Annual boosters after pre-exposure immunisation shall provide life long immunity cover



Rabies is transmitted by:

- Bite of rabid animal
- Lick on intact mucosa
- Suckling milk
- Consuming raw meat
- Mating
- Fresh saliva on fresh wound
- Inserting hands with cuts into rectum/buccal cavity

Rabies is not transmitted by:

- Non-puncturing bite of rabid animal
- Lick of rabid animal on intact skin
- Consumption of boiled milk of rabid animal
- Fresh saliva on healed wound
- Inserting hands with gloves in buccal cavity/rectum of rabid animal
- Patting on the back of rabid animal

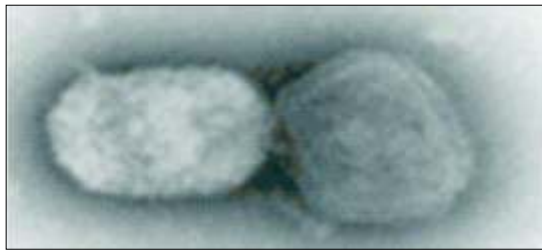


Pox disease of buffaloes - an emerging zoonosis in India

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Introduction:

Buffalopox is a viral disease of buffaloes, characterized by typical pox lesions mainly on udder, teats, buccal cavity, ear, eyelids and to some extent on other parts of the body. The disease has great economic importance, as the lesions on udder and teats, if severe, milk yield goes down up to 50-80%. The animal may develop mastitis because of the secondary infection and sometimes become unproductive. Symptomatic treatment of one animal may cost about Rs. 500/- to 600/-. Due to zoonotic nature of the disease, losses in manpower hours for a week's period also contribute to economic loss.

Etiology:

Buffalopox virus belongs to Family Poxviridae, Genus Orthopoxvirus. It is 300 x 100 nm, brick shaped virus.

Geographic Occurrence:

The incidence of buffalopox virus has been noted in Brazil, Egypt, Indonesia, Iran, Pakistan, Bangladesh and India. In India, Haryana, Uttar Pradesh, Madya Pradesh, Maharashtra, Tamil Nadu, Rajasthan, Gujarat, Andhra Pradesh and Karnataka have reported buffalopox outbreaks.

In Maharashtra, the cases have been reported from the various villages of the districts Dhule, Jalgaon, Beed, Latur, Nanded, Usmanabad, Aurangabad, Nashik, Ahmednagar, Pune, Solapur, Sangli and Kolhapur. It occurs generally during the months of August to April.

In India, buffalopox disease is being reported since 1934 till date with less to severe morbidity. There were number of viral isolations from vesicular fluids and skin scabs from humans and buffaloes. Few viral isolates were obtained from milk samples.

Disease in Animals:

Susceptible hosts are mainly buffaloes, but cows and human are also affected. Lesions on teats, udder, ear, eyelids with some generalized form are common. Some cases

Figure 1 : States in India reporting buffalopox outbreaks

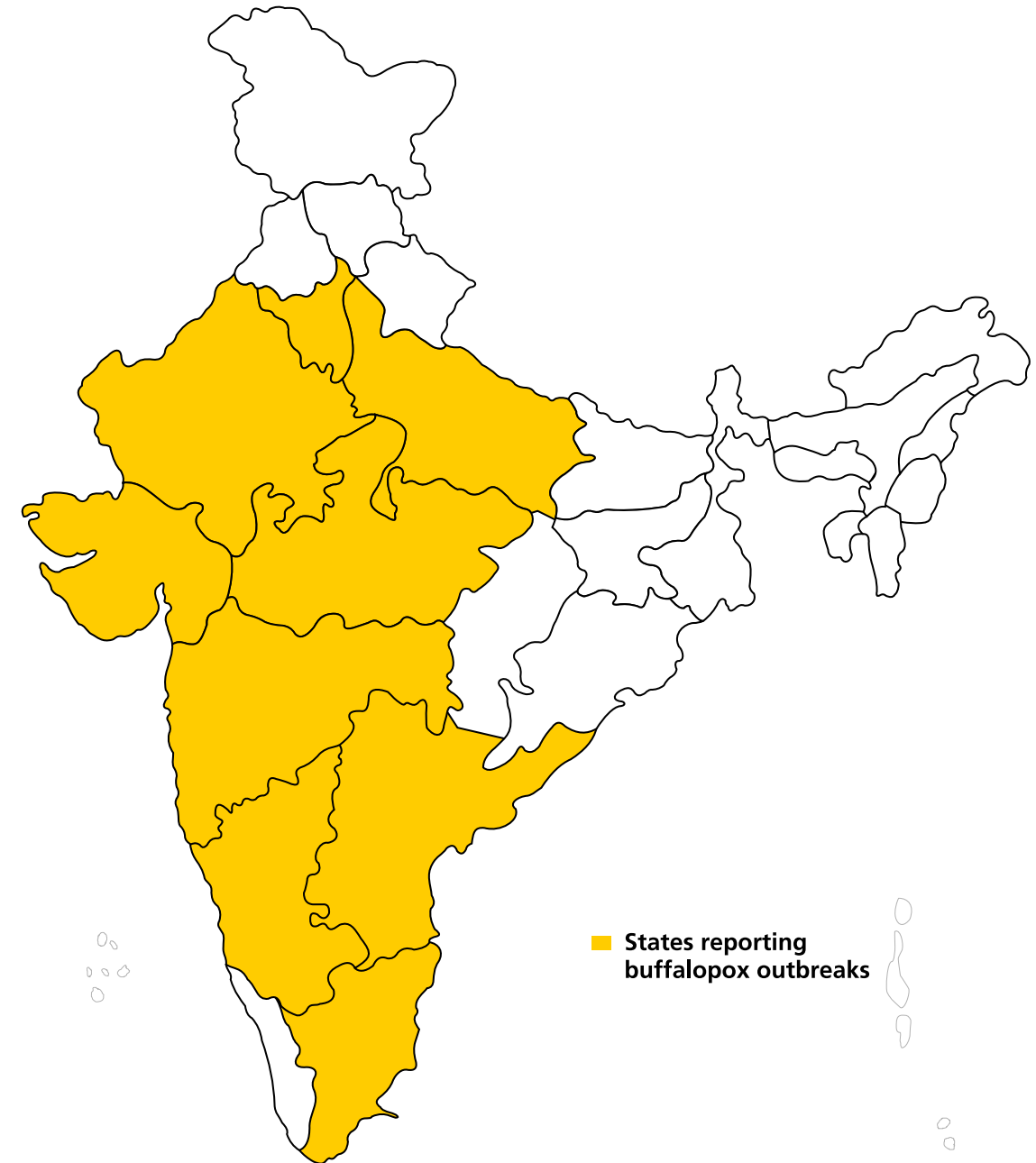




Figure I : Lesions on the teats



Figure II : Lesions on the ear



Figure III : Vesicular lesions on the base of ear



Figure IV : Blepharitis & conjunctivitis

were reported with concurrent otitis and conjunctivitis with purulent discharge. No mortality in adults, but in calves, mortality may be due to anorexia if the lesions are on the buccal mucosa (Fig. I-IV).

Disease in Humans:

Both the genders and all age groups of human beings contract the disease. The clinical symptoms include fever for 2-3 days, pox lesions on hands, localized swelling, pain at site and corresponding axillary lymphadenitis. Generalized one or two lesions could be observed on the face, leg and other body parts. Sero-survey in the affected villages revealed neutralizing antibodies in sera of affected humans and in

70% of their contacts (Fig. V, VI and VII).

Transmission:

Close contact with infected animal transmits the disease. Animal handlers are generally affected by the close contact of the active lesions. Mechanical transmission is possible by flies and insects. Rodents may play the role of reservoir in the ecology.

Sample collection:

Samples to be collected include blood, serum, vesicular fluid, scab and milk. The samples should be collected in sterile and properly labeled container and transported in cold chain to the diagnostic laboratory.



Figure V : Vesicular lesions



Figure VI : Scab lesion



Figure VII : Scab lesions

Animal Models:

Rabbits, rats and mice were found to be the choice of laboratory animal models for the various types of studies of buffalopox disease. Experiments conducted in chick embryos, albino rabbits, infant mice and electron microscopic observations revealed a pattern of morphogenesis similar to that of vaccinia virus, except that the extracellular forms of the virus were devoid of well defined lateral bodies. Study conducted by intranasal instillation of buffalopox virus in infant suckling mice produced fatal disease, which can be used as an animal model for studying pathogenesis of buffalopox virus.

Diagnosis:

Buffalopox disease diagnosis becomes easy as the typical pox lesions erupt on the skin of the buffaloes and the human beings of close contacts mainly with buffaloes. Further confirmatory lab diagnosis can be achieved by detection of genome by Polymerase Chain Reaction (PCR) and analysis by sequencing. Virus particles detection by Electron Microscopy by negative staining of

vesicular fluid or microsectioning of scab may help for supportive evidence. Detection of neutralizing antibodies from the serum samples of animals and humans of close contact add to the evidence of magnitude of the disease.

Virus isolation by following methods and detection by EM, PCR supports the concrete evidence of the etiological agent and disease.

In ovo: (embryonated egg inoculation)-chorioallantoic membrane (CAM)

In vitro: (cell culture) BHK-21, Vero. for cytopathic effect,

In vivo, scarification of shaved skin of rabbits for development of pox lesions.

Treatment:

Generally symptomatic treatment is advisable. Cleaning and washing of infected as well as normal animal during outbreak with 1% potassium permanganate solution is of great help. Topical application of antibiotics on lesions and broad-spectrum antibiotics to check the secondary infections is advisable.



Control:

Segregation of the affected animals and symptomatic treatment to check secondary infections (particularly the mastitis) are recommended to curtail the disease. Restricted movement of affected animals may help to prevent the further spread of the disease. Animal handlers should use the gloves for washing, cleaning and during treatment of the lesions. Affected persons should not touch the new animals as well as avoid the close contact of family members.

At present, there is no vaccine in the market available for this disease. Development of an indigenous attenuated buffalo pox virus vaccine for buffaloes has been attempted and field trials are soon expected.

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Successful management of visceral schistosomiasis in a bullock

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Introduction:

Schistosomiasis is an economically important disease of domestic animals and human beings, mostly found in the tropical and subtropical zones of the world. *Schistosoma indicum* and *S. spindale* are the most common causative agents of visceral schistosomiasis in domestic animals, particularly in ruminants and equines of the Indian subcontinent (Kumar V and De Burbure G, 1986). The disease is widely distributed in cattle, buffaloes, sheep and goats in India (Agrawal and Southgate, 2000). The present paper puts on record a case of visceral schistosomiasis in a non-descript bullock and its successful therapeutic management.

Case history and Clinical Observations:

A Ten year old non-descript bullock was referred to the Department of Veterinary Medicine, College of Veterinary and Animal Sciences, Parbhani with history of partial loss of appetite, weakness, depression and

passing of blood with straining during defecation since last 3 to 4 days. The bullock was earlier treated at local village hospital with styptics, NSAID and astringent preparation but did not show any response. Clinical examination of the bullock revealed moderate rise in body temperature (103.4°F), dyspnoea, palor of mucous membrane, colic pain from the abdomen and suspended ruminal motility. On inspection, it was observed that the bullock was passing streak of fresh blood before defecation with intense straining (Fig .1).



Figure 1

*Department of Veterinary Parasitology



Figure 2

The bullock was further subjected to laboratory investigations such as haematology, fecal analysis and estimation of blood clotting time.

Hematological examination revealed anaemia (Hb-6.2 gm %), leucocytosis ($15.2 \times 10^3/\text{dl}$) and neutrophilia (58%). Clotting time was also found elevated to 10 min and 20 seconds. The fecal examination performed by sedimentation technique as described by Soulsby (1982) showed presence of *Schistosoma indicum* eggs 2-4 per microscopic field (Fig. 2). On the basis of characteristic clinical manifestations and faecal examination, the present case was confirmed as Visceral (Intestinal) Schistosomiasis.

Therapeutic management and Discussion:

The bullock was treated with specific therapy of Praziquantel @ 20 mg/kg b.wt orally daily for 3 consecutive days along with supportive therapy of fluids and electrolytes,

gut acting antibiotic, styptics, astringents, antispasmodics, haematanics and Vit K preparation. The patient was kept under observation for one week. The bullock showed positive response to the treatment as there was abatement of symptoms from the second day. The bullock regained its appetite and fecal consistency returned to normal with absence of intestinal bleeding, indicating signs of recovery. The therapeutic regimen of specific praziquantel and supportive drugs were continued for 3 days. Post-treatment fecal sample collected after week's time was found negative for *Schistosoma indicum* eggs. Complete clinical recovery took about one week and the bullock was discharged from the hospital.

Schistosomes are the blood flukes of the genus *Schistosoma* belonging to family Schistosomatidae. *Schistosoma* spp and in particular *S.indicum* and *S.spindale* are found in the mesenteric veins of the ruminants (Soulsby, 1982) and cause visceral schistosomiasis. In the present clinical case, streaks of rectal bleeding before defecation could be due to capillary damage by the sharp spines of *Schistosoma* eggs and its aggravation during straining leading to the manifestations of Visceral Schistosomiasis.

Visceral Schistosomiasis caused by *Schistosoma* species is characterized by frequent diarrhoea with blood and mucus, colic, weight loss and weakness in animals

(Mohanty et al, 1984). Egg granulomas were observed in the liver and intestine of ruminants (Frankson et al, 1990). This disease is generally chronic in nature and symptoms in majority of animals are insufficient to distinguish the illness from other debilitating infections (De Bont J and Vercruysse J, 1998). Kahn (2005) discussed clinical signs such as hemorrhagic enteritis, anemia and colic in ruminants associated with intestinal schistosomiasis. Similar clinical findings were also observed in the present clinical case.

Bushara et al (1983) reported excellent efficacy of Praziquantel against *Schistosoma bovis* infection in cattle. Jadhav (2010) documented efficacy of praziquantel against intestinal and nasal forms of schistosomiasis in bovines. In the present clinical case, affected bullock responded well to Praziquantel therapy and showed recovery within a week.

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Another use (or misuse?) of Oxytocin

Oxytocin is a hormone for let down of milk in mammalian females. Though controversial, oxytocin is widely used in India for let down of milk, particularly in buffaloes, when a calf dies and buffalo stops giving milk. Recently, oxytocin has been in the news for increasing fruit size in cucurbitaceous vegetables (Dudhi/Louki). Oxytocin is injected at the peduncle at the fruit set. Investigative study, however, proved it to be a myth. The farmers are advised to stay away from this practice.

Source : ICAR News



Management of recurrent ante-partum Cervico - Vaginal Prolapse (CVP) with hydroxyprogesterone and PGF₂α.

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Introduction :

Typically, prolapse of the cervix and vagina (CVP) is a disorder of ruminants, normally in late gestation. Occasionally, it is observed after parturition and rarely it occurs unconnected with pregnancy or parturition (Noakes, 2009). Though the CVP is seen in all species of animals, it is more common in dairy animals as compared to draft breeds. The causes of prolapse of the vagina and cervix are multiple. It is more common during last two months of gestation when a large amount of estrogenic hormone is being secreted by the placenta. The present communication describes management of CVP, using Hydroxyprogesterone and PGF₂α.

Case History and Clinical Observations:

A 4 year old, seven month pregnant, pluri-parous, 75% HF cross bred cow, was referred to the Dept. of Gynaecology & Obstetrics, K.N.P. College of Veterinary Sciences, Shirwal with a history of recurrent, cervico - vaginal prolapse. The prolapse was evident when cow was sitting and unseen

when cow was getting up or standing. The cow was treated symptomatically by local Veterinarian. However, CVP did not respond to routine treatment and hence was referred.

Obstetrical Management and Discussion:

On thorough clinical examination, all the physiological parameters were found within the normal limit. On per-rectal examination it was observed that the fetus was alive. The vulva and the perineal region were scrubbed thoroughly with the mild antiseptic solution. The prolapsed mass was also cleaned thoroughly with chilled potassium permanganate solution (Dilution I: 1000) followed by lubrication with intra mammary preparation. The prolapsed mass was then repositioned as per the method described by Arthur (1964).

The present case of ante-partum CVP was observed in confined, well fed and high yielder cow in an organized dairy farm. It was tentatively diagnosed as prolapse due to increase in intra-abdominal pressure due

to the oversize of fetus as the cow was inseminated with 100% HF bull's semen. It is also suspected that CVP might be due to excess estrogen as leguminous grass lucern was fed on the farm.

Leguminous grasses are rich in estrogen. Therefore owner was instructed to feed non-leguminous greens and reduce concentrate feeding, so as to reduce the rumen volume which might reduce the intra-abdominal pressure. As per the instructions, owner reduced the concentrate and leguminous grass feeding. Similarly, the owner was instructed to let loose the cow in the farm so as to get sufficient exercise, as ante-partum CVP is more observed in confined animals (Roberts, 1971). Simultaneously, Oxytetracycline - LA, was administered. With this treatment cow did not show any ante-partum CVP for next 35 days. However, after 35 days, there was recurrent ante-partum CVP. Hence, earlier treatment was repeated along with Hydroxyprogesterone (Long acting depot) 500 mg intramuscularly. After 15 days Hydroxyprogesterone 500 mg intramuscularly was repeated, as animal was not nearer to parturition and to avoid the recurrence of ante-partum CVP. The cow did not show any CVP up to 8.5 months of the gestation. But thereafter, the prolapse recurred which was difficult to reposition to natural position back. Hence, it was decided to induce the parturition with PGF₂α. Inj. Cloprostenol was administered

@ 500mg I.M. after which cow showed relaxation of the uterus and parturated after 24 hours of the treatment. The weight of the calf was 32 kg. After parturition there was no CVP observed.

As in any disease, best treatment is to remove the cause. Similarly, in present case cause of CVP was considered to be excessive estrogen which might be secreted by placenta. However, after the drop in progesterone level, CVP was observed. As near to the completion of gestation, it was impossible to reposition CVP back to the natural position. Therefore, parturition was induced with PGF₂α which showed uneventful recovery with no relapse. This confirms that the ante-partum CVP could be treated patiently according to prevailing causes and if the animal is nearer to parturition, the parturition can be induced with PGF₂α.

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Effect of Single GnRH administration at the time of insemination on conception rate in crossbred cows

Sharma Mukesh and Sharma Kranti

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Rajnandgaon (Chhattisgarh)

Introduction:

Timely conception is an important factor in dairy industry. The early conception saves 21 days expenditure on feeding and management which is very important for dairy farmers. In crossbreds, delayed ovulation is encountered sometime, which leads to failure of conception even after successful insemination. Delayed ovulation and anovulatory estrus is usually due to delayed LH surge. GnRH plays an important role in release of LH. In this study, attempt has been made to overcome the delayed LH surge and subsequent conception.

Material and Methods:

In the present study, 50 CB cows of same age and lactation were divided in two groups. In group I, 2.5 ml Receptal* was

injected intramuscularly at the time of insemination (12 hr post detection of heat). Group II was treated as control. Per rectal examination was done after 60 days of insemination for confirmation of conception.

Result and Discussion:

Table I. indicates the results. Five animals of group I showed symptoms of heat after 21 days of insemination and 8 animals of group II were found in heat after 21 to 25 days of insemination. Per rectal examination was performed after 60 days and 17 animals were confirmed for pregnancy in group I and 12 animals were found pregnant in group II. The study showed that 20% more animals were found pregnant over control group. This indicates that use of GnRH at the time of insemination regulates the surge of

Table - I : Effect of administration of GnRH analogue on conception rate in CB cows

Group	No. of cows in experiment	No. of cows not repeating oestrus	No. of cows Pregnant	Conception Rate
I	25	20	17	68%
II	25	17	12	48%

*Inj. Receptal : Buserelin acetate 0.0042 mg/ml (Intervet India Pvt. Ltd)



LH and improves conception rate by regulating the ovulation time.

Findings of the present study are in agreement with Rao and Rao (1984), Shankar et al., (1989), Majumdar (1989) Stevan et al., (1988), and Shelar et al., (2002).

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Indian Dairy Sector-I

Milk powder and butter oil importing country in the fifties, attains a status of highest milk producing and milk exporting country in the world during nineties. This is the story of Indian dairy sector, which any countryman should feel proud of. The Veterinarians, Animal Scientists and Dairy Technologists in India, hand in hand with dairy animal owning landless labourers and marginal farmers brought about 'white Revolution' in India between 1970 and 1996. The milk production and per capita availability which was 23 million tonnes and 112 gm respectively during 1970, reach to 110 million tonnes and 252 gm during 2007-08 and to 114 million tonnes and 261 gm during 2010-11.



Vaginal delivery of mummified fetus in cattle

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The present case describes the successful delivery of a mummified fetus in cattle with PGF₂α along with diethylstilbestrol and valethamate bromide.

Case history, observation and treatment

A crossbred Holstein Frisian cow (weighing about 500 kg) in her second pregnancy was presented with the suspicion of fetal death at 6 months of pregnancy. The cow had one previous normal delivery. Animal was examined by local Veterinarian with no conclusive finding and was referred to Teaching Veterinary Clinical Complex. Per-rectal examination revealed fixed cervix with dropping of uterus into abdomen which was out of reach by hand. Futile attempt to retract the cervix was made. No placentome was palpable with absence of fremitus. However, pregnancy diagnosis by Preg-Alert (ultrasonographic machine) revealed presence of fluid in the uterus. On ultrasonographic examination by B-mode, uterus could not be scanned due to more gas filled viscera. On the basis of findings of per-rectal examination, the case was diagnosed as a case of fetal death and it was decided to induce parturition. Per-vaginal

Introduction

Bovine fetal mummification is one of the gestational accidents that occurs both in uniparous and multiparous animals. Occurrence of this is rare and sporadic (Roberts, 1998) and has been reported although in 3rd to 8th month, but most commonly in 4th, 5th and 6th month, of gestation (Noakes et al., 2001). Fetal mummification occurs in cattle with an incidence of 0.13-1.8% (Barth, 1986). If the condition is undiagnosed, mummified fetuses remain in the uterus for months beyond a normal gestation period until treatment is given to expel them or until they are removed by caesarean section. Treatment for bovine mummification with several drugs has been reported in the literature from other parts of the country (Saxena et al., 2001; Srinivas et al., 2007).



examination revealed completely closed os. On the first day, 40 mg of Dexamethasone was administered intravenously. Inj. Iliren 5ml was injected intramuscularly 24 hours after dexamethasone administration. On the 3rd day, per-vaginal examination revealed one finger dilated os. A hard fetal mass was palpated in the pelvic cavity with passage of brown, chocolate coloured exudate through vulva. The animal was injected with Valethamate bromide (100 mg) intramuscularly. Per-vaginal examination 24 hours later revealed same status of os-cervix to that of previous day and hence a second dose of Inj. Iliren along with Diethylstilbestrol (80 mg) was administered. A brown coloured mummified fetus delivered with passage of brown chocolate exudates at about 14 hours after injection Iliren and Diethylstilbestrol (62 hours after first injection of Inj. Iliren). The mummified fetus was cat sized, lacking hairs, developed claws and sockets with no eyeball, indicating that death of the fetus might have occurred at around 5th month of gestation. Following removal of the fetus, a course of antibiotic --

Inj. Floxidin (Enrofloxacin @ 5mg/ kg body weight for 3 days intramuscularly) was given. The cow exhibited estrus after 60 days and was bred artificially. Per rectal examination of the animal at 70 days post breeding revealed pregnancy.

Discussion

The findings of no fetal movement, closed cervix, absence of cotyledon, fremitus and a hard mass with oozing of chocolate coloured discharge per-vaginum were sufficient to diagnose the case as fetal mummification. Similar findings were recorded in fetal mummification by earlier workers (Arthur et al., 1996; Roberts, 1998; Azizunnesa et al., 2010). Roberts (1986) stated that if the mummified fetus exists for longer period in the uterus, the fetus becomes drier, firmer, and more leather like.

In the present case, expulsion of the fetus was probably hastened by administration of second dose of Inj. Iliren (PGF₂α) at 48 hours interval along with estrogen preparation that helped in initiation of myometrial contraction, relaxation of cervix and involution of corpus luteum. Administration of Valethamate bromide at 48 hours from injection of first dose of prostaglandin resulted in further relaxation of cervix. In bovines, vaginal delivery of mummified fetus with prostaglandin administration have been reported earlier (Aruna Kumari et.al., 2003), where single injection of prostaglandin was sufficient for expulsion of mummified fetus. However, Saxena et al. (2001) could deliver bovine mummified

fetus using Valethamate bromide, Estradiol valerate, Betamethasone and Prostaglandin F₂α. Delivery of mummified fetus was achieved quite lately (i.e. 8 days) following PGF₂α administration in a crossbred cow (Srinivas et al., 2007).

Haematic type of mummification has been described earlier in bovines by several workers (Roberts, 1998; Sane et al., 1982; Aruna Kumari et.al., 2003). As the maternal placenta or caruncles undergo involution, variable amount of haemorrhage occurs between endometrium and fetal membrane which after the placenta has been absorbed leaves a reddish brown tenacious mass of autolyzed red cells, clots and mucus. This imparts a reddish brown colour to the fetus.

Summary

Vaginal delivery of mummified fetus from a crossbred Holstein Frisian cow following administration of iliren (PGF₂α), valethamate bromide and diethystibestrol has been reported.

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Aural Haematoma in Canines: a comparative study of treatments with different techniques

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Introduction :

Aural haematoma is frequently encountered problem in canines. (Narwade et al. 1992, Reddy et al. 1992). Sobti et al. 1994, and Aithal 2000, have tried different techniques to treat this condition. This study compares the different techniques used in the treatment of aural haematoma.

Material and methods :

This study compares three established techniques. Out of 27 cases, 10 cases were treated with homeopathy drugs, 10 cases were treated using surgical technique and 7 cases were treated with allopathic drugs i.e. combination of Inj. Dexamethasone and Inj. Gentamicine.

In the homeopathy trials, all the cases were

treated with 30x potency Hammalis, Bufo and Arnica. Six globules of each drug were mixed and used thrice in a day till the disappearance of swelling. Approximately it took 3 weeks to cure the condition.

Surgical technique was employed under sedation with thiopentone sodium @ 20mg/kg. bodyweight. All the necessary aseptic precautions were undertaken and incision was taken under local anaesthesia on the concave surface of the affected ear. Fluid was drained out and the dead space between cartilage and skin was washed with antiseptic solution. Vertical mattress through and through sutures were applied over the ear. The pinna was turned over the head and bandage applied.

Wounds were dressed regularly upto fifth post operative day and parental drugs, the combination of amoxicillin and cloxacillin were used. The sutures were removed after 12th post operative day and the wounds were dressed upto healing.

In the last technique, the aural haematoma was drained with the help of sterilised 16 gauge hypodermic needle. This puncture was made on the concave surface of the ear.

The cavity was thoroughly irrigated with normal saline so as to remove the clots and debris. A combination of Inj. Dexamethasone @ 0.25 mg/kg and Inj. Gentamicin @ 1 mg./kg was introduced into the cavity through the same puncture needle. Then solution was spread by gentle touch. The pinna was left free and no pressure bandage was applied as suggest by Aithal et al. (loc.cit).

Results and Discussion :

These trials were the comparative study of different techniques for the treatment of aural haematoma. It also suggests the most suitable technique, which is easy to employ and effective for early recovery.

Surgical technique was found lengthy, costly and requires long attention. At the same time affected ear was found shrunken after recovery.

The use of homeopathic drugs and surgical technique requires patience, time, expenses and co-operation of the patient.

The technique, which was suggested by

Aithal et al. (loc. cit) is most suitable, practicable and it needs less expenses. No abnormalities with structure of pinna can be noticed.

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Incidence of Babesia outbreak in sheep

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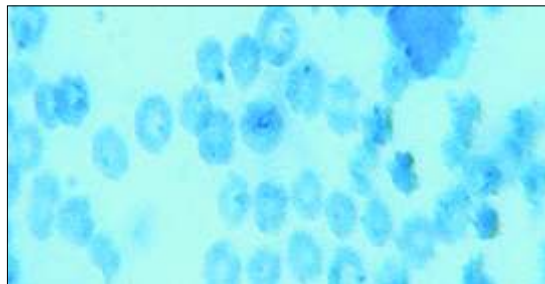


Figure : 1
Introduction:

Outbreaks of bacterial and viral diseases are commonly observed due to fast spread of infective agents through air, water, pastures as well as through contacts. Routine investigation methods and common symptoms help to control such of outbreaks. Outbreaks due to tick borne diseases are found to be rare and only sporadic cases are observed in flocks of sheep / goats. Outbreaks of protozoal diseases are rare. In the present study, babesiosis outbreaks have been discussed.

Materials and methods:

Sheep illness and mortality was recorded from 15 villages of Satara district especially in Khandala and Phaltan talukas. Flocks of 40-100 sheep were located in these villages. During the month of February and March 2010, 30-40% mortality was observed in many of the flocks.

Clinical signs observed included rectal temp 106-107° F, anorexia, red to coffee colored urine, respiratory distress and death. 50 blood samples were collected in citrated vials from jugular vein from affected flocks. Direct blood smears were collected from ear vein.

Detailed hemogram and differential count was done as per the routine method suggested by Maxine and Benjamine (1978). Hemoprotozoa were detected under oil immersion at 100X by using Olympus CH20i microscope.

Detailed postmortem examination was carried out on the carcasses of sheep as per the procedure described by MAFSU (2004)

The ailing animals were treated with Inj. Diminazine Aceturate (7%) @ 8 mg/ kg body weight intramuscularly and Inj. Sodium Acid Phosphate @ 10 mg/ kg body weight administered intramuscularly, Standard liver tonics and oral hematinics were also provided along with Inj. Levofloxacin @10-12 mg/ kg body weight intramuscularly.

Results and Discussion:

Hematological examination revealed severe anemia in all the animals (range of hemoglobin was 2.3 to 4.7 g/dl). Total



Figure : 2 Yellow discoloration of liver tissues

leucocytic count was between the range 12,000 to 18,000 cells/cmm, the differential count was variable but consistent neutrophilia and monocytosis was evident in all the sheep. In RBCs *Babesia ovis* were detected in all the blood smears. (Figure 1)

Post mortem examination: revealed yellow discoloration of subcutaneous tissues, blood vessels, mucous membranes and all serosal surfaces. Liver was completely yellow (figure 2), gall bladder was distended

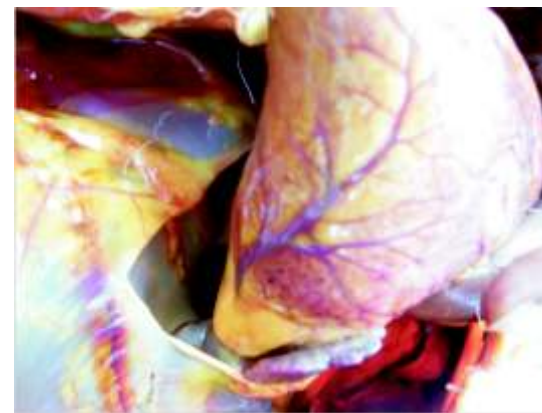


Figure 3 : Yellow discoloration of heart and pin point hemorrhages

and showed pin point hemorrhages. Pericardium was filled with yellowish fluid and heart showed yellow discoloration and pin point hemorrhages (figure 3), thoracic cavity was filled with serous fluid, pleura was thickened and extensive lung edema (figure 4) and froth in trachea was noticed. Kidneys were congested and medulla was yellow in colour, urinary bladder was filled with coffee colored urine (figure 5). It was concluded that the animals died due to severe hemolytic anemia and complicated due to jaundice and hypoxemia.



Figure 4: Lung edema and yellow froth in trachea and bronchi

Other ailing animals were treated as per the schedule and they showed very fast recovery. Most of the animals recovered within two to three days period. A supportive treatment with liver tonics and hematinics was given daily for seven days.

Conclusions:

An early diagnosis of protozoal diseases is needed to prevent losses in sheep as many



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Figure 5 : Coffee colored urine in urinary bladder.

Indian Dairy Sector-II

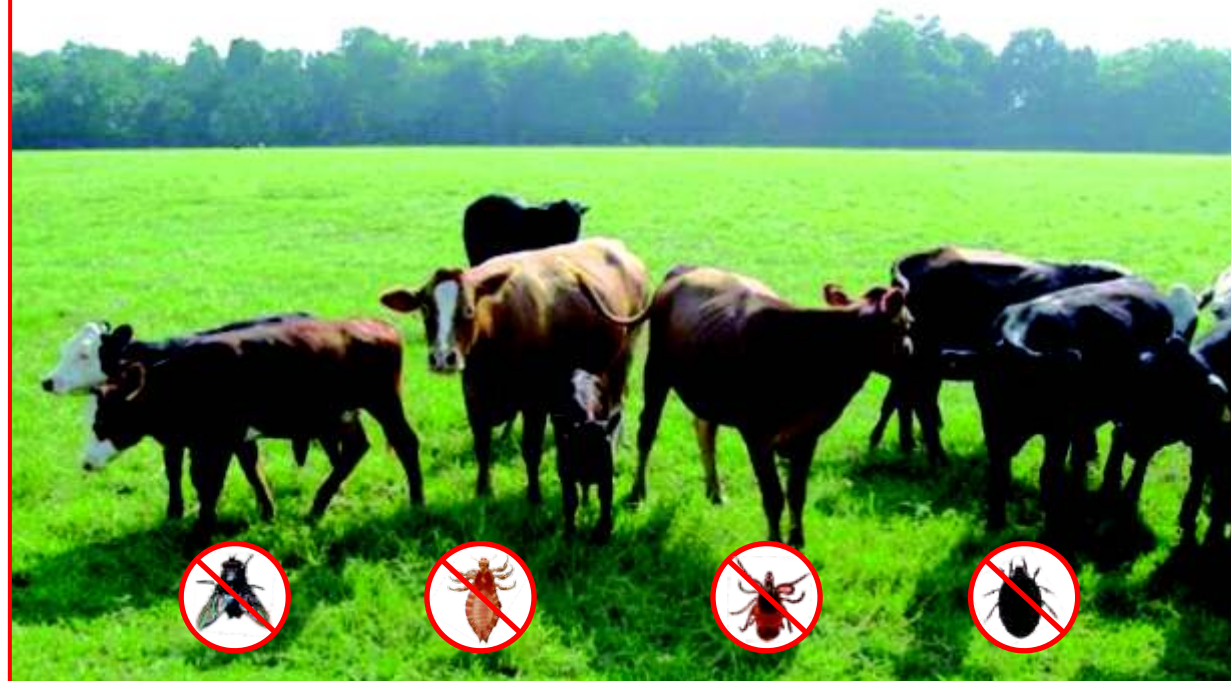
White Revolution

India's major demand of milk supply (43%) was being met through imported milk powder and butter oil during the fifties. The National Dairy Development Board was established in 1965 to find out ways and means to produce and supply milk to Indian population without any import.

With the sale of milk powder and butter oil worth Rs. 100 crores received from European Union during 1969, the money was invested to rejuvenate 18 dairy co-operatives then existing. This helped in getting more money to milk producers. More and more milk producers joined the co-operative movement in milk production and distribution. Starting in 1969 and closing in 1996, the 'Operation Flood Project' inducted 94 million dairy producers through 73 thousand primary village dairy co-operatives. The milk production in 1969 (21 million tonnes) went up to 66 million tonnes in 1996 and India became Number One country in milk production in the world.



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Tibiometatarsal chondrosarcoma in a pigeon (*Columba livia*)

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Introduction:

Although the neoplasms of livestock are commonly reported, neoplasms in birds are not reported often and they are extremely rare in free-flying birds (Siegfried, 1983). This could be because of shorter lifespan of avian species and difficulty in treating such dreadful conditions. Majority of the available reports are related to captive birds. Few cases of tumours such as seminoma in a ibis (Effron et al;1977), hepatocellular carcinoma, adenocarcinoma, hepatocellular tumour and cholangiocarcinoma in lesser flamingoes (Lopez and Merino Moncada, 1986) and sertoli cell tumour in a pigeon (Razmyar et al, 2005) have been reported. This paper presents a case of chondrosarcoma in a Pigeon.

Case History:

A common pigeon (*Columba livia*) approximately one and half years of age was

presented for the treatment with the history of limping since a month with a huge swelling on the left leg. Clinical examination revealed swelling with ulcerative wound over the left leg covering the tibia, hock and metatarsal area. The history revealed that the owner was advised treatment with local antibiotic ointment by a Veterinarian, however, it did not work and the swelling was gradually increasing in size. The owner reported that the swelling has gradually increased with ulcerating wound formation and the pigeon could not put the foot on the perch nor able to fly as it was doing previously.

Clinical examination revealed the swelling to be hard with small areas of softness, squeezing of which resulting in caseated discharge through the smaller pores over the swelling. The motor reflexes were absent in the limb however, the sensory reflexes were present. The radiographic study revealed destruction of proximal metaphysis of tibia and metatarsal bone, periosteal elevation, loss of trabecular pattern of the affected bone and destruction of hock joint indicating osteogenic tumour with tendency to spread.

Considering the malignant nature of the

tumour and absence of reflexes, amputation of the leg at higher level was the only choice in order to alleviate the pain and to increase the longevity of the bird. Thus the pigeon was operated under ketamine dissociative anaesthesia and the limb was amputated at the level of stifle joint. The pigeon was given oral antibiotics for five days through the drinking water. The pigeon recovered in ten days and no complications were reported by the owner.

The histopathology of the tissue revealed pleomorphic cells with increased cellularity, immature spindle shaped cells at the periphery and fully differentiated cartilage cells at the center. The variably sized islands of cartilage were separated by loose fibrovascular connective tissue. The histopathological features suggested it to be chondrosarcoma of tibia and metatarsal bone, an uncommon malignant tumour which characteristically forms mature cartilage. A similar case of chondrosarcoma of nictitating membrane in a wild Great White Heron (*Ardea herodias occidentalis*) has been reported by Spalding and Carroll-Woodard (1992). They opined that this tumour is found mostly in the small bones of the limbs, although it can also occur in long, tubular bones, primarily the humerus, femur and ribs. The cartilaginous portion of the tumour from this case was almost identical histologically to the chondrosarcoma with similar islands or cartilage on the metatarsal-phalangeal joint of a free-flying ruffed

grouse (*Bonasa umbellus*) by Siegfried (1983). According to the authors, the chondrosarcoma may have genetic or viral etiology.

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A case of Centric Fusion Translocation in a Deoni cattle bull calf

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Introduction

Among various numerical and structural chromosomal aberrations reported so far, the translocations are very common in cattle breeds, which are known to cause varying degrees of sub-fertility (Long, 1985). In balanced form, it has no visible effect on body conformation, because the genetic material present in the centric fusion chromosome is the same as in the two separate chromosomes. The centric fusion translocations are also known as Robertsonian translocation as it was first observed by W R B Robertson (1916) while working with grasshoppers. The Robertsonian 1/29 translocation is the most frequent structural chromosomal abnormality in cattle (Popescu, 1978) that was first observed in Swedish Red breed of cattle. It has been documented in various frequencies in about 60 different breeds of both *Bos taurus* and *Bos indicus*. Besides, many cases of centric fusion translocation involving other chromosomes have also been reported in various breeds of cattle worldwide (Patel, 1999). Such

translocations have also been documented for other large animal species (Singh et al, 1994).

India possesses 15% of the total cattle population and there are 30 distinct breeds of indigenous cattle (National Bureau Animal Genetic Resources, India). These cattle are classified in three categories, mainly milch, draught and dual purpose breeds. In addition, a large number of nondescript cattle with poor productivity are also geographically distributed all over the country. However, most of the Indian cattle breeds are well known for their draught resisting quality and to withstand diseases and parasites. Deoni is one of the Indian cattle breeds (*Bos indicus*) known as dual purpose cattle.

This is the first time that a centric fusion translocation involving probable chromosome number 16 and 20 {59,XY,t(16;20)}, appeared in an Indian *Bos indicus* breed that was encountered during routine cytogenetic investigation prior to selection of bull for semen production.

Material and Methods :

Peripheral blood was collected from phenotypically normal two years old young bull calf of Deoni breed, in a heparinized vacutainer blood collecting tube. Chromosomal preparations were performed by using standard whole blood culture in RPMI-1640 (Gibco) medium supplemented with antibiotics, 15% fetal calf serum and 1% pokeweed mitogen (Patel, 1999). Cell suspension was dropped on slides and air dried. Slides were conventionally stained in Giemsa stain for screening under the Nikon compound microscope attached with photographic system.

Results and discussion

The cattle normally possess 60 (2n) chromosomes. The karyotype composed of 29 pairs of autosomes and one pair of sex chromosomes. All the autosomes are acrocentric and sex chromosomes (XY) are submetacentric in *Bos taurus*, whereas Y chromosome in *Bos indicus* is acrocentric. In the present case, all the scored 50 metaphase plates of the bull exhibited a bivalent chromosome, in addition to the submetacentric X and acrocentric Y chromosomes. This is the first time that a centric fusion translocation appeared in Deoni breed out of 458 different breeds of *Bos indicus* screened during routine investigation (karyotyping). This finding is

similar to many cases reported earlier where in 16/20 translocation is reported. As compared to exotic cattle, no case of translocation is reported in *Bos indicus* in India. However, a few cases of translocations were reported in Indian Jersey and Holstein crossbred cattle, and buffalo population. Thiagrajan et al. (1990) identified 1/29 translocation in an Indian Jersey crossbred heifer with the history of anoestrus. Similarly, Chauhan et al (2009) have also observed 1/29 translocation in a Jersey crossbred bull calf. Patel (1999) reported a new centric fusion translocation (7; 16) in an Indian Holstein crossbred bull. Two cases of unusual translocation were also reported in Murrah buffaloes (Vijh et al, 1994; Patel et al., 2006) in India. Except unusual cases (Chauhan et al., 2009), the fertility of male is not grossly affected because of centric fusion.

The reproductive potential of Deoni bull calf with 16/20 translocation in present study is not available since it is not in semen production and it was immediately culled from the semen station because of chromosomal aberration. It is always advisable to cull and avoid using such bulls for semen production as the Robertsonian translocation can have an adverse effect on fertility, apparently due to the production of chromosomally unbalanced gametes (Hanada et al., 1995). Such unbalanced zygotes which tend to die at an early stage of development in females thus giving



repeat breeding problems in normal females.

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Indian Dairy Sector-III

Trends in annual milk production and per capita availability (1950-2010)

Year	Production (million tonnes)	Per Capita availability (gm/day)
1950-51	17.0	124
1960-61	20.0	124
1970-71	23.0	112
1980-81	31.6	128
1990-91	53.9	176
2000-01	84.4	225
2010-11	112	261



Studies on estrous response and symptoms exhibited in Ovsynch synchronization protocol in buffaloes

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Introduction

India has 97.7 million buffaloes which are approximately 56.6 per cent of the total world buffalo population and almost 20 per cent of total livestock of the country. Reproductive performance has direct bearing on economic viability of dairy farming. In fact production follows only after the successful reproduction. However, buffalo reproduction is marred by delayed puberty, long postpartum anoestrous period, poor estrous expression having low heat detection rate, together with miserably low conception rates (Sharma et al. 2006). The failure of buffaloes to show overt signs of estrous together with wide variation in duration of estrous are major constraints for

adoption of AI for genetic improvement in buffaloes. Due to lowest reproductive efficiency, the life time production is not only hampered but also the net calf crop decreases leading to basic economic losses to farmers.

For maintaining optimum reproduction, estrous synchronization is one of the important tools in reproductive management program. The estrous synchronization is a hormonal regulation of estrous cycle at a time in a group of animals with timed artificial insemination. It allows a decrease in unproductive periods by controlling the post-partum subestrous or anestrous as well as reduces the number of days spent in visually appearing estrus. It also increase the accuracy of heat detection. Synchronization of estrous in cattle depends on control of the functional lifespan of the corpus luteum (Hansel and Convey, 1983). The administration of a luteolytic agent that shortens the normal lifespan of the corpus luteum is the most adopted method of estrous synchronization in bovines. This is accompanied generally with estrous and ovulation within 48 to 120 hr after injection. Ovsynch synchronization protocol is most



recently developed; consist of combination of GnRH and prostaglandin. Synchronization of estrous as well ovulation occurs in Ovsynch protocol and is found very effective for improving reproductive performance in buffaloes (Roy and Prakash, 2009; Kumar et al. 2010). In view of the above mentioned facts, the present research was planned to study the estrus response and symptoms exhibited when treated with Ovsynch synchronization protocol in buffaloes under field condition.

Material and methods

The present experiment was conducted at farmers doorstep in Nandapur Village, Tal. Kalamnuri, Dist. Hingoli during the period from December 2010 to February 2011. Total twenty four cyclic buffaloes, non-exhibiting estrous even 90 days after calving, having completed two to five lactations and devoid of any reproductive abnormality as well as infection were randomly selected on the basis of history and gynaeco-clinical examinations. The buffaloes were maintained under village conditions with similar management condition and vaccinated against infectious diseases. Locally available forages, greens, were fed to the buffaloes. Concentrates like cotton seed cake or concentrate from manufacturer were provided on the basis of milk production before milking, while fresh water was available ad-lib. Buffaloes were milked twice daily with hand milking and

calf was allowed to stimulate milk let down through suckling.

The selected buffaloes were given pre-synchronization medicinal treatment like injection Hitek @ 1 ml per 50 kg body wt. s/c., injection Urimin 10 ml i/m, injection Intavita 5 ml i/m and chelated mineral mixture Agrimin forte @ 50gm orally daily. One week after this treatment, buffaloes from this group were checked per rectally and cyclical buffaloes were treated with injection Receptal (GnRH) 2.5 ml on day first, Injection Cyclix (PGF2 α) 2 ml on day 7 and injection Receptal (GnRH) 2.5 ml on day 9. The buffaloes were observed for estrous exhibition after the injection of PGF2 α (d 7). Estrous signs were noted by visual observations in the morning and evening.

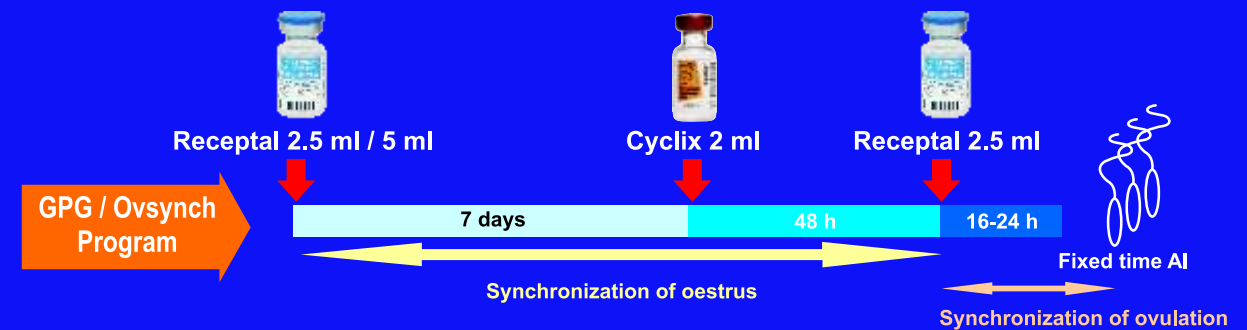
Result and discussion

In the present research experiment, twenty four postpartum cyclic multiparous buffaloes were treated with Ovsynch synchronization protocol. All the twenty four treated (100 percent) buffaloes responded to treatment and exhibited estrous. The results of present study are in agreement with results obtained by Vijayrajan et al. (2007). Ghuman et al. (2009) and Sharma et al. (2010) reported 100 percent ovulation in Ovsynch protocol in buffaloes.

The estrous induction in Ovsynch protocol



Making calf a year a reality



Ovarian profile	GnRH theoretically any time		PGF2 α 7d after GnRH		GnRH 2d after PGF2 α	
	Action	Response	Action	Response	Action	Response
Dominant follicle (DF) selected - LH sensitive	Release of FSH & LH - LH surge	LH surge = ovulation of the DF, new CL is formed. New follicular wave starts	Luteolysis of "new" CL	Start of a new follicular phase development of new DF	Induction of LH surge	Ovulation of the DF in 24-32 h
Small follicles only + CL no LH receptors	Release of FSH & LH - LH surge	Continued follicular development to selection of DF 'old' CL still present	Luteolysis of "old" CL	DF selected from the original wave is fully developed	Induction of LH surge	Ovulation of the "old" DF in 24-32 h
Very small follicles no CL anoestrus	Release of FSH & LH - LH surge	Initiation of follicular growth in some cows	No reaction	Selection of DF	Induction of LH surge	Ovulation of small DF in 24-32 h

To know more about management of reproduction in cattle visit: www.partners-in-reproduction.com



Figure I : Congestion of vaginal mucus membrane

reported by Ingawale et al. (2007) was 86.66 percent in Murraha buffaloes; Kumar et al. (2010) reported 85.35 percent estrous exhibition in postpartum buffaloes, In Ovsynch protocol, Paul and Prakash (2005) have reported 90 percent ovulation in lactating Murahha buffaloes.

In the present study, none of the buffaloes exhibited visible premature estrous between day 0 to 7 of the treatment period so the estrous exhibition rate was 100 percent. Lamb et al. (2001) reported that the major disadvantage in Ovsynch protocol was that approximately 10 to 20 percent of animals exhibited estrous prior to and immediately after PGF2 α injection.

The reproductive seasonality of buffaloes due to the melatonin secretion as an endocrinology variation is observed during the year. The low estrous response as well as ovulation observed by some authors may be due to implementation of the protocol in non breeding season or during summer season. The results of this experiment

demonstrated that during the favorable reproductive season, the synchronization of estrous is effective in buffalo. Dejarnette et al. (2001) and Baruselli et al. (2003) explained that the buffaloes, which is not ovulating after the first GnRH injection experiences less synchronization between the second GnRH injection and ovulation. The presence of high percentage of growing dominant follicles at PGF2 α injection were important for good ovulation rates after the second GnRH injection. Dominant follicle presents larger number of receptors of LH in the granulosa cells promoting better ovulation rate. The low ovulation percentage was reported due to the presence of late static phase or regression phase of dominant follicle (Dharani et al. 2010). Ovsynch initiated at growing phase of first wave dominant follicle results in higher percentage of ovulation after second GnRH injection rather than initiated at regression phase.

To achieve successful synchronization with the Ovsynch protocol, it is particularly critical to ovulate a follicle when the first injection of GnRH is given during the later luteal phase. If a follicle does not ovulate during this period, the cow or heifer may cycle normally and would most likely be in estrus before the second injection of GnRH. If ovulation occurs from the initial injection of GnRH during the late luteal phase, the newly induced corpus luteum appears to be unresponsive to the spontaneous pulses of



Figure II : Tumification of vulval lips

PGF2 α and even though the spontaneous corpus luteum regresses, the new corpus luteum continues to grow until the day of PGF2 α injection (Pursley et al. 1997). Lactating dairy cows primarily have two waves of follicular growth during an estrous cycle, which makes it likely that there would be a follicle that is responsive to LH during the late luteal phase. Thus, differences in numbers of follicular waves or length of follicular waves may be crucial for determining the success of synchronization with Ovsynch. The variation in the estrous response could be due to differences in breed, parity, management practices, estrous detection methods, body score of animals, cyclic stage of animals and type and dose of agonist used in the protocol.

In the Ovsynch synchronization protocol during estrous phase, the frequent micturition symptom was shown by 100 (24/24) percent treated buffaloes whereas congestion of vaginal mucus membrane 91.66 (20/24) percent buffaloes (Fig. I). The symptom like tumification of vulva (Fig. II)

(54.16 percent), vaginal discharge (37.50 percent), tail raising (33.33 percent), and congestion of nictating mucus membrane (33.33 percent) were exhibited by buffaloes. Only 16.66 percent (4/24) buffaloes showed the sign of bellowing during estrous Ovsynch protocol. From the above results it is revealed that frequent micturition and congestion of vaginal mucus membrane are the prominent estrous signs noted during estrous phase treated with Ovsynch synchronization protocol.

Stevenson et al. (1996) opined that the low estrous detection rate could be due to the fact that heifers and cows when treated with GnRH - PGF2 α - GnRH, rarely showed overt symptoms of estrous after PGF2 α or before or after the second GnRH injection. Signs of nervousness, mucus discharge and occasional mounting activity were observed by them in only 3 of 85 cows (3.5 percent). Synchronization of ovulation with GnRH caused LH surge of normal amplitude (12 ng/ml) but of shorter duration (5 h) than expected for spontaneous surges (Lucy et al. 1986). Neglia et al. (2003) reported that the mucus and estrous behavior were only observed in rare occasion. However, 88 percent of Italian Mediterranean buffaloes treated with Ovsynch protocol had a tonic uterus on the day of insemination.

In the present study, the average time required for onset of estrous was 48.70 \pm 0.21 h after the injection of Cyclicx (d 7). The



mean time required for onset of estrous observed in present study is in agreement with reports recorded by Ravikumar et al. (2009), who observed 48.80 ± 7.74 h in Ovsynch subestrous buffaloes while 36.71 ± 2.65 h in Ovsynch plus CIDR subestrous buffaloes. The time required for onset of estrous was 41.40 ± 8.33 hr as reported by Ravikumar et al. (2008) in Ovsynch plus CIDR anestrous buffaloes.

Vijayarajan et al. (2007) reported 55.3 ± 2.11 h while Neglia et al. (2003) recorded 60 h after PGF 2α injection and 70.62 ± 14.82 h by Giripunje et al. (2010) in field buffaloes. However Ali et al. (2010) reported 18.67 ± 3.18 h for onset of estrous which is lower than the results obtained in the present study. The wide variation noticed in the duration of onset of estrous could be due to difference in the developmental stage of the preovulatory follicle at the time of PGF 2α injection. This could also be due to the longer interval from estradiol peak to the onset of estrous or to the lower estradiol concentration. (Vijayarajan et al. 2007). The earlier onset of estrous in Ovsynch protocol could be due to the presence of matured follicle at the time of PGF 2α administration resulting in synchronous onset of estrous.

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Indian Dairy Sector-V

Comparative cost of milk production in India and other countries (dollars/100kg of milk)

Country	Cost of Milk Production (dollars/100 kg)
India	21
Russia	22
Mexico	27
Poland	28
USA	28
China	29
New Zealand	33
European Union	34
Norway	56
Switzerland	57
Canada	58
Japan	68



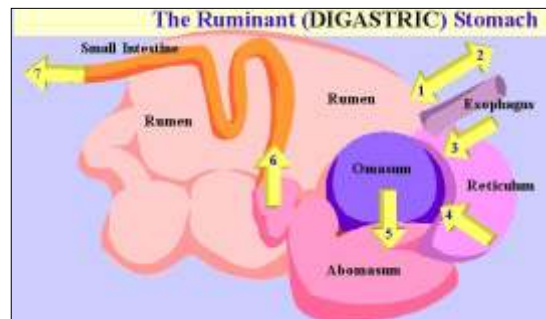
Indian ranks first not only in the milk production (114.4 million tonnes during 2009-10), but also produces it at the cheapest cost.



A Recap of Rumen: the unique bio-fermentation chamber

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Introduction

During the course of ecological development, ingenious adaptations have been evolved to suit microbial fermentation of mixed feeds in the GI tract of ruminants (Philipsson, 1970). The strategically located large reticulo-rumen physiological unit permits regurgitation of voluminous ingested roughages for mechanical break down during rumination, besides serving as a continuous incubation chamber for great variety of resident anaerobic bacteria, protozoa and fungi. Polysaccharides, celluloses and hemicelluloses are sequentially broken down to pyruvic acid, which is fermented to short chain fatty acids (SCFA). The SCFA are transformed into volatile fatty acids (VFA), the primary energy substrates. The remarkable capacity of the rumen wall to rapidly absorb VFA stabilizes the ruminal pH. Rumen micro-organisms

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utilize NPN compounds for synthesis of protein molecules to meet the host animal's physiological needs. Virtually all B-complex vitamins are synthesized, and detoxication of anti-nutritional principles in certain feeds is also accomplished by rumen microbes (Kamra and Pathak, 1996). Food is diluted with copious amounts of saliva (150lit/day) during eating/ subsequent rumination (8 hr /day), at par with grazing interval. Each regurgitated bolus is chewed up 40 to 50 times.

Intra-ruminal milieu

The reticulo-rumen unit provides an ideal continuous fermentation chamber for the resident microbial population. These microorganisms are able to oxidize sugar molecules only partially, and the semi-oxidized organic compounds (VFA) serve as the most dependable energy substrates for the host animal. Maintenance of total anaerobiasis in the ruminal milieu is obligatory for trapping of energy (ATP) from the VFA. Low redox potential (~350 mV) in the rumen is maintained by gases released during fermentation: carbon dioxide, methane and nitrogen, together with a small quantity of hydrogen. The ultimate H+ acceptor, carbon is degraded to methane

(CH₄). The waste gases, methane and carbon dioxide are belched out.

Rumen liquor (pH range 6.5-6.8) is buffered, within limits, with the salivary phosphate and bicarbonate. However, abrupt switch-over from predominantly roughage to high grain (HG)/ concentrate-based ration may induce a marked reduction in pH (<5.5), precipitating acute ruminal acidosis. The temperature of rumen contents (38^o-42^oC) remains virtually at par with the normal body temperature. A dynamic ionic flux keeps the ruminal fluid compartment iso-osmotic with the circulatory blood.

Rumen Microbes

Comprising over 200 different spp, the rumen bacteria play a key role in the initial major phase of digestion of food carbohydrates, mainly celluloses and hemicelluloses with restricted quantities of easily degradable starch, fructans and simple sugars. Here, extra-cellular bacterial enzymes are involved. Total bacterial counts normally vary from 1x10³ to 1x10⁴/μl. The type and amount of feed offered markedly influence the total count as well as relative proportion of different resident bacterial species. For example, high grain concentrate-based feeds promote high total counts with *Lactobacillus* spp. predominating. Biologically important symbiotic relationships are also noteworthy. Thus, succinate, the end product of *Fibrobacter succinogenes* serves as the

substrate for *Selenomonas ruminatium* to form the most important VFA, propionate. *Megasphaera elsdenii* (substrate, lactate) is the major contributor to the propionate pool, essential for glucose synthesis and maintenance of normal blood sugar level (Av. 50 mg/ dl) concurrent with hepatic glycogen reserves in ruminants. *Veillonella alcalescens* is also capable of synthesizing propionate from lactate. Depletion of propionate, as a consequence of gross imbalances in the resident rumen microbial population from dietary disturbances, is the primary factor involved in onset of life-threatening ketosis in high producing dairy animals (McDonald et al., 2002).

Rumen bacteria may be subdivided into four major functional classes i.e cellulose, hemicellulose, starch, and sugar degrading bacteria. Besides the main product, VFA: acetate (generally 65%), propionate (21%) and butyrate (14%) with smaller quantities of lactate, succinate, and formate may be formed. Lactate-utilizing, proteolytic, urea-degrading, lipolytic and methanogenic bacteria are also present. Highly motile *Ruminococcus* spp. is importantly involved in fibre digestion. *Eubacterium cellulosvens* constitutes 50% of the total cellulolytic bacterial population in the rumen. Most of these species are also capable of degrading hemicelluloses. *Butyrivibrio fibrisolvens*, predominating in hay-based ration attacks hemicelluloses and other food carbohydrates. Starch-splitting bacteria eg., *Selenomonas ruminatium* and *Streptococcus*

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bovis form D-lactate, acetate and succinate. On HG rations, *Str. bovis* multiplies exponentially, and the resultant abnormal accumulation of lactic acid induces a drastic fall in the intra-ruminal pH to values < 5.5 (Owens et al., 1998). The low pH, in turn, is propitious to accentuated multiplication of synergistic *Lactobacillus* spp. *L. ruminis* and *L. vitulinus* degrade sugars to the extent of 85% lactate.

Uncontrolled lactate accumulation may precipitate the clinical condition, ruminal acidosis of varying intensity. In addition to the initial i.v. fluid therapy designed to promptly restore the electrolyte and acid-base balance, or oral dosing of magnesium oxide and activated charcoal (Radostits et al., 2007), chronic/ subacute ruminal acidosis may be effectively managed by promoting multiplication of lactate-utilizing rumen bacteria, *M. elsdenii* and *S. ruminatum* through direct intra-ruminal inoculum (McDonald et al., 2002). *M. elsdenii* scavenges deleterious abnormally high lactate pool in the rumen, while transforming it into the most important glucogenic precursor, propionate. Since induction of lactate racemase is apparently substrate-dependent, *M. elsdenii* can synthesize propionate exclusively from lactate.

In the rumen, 60-80% of food protein is first hydrolyzed to the constituent amino acids and peptides by bacterial species eg., *Bacteroides amylophilus* and *Butyrivibrio*

fibrisolvens, then further degraded to ammonia, which is partially incorporated into bacterial proteins. In the intra-ruminal compartment, urea may originate from some commercial cattle feeds, salivary secretion, or diffusion across the rumen wall. Urea ammonia degradation is a very fast urease-catalyzed single step process. Dietary lipids in ruminants originate mainly from green forages (galactolipids, sulpholipids and phospholipids occurring in the chloroplast membrane) and concentrates (triacylglycerols or fats, and generally polyunsaturated fatty acids). Fats are hydrolysed by microbial lipases into the constituent fatty acids and glycerol. Subsequent reduction leads to formation of the corresponding saturated fatty acids. Phospholipids are degraded by a consortium of enzymes: phospholipase A, lysophospholipase and phospholipase C. The methanogenic bacteria, *Methanobacterium ruminatum* and *Methanosarcina barkeri* are strictly anaerobic. The cell wall structure renders these bacteria usually insensitive to antibiotics (Kamra and Pathak, 1996).

Of over 100 species of protozoa (Av. count $1 \times 10^6/\mu\text{l}$ -1 rumen liquor), most are ciliates belonging to the holotrichs and oligotrichs families comprising several genera. On HG rations, increasing numbers of itinerant ciliate protozoa retard lactic fermentation by engulfing starch granules. The life cycle of the strictly anaerobic rumen fungi eg., *Neocallimastix* spp. exist in the motile phase

(zoospore) along with the vegetative phase (sporangium), attached to food particles. The rumen fungi proliferate actively in fibre-rich feeds.

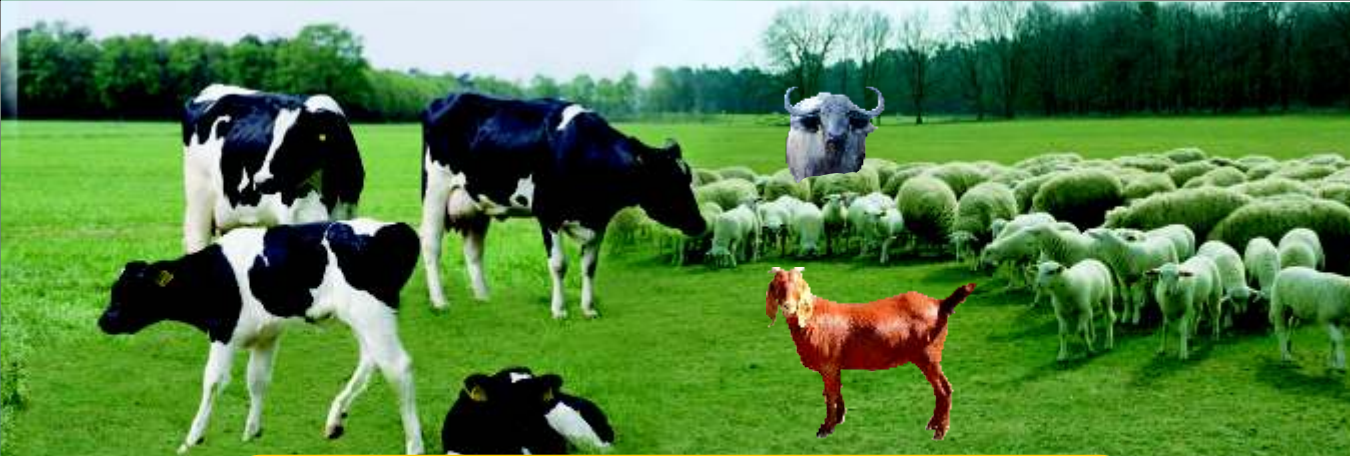
The partly undigested food together with the microbial cell mass pass into the abomasums (true stomach) and small intestines, and are degraded by the host animal's own digestive enzymes. These nutrients, along with a smaller quantity of VFA produced in the large intestine (the site of second minor phase of microbial digestion) are absorbed and enter the metabolic pool.

Summary

Rumino-reticulum physiological unit is pre-eminently suited for microbial fermentation of bulky roughages to the maximum biological advantage of the host animal. The delicately balanced blood glucose status of lactating dairy animals depends heavily on gluconeogenic mechanisms, operating mainly in the liver. Of the three volatile fatty acids (VFA) occurring in the rumen liquor, only propionate is glucogenic (glucose/ glycogen precursor). The VFA are rapidly absorbed across the rumen wall, enter the blood circulation and are processed in the liver. Partial bio-protection against abnormal lactate accumulation on HG/ high concentrate feeds, responsible for acute ruminal acidosis is provided by accelerated scavenger mechanisms.

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Importance of mineral mixture supplementation in Animal Health Care Programme

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Introduction :

Mineral deficiencies and imbalances in livestock have been reported from almost all regions of the world. The problems are more serious among the grazing ruminants in the tropics, which are not stall fed and given any mineral mixture as supplementation. It is, however, necessary to provide required essential minerals as supplements to the stall fed animal as well to promote efficient and profitable livestock production.

Mineral deficiencies :

The bio availability of certain element is to be considered necessary from natural feed ingredients. For example, Phytic-Phosphorus is not available for absorption. Similarly high oxalate content from feed ingredients may bind calcium and may not make it available for absorption.

Sulphur is a requirement in the diet of all species of animals because it is not only a component of cell membranes in the form of sulphate, but also it is required for synthesis of S-amino acids either by microbes in the rumen or otherwise in other body tissue structures.

Dairy cattle require at least 17 minerals and 3 Vitamins in their diet: for optimal milk production, performance and herd health. They derive these from feed, fodder, concentrate and mineral mixture feeding.

The input of minerals and vitamins through concentrate, fodder and water must balance their output through faeces, urine and milk to maintain animal's health. If the output exceeds input for a short period, the animal mobilizes its reserves to meet the normal requirement but continuous imbalance for deficiencies can develop into reproductive, health and milk production problems. Viz

1. Quicent ovaries.
2. Retention of Placenta.
3. Repeat Breeding.
4. Abortion.
5. Prolapse



6. Still birth.
7. Mastitis.
8. Decrease Immunity.
9. Anaemia.
10. Metabolic disorders.
11. Decrease milk production.

The major issue in the profitable dairy development is not only the regular mineral mixture feeding but the right selection of good mineral mixture and proper way of its feeding.

Daily requirements of minerals for a 400 kg. cow with 10 liters of milk is depicted in Table I.

Table I : Mineral requirement of a 400 kg cow, giving 10 liters of milk per day

Sr. No.	Mineral	Requirement	Ratio
1.	Calcium	0.60% to 0.70%	
2.	Phosphorus	0.40%	
3.	Magnesium	0.20%	Cal:Ph 2:1 or 2:1.5
4.	Cobalt	0.10ppm	Zn:Cu 4:1
5.	Copper	15ppm	Fe:Cu 40:1
6.	Manganese	60ppm	K:Mg 5:1
7.	Iron	100ppm	Cu:Mo 6:1
8.	Zinc	60ppm	K:Na 3:1
9.	Iodine	0.60ppm	
10.	Sulphur	0.2%	
11.	Sodium	0.10%	
12.	Chloride	0.20 %	

The composition of ideal mineral mixture is given in Table 2

Table II: Ideal mineral mixture composition

Sr. no.	Name of Mineral	Availability in %	Source of mineral elements
1	Calcium	20%	DCP, Calcite
2	Phosphorus	12%	DCP
3	Magnesium	5%	MgO, MgSO4
4	Cobalt	0.012%	CoSO4
5	Copper	0.10%	CuSO4
6	Manganese	0.12%	MnSO4
7	Iron	0.40/0	FeSO4
8	Zink	0.8%	ZnSO4
9	Iodine	0.026%	KI
10.	Sulphur	1.8 % to 3%	Sod Thio-Sulph

The effects of feeding mineral mixture of above composition to low producing stock of Sumul Dairy Surat is summarised in Table III.

Table III: Effect of feeding ideal mineral mixture on occurrence of important production diseases

Sr. No.	Particulars	2002-03 Control-year	2003-04 Trial-year
1	Mastitis	6.96%	5.49%
2	Hypogalactia	7.06%	6.16%
3	Quicent Ovaries	1.36%	1.07%
4	Retention of placenta	1.51%	1.13%
5	Prolapse (pre partum)	0.54%	0.43%
6	Prolapse (post- partum)	0.49%	0.44%
7	Dystocia	0.57%	0.39%
8	Milk fever	0.19%	0.16%
9	Abortions	0.38%	0.20%

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Immunomodulators -applications In Veterinary Field

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Introduction

In spite of tremendous development in the production technologies of conventional as well as new generation of vaccines, complete protection against many of the diseases following vaccination remains elusive, the cause of vaccine failures being innumerable. To combat such vaccine failures, immunomodulators or immune response modifiers stand to play a role that can revolutionize the field of immunology and vaccinology.

Though the development of vaccines and chemotherapeutic agents, including antibiotics, have contributed to the control of various acute type of diseases in both veterinary and human medicine, many diseases associated with persistent / opportunistic infections and non-infectious pathogenic factors, which are primarily attributable to stress associated immuno-

suppression have become increasingly important in domestic animals.

Opportunistic infections, causing undue problem in chemotherapy and even drug resistant bacteria pose an additional obstacle in the clinical practice. Therefore modulation of immune system (host defense mechanism) in compromised host is important in the field of chemotherapy.

One of the strategies for reducing those stress induced problems is the use of various chemicals and biological response modifiers and their efficiency has been evaluated in domestic food animals. These involve levamisole, lysotrophin, tuftsin, azimexon and touramyl dipeptides. These act on neutrophils and macrophages to stimulate their activities by increasing the intracellular guanosine 3, 5-monophosphate (cGMP) concentration (Coffey, 1992).

There are two types of immunomodulation:

- I. Suppression of the immune system or immunosuppression
- II. Stimulation of the immune system also known as immunopotentiality. In the present article the immunopotentiality is discussed.



substances which augment both non-specific and specific immune responses in the host and totally restore the compromised immunological system.

A wide variety of immunomodulators are now being used to investigate their effect in domestic animals. Immunomodulators vary according to their origin, their mode of action and the way in which they are used

a) Bacteria and Bacterial products:

A wide variety of bacteria have been employed as immunostimulants. These are readily phagocytosed by macrophages and so stimulate cytokines synthesis. Their immunostimulating effects are therefore due to the release of a mixture of cytokines.

The most potent of these cytokine synthesis enhancers is BCG, the live attenuated vaccine strain of *Mycobacterium bovis*. BCG produces a generalized enhancement of both B cell and T cell mediated responses, of phagocytosis, of graft rejection and of resistance to infection. To prevent sensitization, purified cell wall fractions of BCG have been employed.

Muramyl dipeptide, a simple glycopeptide purified from mycobacterium, enhances antibody production, stimulates polyclonal activation of lymphocytes and activates macrophages.

Anaerobic congrefarris such as

Propionibacterium acnes promote antibody formation when administered as a killed suspension. The bacteria are phagocytosed by macrophages and stimulate cytokine synthesis. Staphylococcal cell walls, some streptococcal components and producers from *Bordetella pertussis*, *Brucella abortus*, *Bacillus subtilis* and *Klebsiella pneumoniae* all have immunomodulating activity.

b) Complex carbohydrates.

Certain complex carbohydrates derived from yeasts, namely zymosan, glucans aminated polyglucose and lectinans can increase phagocytic abilities by activating macrophages.

Activated egg white product (AEWP) is supposed to stimulate macrophages and neutrophil function. It is also demonstrated that it increases the nonspecific immunity against bacterial infection in mice.

These may have function as adjuvant and potentiate resistance to infectious agents.

c) Immunoenhancing drugs:

A broad spectrum antihelmenthic, levamisole functions in a manner similar to the thymic hormone thymopoitin i.e., it stimulates T cell differentiation and response to antigens. Thus levamisole enhances bovine lymphocyte blastogenesis at suboptimal mitogen concentration and it enhances interferon production and increases FCR activity in bovine

macrophages. It also enhances cell mediated cytotoxicity, lymphokine production and suppressor cell function. It stimulates phagocytic activities of macrophages and neutrophils.

The effect of levamisole is greatest in animals with depressed T cell function and it has little or no effect on the immune system of normal animals.

d) Vitamines :

Vitamin E affects immune responses and decrease resistance. A deficiency of vitamin E results in immunosuppression and reduced resistance in disease. On the other hand, supplementation of diets with Vitamin E can enhance certain immune response and lead to increased resistance to disease. Vitamin E supplementation given to cows several weeks prior to calving appears to prevent the decline in neutrophil function and macrophage function that normally occurs in the immediate post parturient period. Vitamin E promotes B cell proliferation and the effect is most marked in the primary immune response. Even Vitamin E supplementation can reduce mortality from a challenge with *Escherichia coli* in chicken.

e) Cytokines:

Among all the immunomodulators, cytokines act as powerful immunomodulators and also as protein mediators capable of regulating a wide spectrum of biological function, including



immune response, inflammatory response, tissue repair, graft versus host response and haemopoiesis. At present, there are 20 known cytokines that have been implicated in modulating immune responses. All the cytokines are extremely potent and they can function both in an up and - down regulatory capacity. It is imperative that each cytokine be used at doses suitable for the activity desired to be modulated (Babink et al., 1991).

The prevention of infectious disease by the use of cytokines either alone or in combination with current vaccination protocols has received considerable attention in the veterinary field. In the last five years, rapid progress has been made in the cloning and characterization of cytokines from livestock and companion animals. Cytokine can influence outcome of vaccinations by exerting effects at various stages in the immune response, including enhancement of antigen presentation, polarization of T helper subsets, regulation of antibody isotype production and expansion of the T and B cell memory pool.

Immune response appears to be orchestrated by the production of cytokines in a specific manner in response to invading pathogens. They can be classified according to their release following infection and divided into two categories of (i) early cytokines and (ii) late cytokines.

The qualities of adjuvant are same as some of the qualities that early and late cytokines have on the immune response during infection. Indeed, the success of many of the adjuvants that are available today (for example bacterial products) are due to the fact that they are able to induce both a strong inflammatory reaction and the activation of the lymphocytes. Further, other biological response modifiers that are used as adjuvant (for instance, the lipid amine Avridine) may be successful because of their ability to induce an early (IL-1) as well as late cytokine (IFN- γ).

I) The use of early cytokines as adjuvants

a) Interleukin - 1 (IL-1):The induction of IL-1 production in macrophages by bacteria or bacterial products (such as muramyl dipeptide or lipopolysaccharide) has long been considered one of the major factors for the success of these compounds as adjuvants. Further, IL-1 has been used successfully as an adjuvant and is known to potentiate the immune response to a variety of antigens. The activity of IL-1 is both time and dose dependant, with adjuvancy being optimal if IL-1 is injected 2 hr after the administration of antigen. IL-1 enhances T cell dependant antibody production not only by induction of IL-2 secretion but also by increasing T-helper cell activity. In calves, recombinant bovine IL-113(BOIL-1fs was administered in conjunction with bovine

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herpes virus-1 (BHV-modified live vaccine). Following both primary and secondary immunizations in presence of rBOIL-113 there was significant rise in the cytotoxic capacity of peripheral blood cells against BHV-1 infected target cells in vitro.

b) Tumor necrosis factor- α (TNF- α): The use of TNF- α has been assessed using both a T-cell dependent antigen and an inactivated influenza virus vaccine. The results indicate that TNF- α was able to enhance the immune response to T-cell dependent antigens. However, unlike IL-113, TNF- α was not able to enhance the in vitro antibody response to T-cell independent antigens.

c) Interleukin-6(IL-6): IL-6 is another inflammatory cytokine that also has known immunomodulatory effects. The role of IL-6 in the immune response has been assessed in vitro, using an adenovirus vector for the delivery of this cytokine. IL-6 enhanced both T and B cell maturation.

ii) Use of late cytokines as adjuvants:

The pleomorphic effects that cytokines, such as IL-2 and IL-4, have on B or T cell differentiation and expansion make them excellent candidates for adjuvant use. IL-2 along with IFN- γ was among the first cytokines to be characterized, cloned and expressed in high level expression systems. IL-2 and IFN- γ were also among the first cytokines to undergo clinical trials in

humans. So a significant amount of data regarding their in vitro use and toxicity is available and should be easily transferable to other species.

a) Interleukin-2(IL-2): Among all cytokines, IL-2 has captured the imagination of researchers world wide. Because of its key role in regulation of T-lymphocytic immune response, the IL-2 stimulates natural killer (NK) cell production and B- lymphocyte immunity.

As the central role being played by IL-2 in cell mediated immune response was realized, it became immensely clear that this molecule is a crucial link in immune system related diseases and disorders. These include a multitude of conditions such as bacterial, viral diseases, immunodeficiencies, autoimmune disorders, neoplasms etc, and represent extraordinary potential for immune manipulation. There are two dimensions involved in such studies, that can be studied in terms of perturbations caused by pathogens in IL-2 production and the other involves investigations on IL-2 therapeutic modality. IL-2 may directly influence B cell proliferation and differentiation, it can stimulate the proliferation of oligodendroglia cells and activate NK cells and lymphokine activated killer cells (LAK). Thus attempts to utilize IL-2 in the treatment of cancers and immunodeficiency diseases are being made. Also IL-2 has increased antibody mediated

and cellular immune response in animals that were immunized with bacteria or viral vaccines.

The use of IL-2 in enhancing an existing response to antigen has been assessed in a number of experimental systems, using protein antigens, live or killed organisms or subunit antigens.

In our laboratory, we have shown that the use of avian IL-2 along with NOV vaccination enhanced both humoral, cell mediated and non-specific immunity.

Also rhIL-2 was administered in pigs at the same time they received an *A.Pleuropneumoniae* bacteria and induced a considerable greater protection on challenge. Similar results in case of pseudorabies subunit vaccine were observed.

In case of inflammatory infections rBOIL-2 induced local macrophages and neutrophil infiltration and increase mastitis cure rates. Also low doses of rhIL-2 when injected locally into the papillomas or carcinomas of the vulva in cattle induced on 83% response rate and some complete regressions were observed.

b) Interleukin-4(IL-4): IL-4 is also fundamental in the differentiation and development of B lymphocytes as well as being a T-cell growth factor. IL-4 may be an

excellent candidate for future vaccine strategies, as it has some lymphocyte-activating factor (LAF) activity in common with IL1. Further IL-4 appears to be a co stimulator of macrophage activation with IFN- γ , in that it is able to enhance the production of superoxide and other oxygen intermediates. IL-4 was able to directly enhance the expression of CD 23 on antigen specific B lymphocytes and was able to enhance antibodies production.

Further, more IL-4 appeared to enhance the expression of CD 25 and in conjunction with IL-2 was effective at overcoming genetic non-responsiveness. IL-4 may therefore be of particular use as an adjuvant in those instances where a rapid antibody response is required or may be useful in combination.

c) IFN- γ (Interferon γ) : The ability of IFN- γ to enhance vaccine efficiency is believed to be through the activation of antigen presenting cells. The expression of antigen (i.e. peptides) on antigen presenting cells can be enhanced by increasing MHC class II expression. This has been achieved by the co administration of IFN- γ with antigens. Preliminary experiments in mice indicate that treatment of mice with IFN- γ after immunizing with the vesicular stomatitis virus(VSV) 'G ' protein enhanced the protection against challenge with this virus.

Studies in cattle treated with rBOIFN- γ at the



Single shot immunization for 3 Clostridial infections

time of immunization indicated that their VSV neutralizing titres could be enhanced by the administration of this cytokine.

Also IFN - γ has been well established as an adjuvant in a number of other model systems.

The laboratory under the guidance and supervision of the author different immunomodulators were produced and successfully tried on poultry, one being the avian IL-2 and the other two were being active egg white product (AEWP) and calf thymus extract. A novel approach using biological response modifiers (BRM) has been tried to control various diseases. An active egg white product and chicken egg white derived immunoactive peptides which are supposed to stimulate macrophage and neutrophil function, have also been demonstrated to enhance non-specific immunity against bacterial infections in mice. The immunomodulatory effect of thymus extracts of various species has been attributed to the thymic factors and hormones present in the thymus.

Conclusion

The article emphasizes the need of various immunomodulators for use in the veterinary field to combat the pathogenic effects of

diseases affecting the animals and birds and to boost up the nonspecific immune response in addition to humoral and cell mediated immune responses. The adjuvant characteristic of the immunomodulators also enhance the immunopotentiating activity of the vaccines and it is hopeful that Immunomodulators are used as an adjuvant to the vaccine as well as a drug to potentiate the immune response.

Recommended Readings

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News.... National....



New Entrepreneurship Development Programme in chicken meat processing

National Research Centre on Meat, Hyderabad, has introduced novel entrepreneurship programme in chicken meat processing. A 3 day hands on training is imparted regarding the technologies available for value added meat products. The trainees can acquire the skills for production of 10-12 value added chicken products like sauseges, nuggets, patties, meatballs, idlies, bites and cured/smoked products. The trainees can further collaborate with NRC Meat for entering into an MoU/ Agreement to utilize the HRC Meat facilities for marketing of products and guidance for establishing a small scale meat product processing unit.

This entrepreneurship programme is the first of its kind and shall provide a unique opportunity for those involved in broiler production to boost up the business through value addition.

Source: ICAR News

The White Camel..

A mewari breed female camel has given birth to a "white camel calf" recently at National Research Centre on Camel (NRCC) Bikaner (Rajsthan). It is an extremely rare happening in the history of camel breeding at the institute. The female calf is not an albino. It is construed that the recessive gene has been expressed. The NRCC now plans to grow this white camel carefully and will use it in further breeding programmes to get similar type of white progeny.



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Source: ICAR News

Know the prestigious institutes

NDRI

(National Dairy Research Institute, Karnal, Haryana.)



The first ranking research institute on global basis, the National Dairy Research Institute (NDRI) Karnal, Haryana, is the premier organization that provides research and development support to dairy industry in India.

The NDRI was originally started under British regime as Imperial Institute of Animal Husbandry and Dairying in 1923 at Bangalore. It was expanded and renamed as National Dairy Research Institute after independence. Subsequently in 1955, NDRI head quarter was shifted from Bangalore (Karnataka) to Karnal (Haryana) at the Central Cattle Breeding Farm. The facilities at Bangalore were retained as a Regional Station to serve the Southern States. In 1962 and 1964, two regional stations were established in Mumbai (Maharashtra) and Kalyani (WB) to serve as the Western and

Eastern Regional Stations, respectively. The Western Regional Station in Mumbai, however, was closed in 1984. Presently, both Bangalore and Kalyani Stations continue to provide region specific research and development support for dairy development in these areas. In order to provide greater operational autonomy to the Institute in its research programme, NDRI was brought under the control of Indian Council of Agricultural Research (ICAR) in 1966. In 1989, the status of Deemed University was conferred to the Institute for further strengthening the academic programme for human resource development.

Mandate:

1. To undertake research, teaching and extension programmes towards dairy development in India.

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2. To conduct basic and applied research with the objective to enhance dairy animal productivity and to develop cost-effective technologies for the dairy production, processing and marketing.
3. To provide demand driven and high quality man power to meet human resource requirement of Research and Development institutes and dairy industry.
4. Dissemination of innovative dairy production and processing technologies for socio-economic transformation.

Milestones :

- 1923:** Establishment at Bangalore as Imperial Institute of Animal Husbandry and Dairying.
- 1936 :** Two years Dairy Diploma started
- 1961 :** B.Sc. (Dairying) course bifurcated into B.Sc. (Dairy Husbandry) and B.Sc. (Dairy Technology.) M.Sc. (Dairying) started.
- 1976 :** Department of Human Nutrition and Dietetics established.
- 1979 :** M.Sc. and Ph.D. in Dairy Engineering started.
- 1985 :** Farm Advisory Bureau' and 'Industrial consultancy cell' setup.
- 1987 :** Embryo Biotechnology Center established.

- 1989 :** M.Sc. (Biotechnology) started.
- 1990 :** Birth of first IVF buffalo calf - Pratham- in the world.
- 1994 :** Recognition as Center for Advanced studies in Dairy Technology and Dairy Breeding
- 1997 :** A commercial 'Model Dairy Plant' with a capacity of 60000 lit. / day commissioned.
- 2004 :** First IVF Goat kid borne.
- 2006 :** Animal Biotechnology Center established.
- 2009 :** World's first cloned buffalo calf - Garima -produced by hand - guided cloning technique.
- 2011 :** M.Sc. in 'Forage Production' introduced.
- 2012 :** 'National Academy of Dairy Science' launched.
- 2013 :** Recognised as 'Centre of Advanced Faculty Training (CAFT) in Dairy production and Dairy processing.

Achievements

In academics, over the past five decades, NDRI has provided more than 2000 diploma holders, 1174 dairy graduates 1903 postgraduates and 873 doctorates in different disciplines of dairy production and dairy technology. NDRI Deemed University provides high quality education in dairying,

having no parallel in Asia. The programmes are constantly reviewed and updated to impart requisite knowledge levels to meet emerging global challenges in dairy production and technology. One year in-plant training in an industrial environment is providing opportunity to students to manage dairy processing in commercial environment. NDRI's contribution in providing core faculty for Agricultural/Veterinary Universities and national institutes is unparalleled. NDRI alumni are leading entrepreneurs in dairy equipment design and fabrications, product processing and IT industry.

In research, the core research activities of NDRI are centered around production and management of dairy animals of better productivity. (development of synthetic breeds like Karan Swiss and Karan fries, providing semen of progeny tested sahiwal, crossbreds and Murrah buffaloes, well defined package of practices for different production categories, advanced genome technique for animal selection, molecular intervention for augmenting reproduction, faster multiplication of superior germ plasma through ET and other biotechniques). The institute is engaged in involving milk processing technologies and equipments (suitable technologies for manufacturing indigenous milk products, whey based drinks, sports drinks, low cholesterol ghee, dairy products for diabetic and cardiac patient, equipments for small scale dairy operations etc.). The institute

also provides research based data to dairy farmers and entrepreneurs about existing market demand and making dairying a self-sustaining profitable business.

In extension programme, 'A composite Management Index for Bovines' as a determinant of enhancing milk production has been developed. Economic feasibility reports for dairy farmers and milk plants are prepared.

All the academic, research and extension programs of NDRI are undertaken on the infrastructure consisting of 560 ha campus and well equipped laboratories to conduct research on molecule biology, cell culture fermentation technology, protein chemistry, nutritional studies and micro-element analysis.

Thus, the information generated at the NDRI and the services offered have contributed immensely to the growth of dairy industry as a whole and well being of million of milk produces and consumers of milk. The institute is continuously working to develop its Research and HRD programme to better serve the nation in terms of food security, employment generation, poverty alleviation and economic prosperity.

Source : NDRI Annual Report,(2009-10)
: Internet

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The Merck Veterinary Manual, first published in 1955, was the first book of its kind for Veterinarians' subsequent to the Merck Index and the Merck Manual of Diagnosis and Therapy, published as early as in 1889 and 1899, respectively, for the medical world. There was no comprehensive book, covering all aspects of Veterinary and Animal Science, available earlier. The gap was filled by the Merck Veterinary Manual. Its thumb-tapped sections presentation was unique and the publication became extremely popular among Veterinarians as a ready to access information bank. The world over popularity and demand made Merck to publish nine subsequent editions till 2005.

The 'latest and hence the greatest' is the 10th edition of Merck Veterinary Manual published in 2010. The earlier compact little book has now taken a shape of bigger book, so that the reader can scan and locate information more rapidly on the pages. The new edition is conspicuous by redesigned tables and coloured photographs. Every section in the 10th edition is carefully updated. In addition to farm and companion



animals, exotic and laboratory animals, pet birds, fish, reptiles and rodents find an expanded space and information. New chapters have been added to provide basic information for Veterinarians on key issues including the cloning of domestic animals, alternative medicine, pseudo-pregnancy in small ruminants, emerging zoonosis and so on.

The chapters in this new edition have been contributed by nearly 400 authors, having vast

experience and expertise in different areas of animal productivity and health care. It is a matter of great pleasure to even go through the entire list of contributors, which gives an idea about the completeness of the book.

This 10th Edition of Merck Veterinary Manual, though grownup in size and scope, maintains the same aim as that stated in its first edition - 'to provide the Veterinarians with concise, authoritative and readily available information on diagnosis and treatment of the diseases of animals kept by man for use and pleasure'.

Truly, the book is indispensable and must find a place on every Veterinarian's book shelf, irrespective of wherever he works, may be in academics, research institutes, livestock farms or hospitals and clinics.



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