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DIAGNOSIS AND MANAGEMENT OF TRYPANOSOMIASIS IN CAMEL

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Trypanosomiasis is a historical disease that was first reported by Griffith Evans in 1880 in camel and horses from Dera Ghazi Khan District of Punjab. The disease is prevalent in almost all camel rearing countries of the world and is endemic in camels in Rajasthan, Haryana, Punjab and other states of India. The common clinical manifestations of the disease include recurrent pyrexia, progressive anaemia (pale mucous membrane), depression, lacrimation, blindness, dullness, weight loss, abortion and death. Increase in rectal temperature is associated with high parasitemia. Occasional signs include oedema of dependent body parts, urticarial plaques and petechial hemorrhages in serous membranes. Nervous signs like circling movement, aggression, trembling and aimless wandering is also noted in few acute cases. In chronic cases, shape of faecal pellets becomes conical. Some camel farmers even claim to identify the disease on the basis of characteristic smell of urine. Chronic form is more common than acute form. Death occurs in untreated cases, though in some cases animal may act as reservoir of infection for two to three years. Important post-mortem findings include necrotic foci in the liver and spleen and generalized lymphoid tissue hyperplasia.

The blood picture shows anemia, leucocytosis, neutrophilia and eosinophilia. Generalized lymphoid tissue hyperplasia is recorded in initial stages, but later on immune system is depleted of lymphoid cells. Serum levels of sorbitol dehydrogenase (SDH) increases many fold (normal level 1 to 17 IU/l) soon after infection. In chronic cases serum levels of aspartate amino transferase (AST, normal level 40-55 IU/l) show marked increase along with mild increase in alanine amino transferase (ALT, normal level 2 to 15 IU/l). Marked increase in AST is due to tissue damage in heart, kidney, skeletal muscles and liver as evident from necrotic foci in these organs at post-mortem. Significant decrease in serum albumin level and increase in globulin is another important finding in chronic cases. The pathogenesis and course of the disease is influenced by several factors such as other infections, nutritional status, age, pregnancy, previous exposure or immunosuppression by other diseases and stress.

Diagnosis is largely based upon direct microscopic examination of blood or buffy coats for presence of trypanosomes. However, it is not a sensitive test as parasitemia is usually very low, hence chances of giving false negative result is quite common. It has been reported that trypanosomes could be detected in peripheral blood smear in only 50% cases. Chances of detection of the parasite in peripheral blood smear increases when the blood is collected after intravenous glucose administration. Examination of buffy coat or thick blood smear also increases chance of detecting parasite in peripheral blood. Anemia (characterized by macrocytic and hypochromic) is a major finding. The mucous membrane are pale and the packed cell volume (PCV) goes below 25% (V/V) or even as low as 10% (v/v). For mass screening formal-gel test and mercuric chloride test are conventional diagnostic tools that

are based upon high serum globulin level associated with the disease. Several serological tests like ELISA, Latex Agglutination Test (LAT), Card Agglutination Test for Trypanosomiasis (CATT), Immunofluorescent antibody test (IFAT) have also been developed, but their practical utility under field conditions are limited. Inoculation of blood of suspected animal in mouse is reported to be sensitive method for diagnosis in chronic cases.

Several drugs have been tested for their safety and efficacy in trypanosomiasis in camel. Their name, trade name, dose rate, advantages and limitations are given in Table 1. Unfortunately, many drugs that are highly effective in vitro or in other animal species are toxic for camels. Availability of certain drugs that are safe and effective in camel is also a problem, as market for these drugs in India is very limited. Therefore, under field conditions, Quinapyramine prosalt remains the most commonly used drug. Many quacks and camel owner even inject this medicine to camels without proper diagnosis. Due to its overuse or repeated under-dosing problem of drug resistance against this drug is also noticed, particularly when the disease occurs in outbreak form. Relapse of the disease is also common, hence the diseased camel should be monitored for several months even after clinical recovery.

Fly control is an important aspect of control of Trypanosomiasis in camel. In India, *Tabanus* (Horse fly) and *Stomoxys* are two important fly vectors for the parasite. Quinapyramine prosalt may be administered to camel before onset of summer or monsoon for prophylaxis. Animals in good body condition are generally less susceptible for the disease. Blood of a cachexic animal should be examined several times before declaring it negative for Tryps. Repeated use of Quinapyramine prosalt after short interval should be avoided as chances of drug resistance development in trypanosomes increases and it may toxic effects on renal and other soft tissues. Carrier animals or animal with relapsing Tryps problem should be removed from the herd.

Table 1. Dose rate of various drugs used for treatment of trypanosomiasis in camel

Drug (Trade name)	Dose rate	Remarks
Quinapyramine methylsulphate (Triquin S)	3 to 5 mg/ kg body weight SC	<ul style="list-style-type: none"> ⚡ Weak/ and dehydrated animals may show transient salivation, muscle tremors, stiffness and depression. Have nephrotoxic effects. ⚡ Curative ⚡ Resistance against this drug is a common problem
Quinapyramine chloride methyl sulphate (Triquin)	5 to 8 mg/ kg body weight SC	<ul style="list-style-type: none"> ⚡ Use with caution in weak/ dehydrated animals ⚡ Curative as well as prophylactic
Cymelarsen	0.25 mg/ kg deep IM	<ul style="list-style-type: none"> ⚡ Curative ⚡ Effective in cases resistant to Quinapyramine
Suramin (Naganol/ Antrypol)	12 mg/ kg body weight IV	<ul style="list-style-type: none"> ⚡ Leakage of drug into soft tissues while injecting may cause severe irritation and abscess formation ⚡ Curative as well as prophylactic effects (for 3 weeks)
Isometamidium chloride (Samorin, Trypamidium)	0.5 mg/ kg body weight IV as 2% solution	<ul style="list-style-type: none"> ⚡ Leakage of drug into soft tissues cause severe irritation and abscess formation
Diaminazine aceturate (Berenil)	4 mg/kg IM (Citation 1)	<ul style="list-style-type: none"> ⚡ Caution: Toxicity: Symptoms: hyperaesthesia, salivation, convulsions, frequent urination and defecation, itching and sweating. Hepatic and renal damage may occur particularly at higher doses

LATEST TECHNIQUES FOR SEMEN EVALUATION

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Successful fertilization needs healthy and functionally competent sperm. No single test can provide information regarding its functional integrity of spermatozoa. Moreover, traditional methods do not provide adequate information regarding its functional aspects. Due to inconsistent and lower relationship of physical characteristics of spermatozoa, there is a need to identify suitable tests which could assess the functional integrity rather than physical integrity. Following are some latest techniques used for semen evaluation:

1. CASA based-motility: It is one of the most important and common factor responsible for sperm transport within the female reproductive tract primarily for penetration of the zona pellucida. Traditionally, subjective method was being carried out for determination of sperm motility through microscopic evaluation of mass motility and individual motility. However, the results from subjective method exhibited lot of variation owing to observer's skill, training, subjective error and bias. Therefore, emphasis had been laid on the development of objective method of semen evaluation. An overall objective evaluation of all the semen traits is possible through computer assisted semen analysis (CASA). The CASA machine is able to process and analyze the digitalized data using digital images of each sperm's track. It provides repeatable estimates of several sperm motion traits, viability and morphology viz. total motility (TM, %); progressive motility (PM, %); rapid motility (RM, %); slow motility (SM, %); velocity average path (VAP, $\mu\text{m/s}$); velocity straight line (VSL, $\mu\text{m/s}$); velocity curvilinear (VCL, $\mu\text{m/s}$); amplitude of lateral head displacement (ALH, μm); beat cross frequency (BCF, Hz); distance curve line (DCL, μm); distance average path (DAP, μm); distance straight line (DSL, μm); straightness (STR, %); linearity (LIN, %); sperm size (SS, μ) and sperm nucleus (SN, μ).

2. Membrane integrity: It includes the following:

a. Hypo-osmotic swelling test (HOST): The functional integrity of sperm plasma membrane is of fundamental importance for fertilization. The capacitation, acrosome reaction and binding of spermatozoa to oocyte require biochemically active plasma membrane. The HOST evaluates the functional integrity of sperm plasma membrane. The volume of spermatozoa increases when placed in hypo-osmotic solution. The increase in volume is associated with the spherical expansion of sperm plasma membrane and as the thickness and elasticity of membrane covering the tail is not uniform; the flagellum is forced to coil inside the membrane. Hence, the tail curling in sperm occurs as an effect of hypo-osmotic medium. Biochemically active sperm exposed to hypo-osmotic solution, swells until equilibrium is established between fluid compartment and the external environment. The optimal hypo-osmotic medium should exert enough osmotic stress to cause an observable increase in sperm value but not enough to induce lysis of plasma membrane due to influx of water.

b. Acrosome integrity: It is considered an important semen quality test to predict fertility. Acrosome encapsulates a variety of enzymes essentially required to penetrate ovum for fertilization. Spermatozoa have on their head a discrete deeply staining area mostly antero-laterally which appears as a refractile area. Acrosomal abnormalities may be hereditary (knobbed acrosome) or acquired (ruffled acrosome) and may lead to sterility or infertility. The different stains employed to evaluate acrosomes include Giemsa stain, Wells-Awa stain, Aslseth and Saacke's stain, chondroitin sulfate or India-ink. Giemsa stain has been mostly employed for acrosomal assessment. Giemsa is specific for the phosphate groups of acrosome and attaches itself to regions with high amounts of adenine-thymine bonding. It is also a differential stain with a mixture of methylene blue, Eosin and azure B.

3. DNA integrity: Damage to DNA has been studied as a cause of male subfertility. The testis is characterized by very high rates of cell proliferation and excess germ cells are eliminated by apoptosis. One characteristic of apoptosis is endonuclease cutting of DNA into discrete sizes demonstrating the presence of fragmented DNA in mature sperm. During the freeze-thaw process, the primary damage to DNA is caused by excessive accumulation of hydrogen peroxide (H_2O_2) which is the end product of superoxide radical. Acridine orange (AO) is the most commonly used staining method to evaluate sperm DNA integrity. AO intercalates into native DNA and fluoresces green (double-stranded) when exposed to blue light and fluoresces orange, yellow or red when associated with single stranded DNA because of the metachromatic properties of AO. Red and green sperm obtained from sub-fertile bulls could be seen under the fluorescent light microscope and roughly corresponded to the proportion of green and red sperm as measured by flow cytometry. Therefore, AO fluorescence staining of semen samples has been suggested as a practical and clinically significant procedure to determine sperm quality during infertility investigations.

4. Detection of antisperm antibodies

a. Immunoperoxidase Assay: This technique is used for determination of antisperm antibodies in serum and seminal plasma and is based upon the principle of enzymatic antigen detection in which the antibodies are visualized through peroxidase-catalyzed reaction. It is also used in pathology to demonstrate hormones, tissue-specific antigens, structural proteins, tissue enzymes, onco-fetal antigens, microorganisms and viruses.

b. Sperm-Mar Test: The Sperm-Mar IgA test is used for detecting antisperm antibodies of the IgA class in semen which otherwise can interfere with sperm function and zona binding and the acrosome reaction.

5. Sperm zona pellucida binding assay: Zona pellucida binding assays (ZBAs) have proven useful in determining the fertilizing ability of spermatozoa in several species. This test analyses the sperm capability to bind and penetrate the zona pellucida. Briefly, each zonae pellucidae of oocytes are inseminated with 10^5 to 10^6 motile spermatozoa/ml, prepared by a direct swim-up method. Following 4 h of incubation at $37^\circ C$ in humidified air, the zonae pellucidae are 'washed' by vigorous pipetting to remove any loosely attached spermatozoa. The zonae are then placed individually in microwells and dissolved by exposure to acidified ($pH < 2.0$) medium to form a fluid monolayer. The slides are sealed and the number of spermatozoa in the monolayer are counted within 24 h.

6. Hemizona assay: The hemizona assay (HZA) has been developed as a diagnostic test for the tight binding of spermatozoa to the zona pellucida to predict fertilization potential. In this homologous bioassay, the two matching hemizona halves are functionally equal surfaces allowing controlled comparison of binding from a fertile control versus a test sample, with reproducible measurements of sperm binding obtained from a single oocyte. Oocytes from different sources are salt-stored and used after micro-bisection. Extensive clinical data have demonstrated excellent predictive power of the HZA for the outcomes of intrauterine insemination and IVF, and therefore the assay has relevance in the clinical diagnostic setting in infertility.

7. Cervical mucus penetration test (CMPT): The *in vitro* CMPT is used to diagnose bovine infertility by measuring the distance travelled in millimeters by the most progressive or vanguard spermatozoa in cervical mucus of homologous species after 60 minutes of incubation. The structural arrangements of glycoproteins are responsible for the permissive or inhibitory effect of mucus on sperm migration. Cervical mucus acts as a natural barrier for the spermatozoa and as the first medium into which the sperm penetrates on their way into the reproductive tract. The cervical mucus penetration test can be used to distinguish between good and poor progressive motility of bovine sperm but it is merely useful to define the fertility level of semen sample. Grading of the semen samples is carried out as mentioned below:

Excellent: Distance travelled more than 30 mm.

Good: Distance travelled between 20 mm to 30 mm.

Medium: Distance travelled between 12 mm to 20 mm.

Poor: Distance travelled between 8 mm to 12 mm.

8. *In vitro* capacitation / acrosome reaction: The capacitation can be accomplished *in vitro* in numerous species by incubating ejaculated or post-thaw sperm under a variety of conditions in defined media that mimic the electrolyte composition of oviductal fluid. Ejaculated mammalian sperm need a period of incubation in the female reproductive tract in order to acquire the capacity to fertilize an egg. This period of attaining functional competence, referred to as capacitation, is required for undergoing the acrosome reaction induced by physiological stimuli such as zona pellucida. The most popular *in vivo* method of capacitation is by using heparin. In addition, *in vitro* treatment with calcium ionophores (Hoescht A23187) can also be used to induce acrosome reaction.

9. Oviductal epithelial cell explant test: Prior to fertilization, mammalian sperm attach to the oviductal epithelial cells (OEC) where they are stored for varying periods of time. The attached sperm are maintained at this site and then sub-populations of sperm are released over time. The sperm oviductal binding, which appears to be mediated through lectins, help the sperm maintain motility for prolonged periods of time while maintaining membrane integrity. In addition sperm calcium influx, a necessary prerequisite for acrosome reaction, is delayed while sperm are attached to OEC. *In vitro* studies using sperm and oviductal cell culture have been used as a bioassay to evaluate different bull spermatozoal treatments. The number of spermatozoa bound to the epithelial cells indicates its viability.

10. Heterospermic insemination: It is also called as competitive fertilization. It is a powerful test for male fertility with mixtures of sperm from different males and involves direct assessment

of fertilizing ability of spermatozoa. This procedure controls variation in environmental factors, technicians, and sperm numbers and is not affected by male-female interactions. Thus, when males differ slightly in fertility using homospermic insemination, heterospermic insemination can be used to exaggerate the differences. Heterospermic insemination has been estimated to be up to 170 times more efficient in assessing the fertility of bulls compared with homospermic procedures.

11. Zona free hamster oocyte penetration test: The hamster zona-free ovum test (HZFO test), or hamster test is a method for diagnosing male infertility due to the inability of the sperm to penetrate the ova. In this test, sperm are incubated with several hamster eggs. After 24 h incubation, the number of sperm penetration per egg is measured. The hamster eggs that have had the zona pellucida are called zona-free. Having all eggs penetrated by multiple sperm is considered to be a positive sign for fertility.

12. Sephadex filtration: A good deal of heterogeneity in spermatozoa morphology is encountered in mammalian semen and significant reduction in the percentages of dead and abnormal spermatozoa has been reported following sephadex filtration in semen. The separation of spermatozoa is based on complex and interacting properties of sperm plasma membrane and the medium suspending sperm and sephadex particles. Different types of sephadex G-25, G-50, G-100, G-200 and G50-200 are used which have a significant effect on sperm motility. Samples filtered through both sephadex G-75 and G 50-200 reveal higher semen quality than those filtered through sephadex 25, 50, 100 and 200.

Conclusions

Semen quality evaluation is the most important part in predicting fertility of domestic animals. However, due to the complexity of the fertilization process, a single semen evaluation test is not able to predict fertility. Therefore, a combination of semen tests must be selected with high relevance for important sperm traits and low redundancy of assay results.

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CLINICAL ANATOMY OF HEART AND LUNGS IN ANIMALS

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Heart and lungs are important vital organs clinically in diagnosis of disease following which appropriate treatment and prognosis can be given. Consequently, the normal topographical and applied anatomy of the heart and lungs must be appreciated and understood before clinical conditions can be approached.

Heart is cone shaped organ located in middle mediastinum with base directed upwards and apex towards sternum generally extends from 3rd to 6th rib. It is about 60% towards the left side. The heart is enclosed in fibroserous sac called pericardium having outer fibrous and inner serous layers. The fibrous outer layer is a relatively thin inelastic collagenous sheet. The serous is closely associated with the cardiac tissue and forms the outer glistening coat of the heart, the epicardium. In horse, ox and pig the fibrous pericardium is firmly attached to the caudal half of the thoracic surface of the sternum by the sternopericardial ligament. In the carnivores it is attached to the diaphragm by the phrenicopericardial ligament. In ruminants the topographical relations of the pericardium are of greatest clinical importance in which heart is closely related to the reticulum across the diaphragm. This is often a route of penetration of sharp foreign bodies from reticulum to pericardium resulting in the condition of traumatic pericarditis.

During ventricular relaxation pulmonary and aortic valves are closed. During ventricular contraction atrioventricular valves are closed and eversion of valve cusps into atria are prevented by contraction of papillary muscles projecting from ventricular wall and attached to chordae tendinae of cusps of valves. The arterial valves are opened and aorta and pulmonary artery are expanded by this sudden flow of blood. The right ventricular lumen is contracted in a bellows action in which outer wall is drawn towards the septum whereas contraction of left ventricle is radial and is more effective. The closure of these valves produce some distinctive sounds that are audible on auscultation. Their sound provides a valuable information on the condition of valves. The heart produces a characteristic sound which is easily divisible into two components a lower pitched "lub" arising from closure of the two A-V valves and a higher pitched "dup" which follows the first component closely and arises from closure of the valves of the aorta and pulmonary artery. If the chest piece of the stethoscope is placed over the wall of the thorax in the region of any one valve the contribution of that valve to the heart sounds is accentuated. Laminar blood flow is practically silent, but valvular incompetence may produce turbulent flow at the valve the resulting murmur may be heard if the stethoscope is correctly positioned. Systolic murmurs occur between the first and second heart sounds. Diastolic murmurs occur after the second sound and before the first sound of the next cycle. Once it has been decided that a heart murmur is systolic or diastolic, it is still necessary to determine which of four possible valvular conditions is the cause.

Below are given the sites of puncta maxima (points where sound of different valves can be clearly heard).

Species	Right AV valve	Pulmonary valve	Left AV valve	Aortic valve
Horse	4 th I/C R	3 rd I/C L	5 th I/C L	4 th I/C L
Ox	3 rd I/C R	3 rd I/C L	4 th I/C L	4 th I/C L
Dog	4 th I/C R	4 th I/C L	5 th I/C L	5 th I/C L

Percussion is also used to evaluate the size of heart. The cardiac dullness can be compared with high pitch obtained from lungs.

Intracardiac injection

In dog the projection of the pericardium upon the chest wall extends between the third and sixth ribs whereas in cat it extends from third and fourth to the sixth and seventh ribs, i.e. there is a variation according to size. Triceps muscle reaches not beyond fourth rib so a little part of the heart is covered by forelimb.

The injection is most easily made into the left ventricle because it is easy to locate externally via the apex beat. However the left ventricle has a very thick wall and the point of the needle tends to lodge in the wall rather than in the lumen. The right ventricle on the other hand, has a much thinner wall. The wall of the atria is also thin, but they are deeper within the thorax and less accessible. Therefore the best chamber to aim for is the right ventricle. If the purpose of injection is for resuscitation and is associated with cardiac massage, the best chamber to aim for is the left ventricle. This is much less likely to bleed during massage and produce cardiac tamponade.

Despite the close relationship of the ventricles to the sternum, a direct ventral approach is unsatisfactory, because the pectoral muscles are so thick ventrally that palpation of the spaces between the costal cartilages is very difficult. In both dogs and cats the best place to enter is through the right side 5th intercostal space, as close to the sternum as possible. At this point the needle will go through the cardiac notch which is larger on the right side lung in the dog. The needle is inserted obliquely, in a cranio-dorsal direction. A dog should be standing, or lying on its left side, but the cat is normally restrained on its left side. In cats the point of the elbow is close to the 5th costochondral junction, and this provides a landmark if the limb is placed at normal standing position. In both the dog and the cat it is also possible to enter through the 6th intercostal space but the needle must then be directed more cranially.

Lungs:

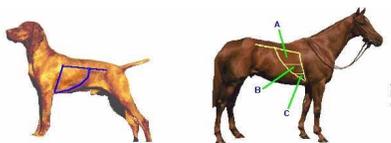
Each lung has an apex lying in the cranial thoracic aperture and an oblique base lying on the dome of the diaphragm. The ventral border presents the cardiac notch which permits the heart, within its pericardium, to make contact with the lateral thoracic wall. The basal border (between the costal and diaphragmatic surfaces) is of considerable clinical importance. The left lung has cranial and caudal lobes. In some species (carnivores, pig

and ruminants) the cranial is divided into cranial and caudal parts. The right lung has cranial, middle, accessory and caudal lobes.

The line of reflection of pleura from costal to diaphragmatic is known as the costodiaphragmatic line of pleural reflection. This is important clinically since it represents the functional division between thoracic and abdominal cavities. The area of pleural cavity within the acute angle formed by this reflection is called the costodiaphragmatic recess. Although this forms the theoretical limit to which the lung may expand, even in life the border of the lung never completely fills the recess. The exact position of the costodiaphragmatic line differs between species. In horse, the costodiaphragmatic reflection runs from the eighth rib cartilage to the vertebral end of the seventeenth rib. It slopes dorsocranially concave and is projected cranially at the last rib. In ruminants, the costodiaphragmatic reflection runs from the eighth costochondral junction to the twelfth rib, below the lateral margin of the iliocostalis. It has a steep caudal ascent and crosses the middle of the eleventh rib. In carnivores the costodiaphragmatic reflection runs from the eighth costal cartilage to the dorsal end of the thirteenth rib. It passes the costochondral junction of the eleventh rib and in pig the costodiaphragmatic reflection runs from the seventh costochondral junction to the dorsal half of the last rib. It is a uniform curve. For any clinical intervention in thoracic cavity needle must be inserted cranial to the costodiaphragmatic line otherwise the needle will enter the abdominal cavity.

Area available for auscultation: A triangular area is used for both auscultation and percussion. The cranial boundary of this triangle is formed by a line from the caudal angle of the scapula to the olecranon - the line of the triceps muscle. The position of this border is obviously variable with the position of the forelimb, dorsal boundary by a line taken from the caudal angle of the scapula to the tuber coxae and caudo-ventral boundary is formed by a line from the olecranon to the penultimate intercostal space (which is said to represent the basal border of the lung mid-way between inspiration and expiration). This line is straight in the ox but well curved toward the costal arch in the horse and dog. This triangle can be divided into three zones :

- The lower third represents the area of cardiac dullness .
- The middle third is used for auscultation of bronchial sounds.
- The upper third is used to auscultate vesicular sounds.



A : Area of vesicular breath sound

B : Area of bronchovesicular sound

C : Area of cardiac dullness

During inspiration Vesicular sound should be a soft and breezy. In the bronchial area turbulent air flow can be heard with no liquid sounds. During expiration the sound are shorter than the inspiration and will be weaker (or even the sound may be absent) as it is a passive action and so will not be very obvious. Some deviations from this normal pattern means animal has a disease

Sounds heard during auscultation:

- Prolonged expiration - This occurs in Emphysema. The lungs are in a constant state of inspiration and very little air can enter the alveoli with each inspiration. It also occurs in Asthma. Breathing in this case is very noisy. It can be heard with a stethoscope, inspiration and expiration are very loud, and expiration is prolonged. This is a continuous sound.
- Diminished vesicular breathing - Occurs when the alveoli are compressed by fluid or growths. Very little air can enter and so the vesicular sounds will be low. The vesicular sound is also diminished over that part of the lung where the pleura is thickened and adherent. It also occurs if there is a tumour in the lung area. This is a continuous sound.
- Crackling noises - This can occur if air is escaping from the lungs due to an open glottis. It can also occur if there is very little surfactant in the lungs and so the alveoli are 'stuck together' and when they open they crackle a little as the surface tension is broken. This is a discontinuous sound
- Bronchial breathing - Heard over a consolidated lung with patent bronchial passages and occurs most typically in acute pneumonia. If the lungs are completely consolidated then the sound is harsh blowing sound but when the lungs are not completely consolidated then it is softer and more blowing. It also occurs in tuberculosis. This is a continuous sound.
- Metallic tinkling - This is a clear ringing sound of metallic quality, the sound of bubbles bursting in a small cavity. The sound has also been likened to that produced by drops of water falling from a height on to the surface of water in a small cavity. Occurs in a pneumothorax. This is a continuous sound.
- Cavernous or amphoric - Distinguished by its peculiar hollow character which affect both inspiration and expiration, and is caused in one of three ways.
 - 1) By the effect of a large air space on the conduction of the breath sounds to the surface of the chest.
 - 2) By sound vibrations set up in the air cavity, when the air passes over its orifice.
 - 3) By air entering into a large air containing cavity, especially into a pneumothorax.

Percussion

When percussing the lungs, it is important to know the lung boundaries as the lungs do not fill up the ribcage entirely. Sounds of other organs can be heard within the area of the ribcage e.g of stomach. In the ruminant, every few minutes on the left side of the animal, ruminating can be heard, this sounds like a rustling which gradually gets louder up to a crescendo as the cow is ruminating.

- Hollow tubular sounds - This occurs when air is escaping and is heard if trachea is percussed with open glottis. This is a continuous sound.
- Drum-like (tympanic) sounds - Tympanic resonance is of high pitch and great clearness. There are four common reasons for obtaining this sound:

- 1) It occurs if the lung is in contact with the chest wall and it is relaxed, but not compressed, by effusion into the pleura.
 - 2) The presence of a pneumothorax.
 - 3) A central consolidation of the lungs.
 - 4) A tympanitic note is obtained if the distended stomach is percussed.
- Flat, toneless sound - If the sound is dull or toneless in an area normally occupied by air, this would mean that air could not resonate for some reason. This could be caused by consolidation of the lungs or displacement of the lungs by fluid or tumour.
 - Hyper-resonance - More air than normal in the alveoli. This increases the resonance of the percussion note and this hyper-resonance varies with the amount of additional air space in the lungs. This change in the amount of air may occur: In both lungs in Emphysema.

In one lung, to compensate when the other is airless and out of action. In part of one lung adjoining an airless portion of the same lung. The hyper-resonant note is heard in its most extreme form in the presence of a pneumothorax, when it may resemble the tympanitic note of the distended stomach.

Some diseases produce sounds which can be helpful to diagnose the problem:

- Central consolidation -tympanic resonance
- Pulmonary fibrosis - greatly reduced resonance
- Spontaneous pneumothorax - extreme tympanitic hyper-resonance
- Emphysema - hyper-resonance in both lungs
- Fluid in pleural cavity - reduced resonance, especially in lower lungs
- Tumour in lungs, thickened or adherent pleura, inflammatory material in alveoli, pneumonia, pulmonary tuberculosis - reduced resonance

When using a stethoscope, it must be kept very still over the area of the body as movement of the head will cause a loud rustling sound. To avoid this the hair around the area of the stethoscope should be wetted slightly so as to stop the rustling of the hairs on the stethoscope membrane.

Thoracocentesis

Thoracocentesis is a clinical technique of removal of fluid or air from the thoracic cavity. The needle is inserted into the middle of the intercostal space to avoid the blood vessels and nerves that run down the caudal edge of each rib. The needle is inserted at a 45° angle towards the parietal pleura preventing the lung parenchyma from obscuring the needle lumen when aspiration is being performed.

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OSTEOCHONDRITIS DISSECANS IN HORSES: AN IGNORED DISEASE

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Osteochondritis dissecans (OCD) is one of the most important developmental orthopaedic disease. It is a common cause of lameness in young athletic horses and may require surgical intervention. The terms osteochondrosis, osteochondritis dissecans and osteochondrosis dissecans have been regularly used as synonyms, but this is misleading. Osteochondrosis is the disease, osteochondritis is the inflammatory response to the disease, and OCD is the condition in which a flap (an area of cartilage or osteochondral separation) can be demonstrated.

The osteochondrosis affects the articular (joint) cartilage, and often involves the subchondral bone beneath the cartilage surface. Clinical signs develop when the joint surface is reached by the lesions. Sometimes the OCD fragments can detach and become a loose fragments called joint mouse. If the fragment remain attached to the bone, it causes synovitis, leading to pain and inflammation. Radiographically, abnormally focal thickening of joint cartilage suggests initial stages of disease. Osteochondritis dissecans can affect a number of joints, but the most commonly involved are the femoropatellar, tarsocrural and fetlock joints. Shoulder joints are less frequently affected.

A variety of radiographic presentations are seen with OCD. Only flattening or a defect in the joint surface (type I OCD), a loose cartilage flap in place within the area of flattening (type II OCD), and flattening with or without a fragment in place, but also have free or loose bodies within the joint (type III OCD).

The femoropatellar (stiflre) joint is one of the principal joints affected with OCD. Stifle joint OCD is more common in Thoroughbreds than in other breeds. This disease is common in young horses of age less than a year. Younger animals showing clinical signs often have more severe changes within the joint compared to older horses.

In fetlock joint OCD, joint swelling (effusion) is the most common clinical sign, with lameness variable in both appearance and severity. Fetlock flexion tests are usually positive. It is not unusual for all four fetlocks to be involved, however bilateral forelimb or hindlimb involvement is quite common.

Most horses with shoulder OCD are presented at 1 year of age or younger, with a

history of forelimb lameness of variable severity. Many of these horses have prominent lameness, and if lameness has been present for many weeks, shoulder muscle atrophy is also seen. Because of the altered gait and use of the limb, many cases develop an upright or club-footed appearance to the foot, and the foot may appear smaller on the affected limb. Deep pressure over the shoulder joint often causes discomfort, and forced flexion/extension of the limb sometimes accentuates the lameness that is seen.

Treatment: A conservative approach (rest, analgesics and supportive medication) is initially recommended for type I lesions. The majority of these cases may show improvement in clinical signs, as well as improvement or disappearance of radiographic signs; however, surgery may be necessary in a few number of these cases. Moreover, in high performance racing horses it is preferred to do surgery at the earliest to eliminate the chance of an OCD flap or fragment breaking loose later. If clinical signs have persisted as the horse approaches a year of age, surgical intervention is appropriate. Otherwise, the type I cases showing persistent clinical signs may develop secondary osteoarthritis. Surgical debridement of the lesions (loose flaps of cartilage) using arthroscopic surgery is recommended for type II and III lesions, where fragmentation or loose bodies are present.

BENEFITS OF EARLY NEUTERING IN PET MALE DOG

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Neutering is a common surgery done in stray male dogs for sterilization purpose under animal birth control programme. This column is to highlight that neutering in male dog is not only to avoid breeding but also to save them from many chronic and untreatable conditions. Since veterinary officer at the field level is the primary doctor dealing with cases, they can better guide the pet owners and advise them to get their male dogs neutered in time for their future better health. Below discussed are some of the points which highlight the benefits of early elective neutering of male pet dogs:

1. Neutering reduces the nuisance of leg-lifting in house on furniture and other items, which is otherwise an act required by wild /stray male dogs done to mark their territory.
2. Neutering reduces the dominance and aggression in the animal, if done at an early age of 6 months, especially for furious dog breeds like Rottweiler, Pit bulls etc.
3. Neutering reduces the risk of male dog going out after females in breeding season and being attacked by other male dogs. The incidence of dog bite is the maximum during this period. Rabies is another communicable disease widely reported in breeding season.
4. The dog may get infected with transmissible venereal disease like Venereal granuloma, if not neutered.
5. Neutering makes the pet more loyal as its attention from the sexual activities is reduced. It also reduces the sexual behavior of the male dog with the family members.
6. Neutering is very important to reduce the risk of prostate disorders like cancers, cysts, infections etc. Enlargement of prostate in middle to old age is very common in intact male dogs. Prostate disorders further lead to urinary incontinence, constipation, anal fistulas/wounds and perineal hernia. In developed countries, where neutering is compulsory, such diseases are rare. Neutering also prevents testicular cancers.
7. Neutering is necessary in cryptorchid dogs. Cryptorchidism is the non-descend of

testicles in the scrotal sac. This may be unilateral or bilateral i.e one testicle has not descended or both. These testicles in abdomen or subcutaneous tissue could lead to multiple hormonal imbalances leading to hair fall, test enlargement and development of sertoli cell tumor of the retained testicle. It is recommended to wait for testicle descend maximum up to 6 months.

8. A chronic and frustrating disease condition of intact males is anal frunculosis in which multiple fistulas may develop around anus along with inflammation of rectum. This condition leads to very painful defecation. It is very common in German shepherd dogs due to broad base and non-lifting of tail. Occurrence of this condition can be reduced by neutering the dog at the recommended age.
9. Neutering of pet dog is of utmost importance in a country like India, where we want to limit the population of dogs. Our pet dogs may go out and mate with any stray females, thus, increasing the population. Every dog cannot be bred with another dog without proper knowledge of breeding. This lead to emergence of many hereditary diseases which get transmitted from generation o generation with more severity.
10. So, general public should be encouraged to opt for getting their male dogs neutered at the age of 6-9 months under your consultation.

BRUCELLOSIS: PREVENTION, CONTROL AND TREATMENT

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Brucellosis is a contagious disease of livestock with significant economic impact. The disease is caused by various bacteria of the family *Brucella*, which tend to infect a specific animal species. However, most species of *Brucella* are able to infect other animal species as well. It affects cattle, swine, sheep and goats, camels, equines, and dogs. It may also infect other ruminants, some marine mammals and humans. Brucellosis, also known as “undulant fever”, “Mediterranean fever” or “Malta fever” is a zoonosis and the infection is almost invariably transmitted by direct or indirect contact with infected animals or their products. It affects people of all age groups and of both sexes.

This zoonotic disease is present in all livestock systems and increased demand for dairy products accompanied with changing and intensified farming practices has raised the concern for increased spread and intensified transmission of this infection to the human population with increased risk of disease. The disease in animals is characterized by abortions or reproductive failure. While animals typically recover, and will be able to have live offspring following the initial abortion, they may continue to shed the bacteria.

Six main “species” are distinguished: *B. abortus*, *B. suis*, *B. melitensis*, *B. neotomae*, *B. ovis*, *B. canis*. *B. abortus* is normally associated with cattle, *B. melitensis* with sheep and goats, *B. suis* with swine. *B. ovis* causes an infection specific for sheep and has not been conclusively implicated in human disease and *B. canis* is usually associated with disease in dogs but occasionally causes human brucellosis. *B. neotomae* has been isolated on few occasions and has never been implicated in human disease.

KEY POINTS ON PREVENTION OF BRUCELLOSIS IN HUMANS

- The prevention of human brucellosis is based on occupational hygiene and food hygiene.
- Vaccination is not generally recommended.
- All dairy products should be prepared from heat-treated milk.
- Consumption of raw milk or products made from raw milk should be avoided.
- Meat should be adequately cooked.
- Special precautions should be taken by laboratory workers.
- Physicians and health workers should be aware of the possibility of brucellosis.
- Public health education should emphasize food hygiene and occupational hygiene.
- People who handle animal tissues (such as hunters and animal herdsman) should protect themselves by using rubber gloves, goggles, gowns, aprons etc. This will help ensure that bacteria from potentially infected animals do not get into eyes or

inside a cut or abrasion on the skin

TREATMENT OF BRUCELLOSIS IN HUMANS

- The essential element in the treatment of all forms of human brucellosis is the administration of effective antibiotics for an adequate length of time.
- Treatment of uncomplicated cases in adults and children eight years of age and older: doxycycline 100 mg twice a day for six weeks + streptomycin 1 g daily for two to three weeks.

OR

- Doxycycline 100 mg twice a day for six weeks + rifampicin 600– 900 mg daily for six weeks.

KEY POINTS ON PREVENTION, CONTROL AND ERADICATION OF ANIMAL BRUCELLOSIS

Prevention

For brucellosis, the measures of prevention include:

- Careful selection of replacement animals. These, whether purchased or produced from existing stock, should originate from *Brucella*-free herds or flocks.
- Isolation of purchased replacements for at least 30 days.
- Prevention of contacts and commingling with herds or flocks of unknown status or those with brucellosis.
- If possible, laboratory assistance should be utilized to diagnose causation of abortions, premature births, or other clinical signs. Suspect animals should be isolated until a diagnosis can be made.
- Herds and flocks should be included in surveillance measures such as periodic milk ring tests in cattle (at least four times per year), and testing of slaughtered animals with simple screening serological procedures such as the RBT.
- Proper disposal (burial or burning) of placentas and non-viable fetuses.
- Disinfection of contaminated areas should be performed thoroughly.
- Cooperation with public health authorities to investigate human cases. Animal brucellosis, especially when caused by *B. melitensis*, can often be identified through investigations of cases in humans.

Control

The aim of an animal control programme is to reduce the impact of a disease on human health and the economic consequences. Control and prevention schemes require effective collaboration between all sections of the community. Control programmes must be properly planned, coordinated and resourced

Certain principles apply, namely:

- 1) test and isolation/slaughter,
- 2) hygiene
- 3) control of animal movement
- 4) vaccination
- 5) the reduction of exposure to *Brucella* spp.

Eradication

- Eradication can only be achieved by test-and slaughter combined with effective prevention measures and control of animal movements.
- Animal brucellosis is best prevented by careful herd management and hygiene.
- Vaccination is useful for prevention and control of infection
- Education and information programmes are essential to ensure cooperation at all levels in the community

Treatment of animals

In animals treatment is neither advisable nor practicable.

Immunization:

1. Cattle: The vaccines for animals include live attenuated vaccine- *B.abortus* S-19 and *B.mellitensis* Rev-1; and killed adjuvant are *B.abortus* 45/20 and *B.mellitensis* H38.
2. Sheep and Goat: *B.mellitensis* Rev-1 by s/c route is most appropriate.
3. Pig and Dog: No suitable vaccine is available, so control can be achieved by slaughter.

EMERGING THREATS FROM VECTOR BORNE VIRAL ZONOTIC DISEASES IN INDIA

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The diseases transmitted by arthropod vectors are one of the most dangerous and difficult to control, with an unpredictable spread of the disease. These diseases can have larger range and high disease transmissibility. Vectors are living organisms that can transmit infectious diseases, most of which are zoonotic in nature, between humans or from animals to humans. They ingest disease-producing microorganisms during a blood meal from an infected host (human or animal) and later inject it into a new host during their subsequent blood meal. Mosquitoes, followed by ticks, flies, sandflies, fleas, and triatomine bugs are some of the important disease vectors.

Of the 1,407 recognized species of human pathogens, 816 (58%) are known to be zoonotic. Of the total, 177 are regarded as emerging or reemerging, most of which are viral zoonotic diseases (Woolhouse and Gowtage-Sequeria 2005). Following are some of the important vector borne viral zoonotic diseases in Indian context.

JAPANESE ENCEPHALITIS

Japanese encephalitis (JE) is an inapparent to acute arthropod-borne viral infection and one of leading cause of viral encephalitis and neurological infection in Asia (Halstead *et al* 2008). It is due to infection with the JE virus (JEV), a mosquito-borne Flavivirus belonging to the family Togaviridae. The main JEV transmission cycle involves *Culex tritaeniorhynchus* mosquitoes and similar species that lay eggs in rice paddies and other open water sources, with pigs and aquatic birds as principal vertebrate amplifying hosts (Burke *et al* 1988). Humans are generally thought to be dead-end JEV hosts, i.e. they seldom develop enough viremia to infect feeding mosquitoes i.e. less than 1% of human JEV infections result in JE. Approximately 20–30% of JE cases are fatal, with neurologic sequelae in 30–50% of survivors (Fischer *et al* 2008).

JE is primarily a disease of children and most adults in endemic countries have natural immunity after childhood infection, but all age groups are affected. In most temperate areas of Asia, JEV is transmitted mainly during the warm season, when large epidemics can occur. In the tropics and subtropics, transmission can occur year-round but often intensifies during the rainy season (Fischer *et al* 2010). A large scale outbreak of JE was reported in 1973 from Bankura and Burdwan districts of West Bengal. Since 1972, JE has spread to newer areas epidemics/outbreaks were also reported from Assam, Andhra Pradesh, Bihar, Uttar Pradesh, Madhya Pradesh, Karnataka, Kerala, Tamil Nadu, Goa, Pondicherry and Maharashtra.

Clinical signs and symptoms:

Humans Beings: JE has an incubation period of 5 to 15 days and the vast majority of infections are asymptomatic as only 1 in 250-300 infections develop into encephalitis.

Fever, headache and malaise are other non-specific symptoms of this disease which may last for a period of between 1 and 6 days. Signs which develop during the acute encephalitic stage include neck rigidity, cachexia, hemiparesis, convulsions and a raised body temperature between 38 and 41 degrees celsius. Mental retardation developed from this disease usually leads to coma. Mortality of this disease varies but is generally much higher in children. Life-long neurological defects such as deafness, emotional liability and hemiparesis may occur in those who have had central nervous system involvement.

Animals:

Pigs: JE virus is maintained between pig-mosquito-pig cycle in nature. Pig acts as an amplifying host of JE virus. The infection is inapparent in pigs. Pregnant sows may give birth prematurely to infected and often dead pigs.

Horses: JE virus infection is prevalent in horses usually in an inapparent form. However, sometimes it could be acute with fatal encephalitis.

Birds: The black crowned night heron, little egret and plumed egrets are important in transmission cycle showing high level of viraemia as well as seroconversion.

Antibodies to JE virus have also been demonstrated in cattle, sheep and goat but these animals do not seem to play a significant role in the maintenance and transmission of JE virus in nature.

Laboratory Diagnosis: The important diagnostic methods include

- (a) **Isolation of virus from autopsy specimens of brain tissues**, which can be achieved by inoculation of suckling mice, vertebrate cell culture or insect cell culture (C636 *Aedes albopictus* cell line).
- (b) **Demonstration of viral antigen** in the autopsy specimens of brain by fluorescent antibody technique.
- (c) **Serological diagnosis** by demonstration of virus specific IgM antibody by IgM antibody capture ELISA (MAC ELISA) in the acute serum sample of patients or demonstration of 4 fold or higher rise in antibody titre on testing paired sera by HI, CF or mouse neutralization test.

Treatment: In the absence of a reliable antiviral drug, symptomatic treatment using antipyretic and anticonvulsant drugs with proper management is indicated. Maintenance of electrolytes balance and reducing of intracranial pressure is also advisable.

Prevention and control: In India- JEEV is the purified inactivated vaccine available. However, for want of specific antiviral drugs and several limitations on the use of vaccine, vector control seems to be the only possible way to break the transmission cycle to control the disease. Prevention of mosquito bites and vector control by larvicides and insecticide house spraying are the best ways, besides water management in irrigation practices for paddy fields.

CRIMEAN CONGO HEMORRHAGIC FEVER

Crimean Congo hemorrhagic fever (CCHF) is one of the severe forms of

hemorrhagic fever endemic in Africa, Asia, Eastern Europe and the Middle East with a near fatal mortality rate. India was always under the potential threat of CCHF viral infection until an outbreak hit parts of Gujarat. In India, the first laboratory confirmed case of CCHF was reported in January, 2011 from Ahmedabad, in Gujarat (Patel *et al* 20011).

CCHF is a zoonotic viral disease caused by tick-borne virus *Nairovirus* (Family Bunyaviridae). *Hyalomma* tick is the vector responsible for viral transmission. Other ixodid ticks including members of the genera *Rhipicephalus*, *Boophilus*, *Dermacentor*, and *Ixodes* may also transmit the virus. These vectors have both trans-ovarial and trans-stadial transmission of virus, thus contributing to circulation of the virus in nature by remaining infected throughout their developmental stages and also by passing to the next generation.

The CCHF virus circulates in an enzootic tick–vertebrate–tick cycle. The disease is generally asymptomatic in infected animals but highly fatal in humans. Human beings may acquire infection by direct contact with blood or other tissues of infected livestock or may become infected through a tick bite or crushing of infected tick. Further secondary cases are frequently seen due to human to human transmission via percutaneous or per mucosal exposure to blood and body fluids containing the virus. History of tick bite, high-risk occupations, contact with livestock and older age are risk factors. A variety of vertebrates like cattle, goats, donkeys, horses, etc., along with smaller wild life species like hares and hedgehogs act as a reservoir for the virus.

A related species of the genus *Nairovirus* – Ganjam virus – that belongs to the Nairobi Sheep group is transmitted by *Hemaphysalis* ticks. This virus has veterinary importance in India and has been demonstrated in mosquitoes, man, and sheep.

Clinical signs and symptoms:

Human beings are the only host in whom the disease manifestations are visible. The typical course of CCHF infection has four distinct phases-incubation period, prehemorrhagic phase, haemorrhagic phase, and convalescent phase. The incubation period is in the range of 3-7 days. The disease begins by nonspecific prodromal accompanied by hypotension, relative bradycardia, tachypnea, conjunctivitis, pharyngitis, and cutaneous flushing or rash. The prehemorrhagic phase lasts for 4-5 days and in a majority of the patients it progresses to hemorrhagic phase. The hemorrhagic phase is generally short and has a rapid course with signs of progressive hemorrhage and diathesis. The disease is fatal in 40-60% of the cases. In severe cases, death occurs as a result of multiorgan failure, disseminated intravascular coagulation, and circulatory shock.

Laboratory diagnosis:

As CCHF virus is classified as risk group 4 virus and hence the clinical samples are handled in specially-equipped, high biosafety level laboratories (BSL 3 plus or 4). The ante-mortem samples comprise of blood samples and the post-mortem samples include tissue samples (liver, spleen, bone marrow, kidney, lung and brain).

- (a) **Virus Isolation:** It is carried out in maximum bio-containment laboratory i.e. BSL - 4. The virus may be isolated from blood or tissue specimens in the first five days of illness.

(b) Molecular Technique: The Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) is test of choice for laboratory diagnosis of CCHF virus infection.

(c) Serology: IgG and IgM antibodies may be detected in serum by ELISA from about day six of illness. IgM remains detectable for up to four months, and IgG levels decline but remain detectable for up to five years.

Treatment: According to World Health Organization (WHO), ribavirin is the anti-viral medication of choice for CCHF and the recommended dose is an initial dose of 30 mg/kg followed by 15 mg/kg for four days and then 7.5 mg/kg for six days for a total of 10 days. A new specific immunoglobulin CCHF-Venin that contains antibodies to CCHF virus has been prepared, but limited studies are available, which show the beneficial effects of immunotherapy in CCHF.

Prevention and control measures: These include use of tick repellents, avoidance of tick prone areas, and regular examination of clothing and skin for ticks. While handling livestock or domesticated animals, appropriate acaricidal agents should be used to control tick population. Protective clothing and gloves should be used whenever there is chance of contact with skin or mucous membranes of viremic animals, particularly when blood and tissues are handled. Consumption of unpasteurized milk and uncooked meat should be avoided. CCHF V irus can be inactivated by disinfectants including 1% hypochlorite and 2% glutaraldehyde; and can be destroyed by heating at 56°C (133°F) for 30 min.

WEST NILE FEVER

West Nile virus (WNV) is an arthropod borne virus of the genus *Flavivirus* under family *Flaviviridae* and is found in both tropical and temperate regions. It mainly infects birds, but is known to infect humans, horses, dogs, cats, bats, chipmunks, skunks, squirrels and domestic rabbits. The main route of human infection is through the bite of an infected mosquito, mainly *Culex* spp. The disease causes mortality in horses, domestic and wild birds. In India, this virus is known to be active in mosquitoes, birds and pigs. It has also been associated with human encephalitis cases. In India, presence of West Nile antibodies in humans was first reported from Bombay by Banker in 1952 and confirmed by Smithburn in 1954 by detecting the WNV neutralizing antibodies. WNV neutralizing antibodies (about 20-30%) have been detected in human sera collected from Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Gujarat, Madhya Pradesh, Orissa and Rajasthan. The WNV strain P-4230 has been isolated from a laboratory worker who got lab infected while handling the Indian mosquito strain G-2266 and the Egyptian human strain E-101 on consecutive two days (Virus Research Centre, Annual Report-1956).

Clinical signs and symptoms:

Human beings: The incubation period of disease is usually 3 to 14 days. The symptoms of severe neuroinvasive disease include headache, high fever, neck stiffness, stupor, confusion, seizure, chorioretinitis, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis.

Animals: Most infections in animals are subclinical. WNV infection in horses typically cause listlessness, depression, somnolence, listlessness, apprehension, hyperexcitability and meningoencephalitis. Approximately 90% of symptomatic cases in horses result in

neurological disease with case fatality rates of 30-40% (Venter *et al.*, 2011). However, WNV infection in horses has not been documented in India. General signs of infection in birds include lethargy, recumbency, and in some cases, hemorrhage.

Laboratory diagnosis:

- (a) The most efficient technique is detection of IgM antibody to WNV in serum or cerebral spinal fluid (CSF) collected within 8 days of illness onset using the IgM antibody capture enzyme-linked immunosorbent assay (MAC-ELISA).
- (b) Other methods to confirm WNV infection include IgG antibody sero-conversion (or significant increase in antibody titers) in two serial specimen, neutralization assay, RT-PCR technique, and virus isolation by cell culture (CDC, 2011).

Treatment: Currently, there are no effective medicines available for the management of WNV infection. Treatment in patients with severe disease may require supportive therapy such as hospitalization, mechanical ventilation, intravenous fluids and prevention of secondary infections.

Prevention and control: The integrated vector control strategies includes the use of personal protection measures like protective clothing, bed nets, both chemical and neem based repellants, insecticides, insecticide impregnated curtains, and biological control methods by larvivorous fish, introducing natural parasites and predators and bacterial agents.

KYASANUR FOREST DISEASE

Kyasanur Forest Disease (KFD) is a tick-borne viral disease characterised by sudden onset of fever and/or headache followed by hemorrhagic manifestations such as conjunctival congestion, bleeding gums, epistaxis, haemoptysis, haematemesis and malena. Heavy mortality in two species of monkeys *viz.* the black faced langur (*Semnopithecus entellus*) and the red faced bonnet monkey (*Macaca radiata*) in March 1955 in forests of Shimoga district, Karnataka led to the disease discovery. Investigations resulted in the isolation of the virus from monkeys, man and ticks.

The disease is now localised in five districts (Shimoga, Chikamagalur, Uttar Kannada, Dakshina Kannada and Udupi) of Karnataka. Recently, in 2014, a new focus of KFD virus activity has been reported in a tribal area of Kerala (Babasaheb *et al* 2015).

The causative agent is a Flavivirus, which is transmitted to man through the bite of a tick *Haemaphysalis spinigera*. KFD is mainly seasonal and most cases occur during the inter-monsoon period i.e., from December to June. Epidemics coincide with nymphal activity of ticks, which is high from December to May; hence nymphs are considered as the most important stage for human transmission. Adults are more susceptible than the children primarily because children in this age group rarely visit the forest and males more than the females. The number of human cases occurring each year varied from 40 to ~1000 with a mortality rate of 4-15%.

KFD epizootics in monkeys are a regular feature in the area. However, in enzootic state, KFD virus circulates through small mammals such as rodents, shrews, ground birds and an array of tick species. Cattle are the important source of blood meal for these adult

ticks but do not play a role in the virus transmission cycle.

Clinical signs and symptoms:

The onset is sudden with chills; frontal headache and high fever about 40°C. The clinical symptoms include continuous fever for 12 days or longer, usually associated with severe myalgia, cough, diarrhea, vomiting and photophobia. The incubation period is of 2-7 days. The convalescent phase is prolonged. Often, there is a relapse after 1 to 2 weeks of a febrile period. The second phase lasts for 2-12 days and is marked by the same symptoms. Neck stiffness, mental disturbance, giddiness and abnormality of reflexes are additional complications in the second phase of illness. The ratio of apparent:inapparent infection is 1:1. The attack rate is 5 per 100 in a given village. Recovered persons have a life-long immunity.

Diagnosis:

- (a) Isolation of the virus from the acute serum by inoculation of suckling mice
- (b) Demonstration of a rise in titre of antibodies in paired serum samples (acute and convalescent) by haemagglutination inhibition and mouse neutralization tests.

Prevention and control: This includes measures related to avoidance of tick bites and eradication of ticks. An inactivated vaccine for KFD virus is routinely being manufactured in the laboratory of Karnataka State Government for human immunization.

CHIKUNGUNYA FEVER

Chikungunya is a mosquito-borne viral disease of great public health concern in India. Chikungunya fever (CHIK fever) caused by chikungunya virus (CHIKV) is transmitted by the mosquito, *Aedes aegypti*. The virus is currently causing one of the largest reported outbreaks of CHIK fever in last 40 years.

Chikungunya is believed to have originated in Africa where it has maintained in 'sylvatic cycle' involving wild primates and forest dwelling mosquitoes such as *Aedes furcifer*, *Ae. luteocephalus*, or *Ae. taylori*. The first recorded chikungunya outbreak in India was in Kolkata in 1963. This was followed by epidemics in Tamil Nadu, Andhra Pradesh and Maharashtra in 1964–65 and in Barsi in 1973. The virus re-emerged in 2006 after a gap of 32 years and caused an explosive outbreak affecting states like Andhra Pradesh, Karnataka, Maharashtra, Madhya Pradesh, Tamil Nadu, Gujarat and Kerala. During 2009–2010, cases were also reported from Maharashtra. In the subsequent years, CHIKV spread to other states: Goa, Orissa, Rajasthan, West Bengal, Andaman & Nicobar Islands and Puducherry. In the year 2011 cases were reported from all states except Punjab, Dadra and Nagar Haveli and Lakshadweep.

The virus is transmitted by culicine mosquitoes, *Aedes aegypti*, *Ae. albopictus* and *Ae. Polynesiensis*, although *Culex* and *Anopheles* have also been reported for the transmission in some cases. The common reservoirs for Chikungunya virus are monkeys, lemurs and other vertebrates. The role of cattles and rodents has also been reported in the transmission of the virus. Chikungunya virus usually shows a periodicity with re-occurrence of disease in the community after interval of 3-4 years. A recently published study has

reported some mutations in the virus at E1-226V portion of the genome, which possibly have made it possible for the virus to survive longer in humans and mosquitoes, explaining, to its rapid spread.

Clinical signs and symptoms:

The symptoms develop after an incubation period of 4 to 7 day. A clinical triad of 'fever, rashes and arthralgia' is suggestive of chikungunya fever. Movement at the joints causes excruciating pain to the person forcing to make bend up position giving it the name 'Chikungunya'. The clinical features also include severe headache, chills and rigors, nausea and vomiting. The fever may disappear to return in one or two days giving it the name of 'Saddle back fever'. Rashes occur mainly on trunks or extensor surfaces of the limbs and are itching in nature usually accompanied by secondary rise in the temperature.

Laboratory Diagnosis:

- (a) Serological diagnosis against neutralising and HI. IgM capture ELISA is the most sensitive serologic assay, and is necessary to distinguish the disease from dengue.
- (b) RT-PCR is confirmatory for the identification of chikungunya virus.
- (c) The virus isolation procedures need to be done under BSL-3 precautions

Prevention and control: The only mode of prevention is use of physical and biological means of protection from the vector. Center for Disease Control and Prevention (CDC) has advised a repellent containing 30 to 50% DEET (N, N-diethyl-m-tolamide).

Chandipura virus encephalitis:

Chandipura virus (CHPV) is a vesiculovirus of Family Rhabdoviridae. The virus, known to be carried in dormant stage by sandflies, which live near domestic animals like cows and buffaloes and is transferred from the fly to human beings specifically during monsoon. Cases clinically diagnosed as viral encephalitis from Raipur in central India in 1980 showed CHPV etiology, confirmed by isolation of CHPV virus from the acute sera Chandipura virus has been isolated in from a pool of 253 unidentified Phlebotomine sandflies (*Phlebotomus* spp.) in the Maharashtra State of India (Dhanda *et al.*, 1970) and from unidentified Sargentomyia in the Karimnagar district in Andhra Pradesh, India (Geevarghese *et al.*, 2005). CHPV was incriminated as the etiological agent of large-scale encephalitis outbreaks in children (9 months to 15 yr of age) in various districts of Andhra Pradesh in 2003 with high case fatality rate (CFR) of 55.6% (Rao *et al.*, 2004).

Ganjam Virus Disease:

Ganjam virus (GANV), a tick-borne arbovirus of veterinary importance causing high morbidity and mortality in exotic and crossbred sheeps and goats, is widely prevalent in India (Banerjee 1996). It causes an acute febrile illness in sheep and goat characterized by fever, anorexia, lumbar paralysis and high fatality. It was first isolated from *Haemaphysalis intermedia* ticks collected from sheep in Ganjam district of Orissa state in 1969. Subsequently, the virus was also isolated from ticks collected from sheep and goat from Shimoga district and also from *Culex vishnui* mosquito from Vellore and acute sera of sheep from Chittoor

district of Andhra Pradesh. The virus was also isolated from *Rhipicephalus haemaphysaloids* ticks collected in Pune city in 2004-05 and from sheep of Chittoor district, Andhra Pradesh.

Bhanja virus:

The Bhanja virus of family Bunyviridae, was first isolated from adult tick *H. intermedia*, collected from a goat with lumbar paralysis in Bhanjanagar, Orissa, in December, 1954 (Hubalek 1987). Later, the virus has been isolated from various countries such as Nigeria, Italy, Senegal, Southern USSR, Yugoslavia and Bulgaria. Generally in adults, the virus causes an unapparent infection but in young ruminants (lamb, kid, calf) it is pathogenic, causing fever and neurological symptoms. In spite of the presence of virus in small ruminant and ticks, the human cases of bhanja virus has not been reported from India. This might be due to underreporting system and poor diagnostic facilities. The wide geographical distribution and presence of antibody in domestic animals could probably make Bhanja virus as an emerging virus infection.

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SOURCES OF INFORMATION ADDING TO PRODUCTIVITY AND PROFITABILITY OF LIVESTOCK OWNERS

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Information sources for farmers

Livestock sector is an integral part of the agricultural system in India and contributes significantly to the GDP (4.11% in 2012-13). It ensures food and nutritional security on one hand and provides income and employment opportunities on the other. The livestock sector is expected to spur the growth of agricultural sector over the coming decade. However, low productivity of animals owing to low knowledge level of the owners remains an unresolved issue and a major challenge for the future. Animal husbandry practices in India are mostly based on traditional knowledge. It is estimated that in India, 40% of farmer households access information on agricultural techniques and inputs and only about 5% of farm households access information on livestock. The increasing demand for animal products, complex production technologies, market liberalization, financial analysis and globalization and consumer concerns about food safety have necessitated the increased flow of information to the producers.

The main purpose of information sources in animal husbandry is to reach farmers who cannot be contacted personally by extension workers, in the shortest possible time. The choice of information sources depends on the location of the audience group and availability of time. Fig. 1 depicts the percent share of respective information sources accessed by livestock owners and Fig. 2 configures the type of information accessed by livestock owners.

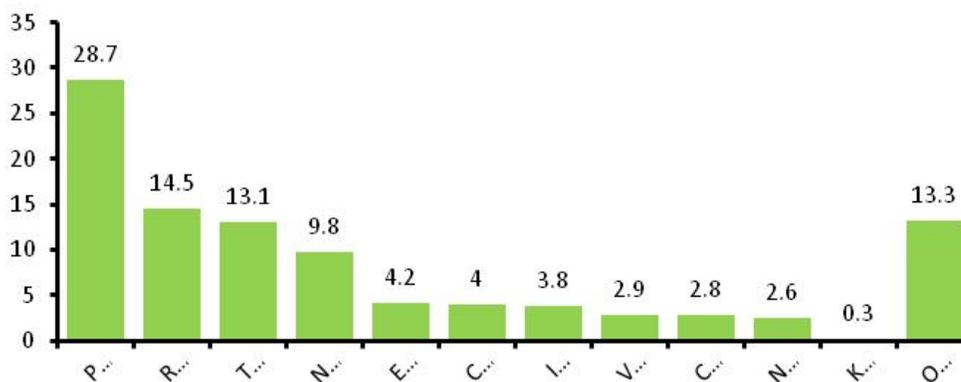


Figure 1. INFORMATION SOURCES ACCESSED BY LIVESTOCK FARMERS

Report No. 499(59/33/2), Access to Modern Technology for Farming, NSSO, GoI, 2005

Type of information on Animal Husbandry in India

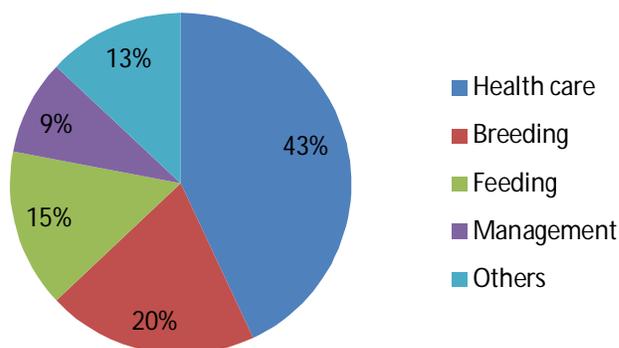


Figure 2. TYPE OF INFORMATION ACCESSED BY LIVESTOCK FARMERS

Report No. 499(59/33/2), Access to Modern Technology for Farming, NSSO, GoI, 2005

SOURCES OF INFORMATION

As long as the newly developed technologies do not reach the livestock owners, they cannot be put into use. Their applicability in the field also cannot be assessed. Therefore for any technology to be successful, the source of information plays a pivotal role. To get appropriate information, it is important to knock the right door. There is no dearth of vital information but it is upto oneself to tap the appropriate source.

The sources of information can be categorized as: 1) Institutional sources 2) Pashu-palan mela/ Village fairs and Livestock championships 3) Mass media 4) Information and Communication Technology 5) Non-Governmental Organizations (NGO) 6) Progressive farmers

1 INSTITUTIONAL SOURCES

a) State Department of Animal Husbandry- The department of animal husbandry is responsible for the formulation of various schemes and policies related with livestock. Farmers can contact the officers of the department at the district and tehsil level offices of the department for any information on livestock development. They can also access the website of the department (<http://www.husbandrypunjab.org/>) for their issues.

b) State Veterinary University- State Veterinary Universities are an assemble of scientists, researchers and experts on veterinary and animal husbandry practices. Farmers from all over the state can visit the campus or call on helpline numbers (Helpline number of Veterinary University in Punjab: 0161-2414005, 2414026) for any queries on livestock farming. The farmers can also visit the Regional research stations and KrishiVigyanKendra(KVK) associated with the University for information on livestock related issues. GADVASU has two research stations- Regional Research and Training Centre, Kaljharani (Bathinda) and Regional Research and Training Centre, Talwara

(Hoshiarpur).

c) Krishi Vigyan Kendras- Krishi Vigyan Kendras (KVK) are the district level farm science institutes for speedy transfer of technology to the farmer's fields. The aim is to reduce the time lag between generation of technology at the research institutions/university & its transfer to the farmer's fields for increasing productivity and income from the agriculture and allied sectors on a sustainable basis. Scientists at Krishi Vigyan Kendra impart short and long term trainings to the farmers and farm women in the respective field to enrich the knowledge of the farmers to adopt the recommended practices. The farmers are also provided vocational trainings on dairy farming, hybrid seed production, beekeeping, establishment of custom hiring centres, preservation of fruits and vegetables etc. GADVASU is currently operating three KVKs at Booh (Tarn Taran), Mohali and Barnala.

2 PASHU-PALAN MELA/ VILLAGE FAIRS/ LIVESTOCK CHAMPIONSHIPS

Pashu Palan Melas are an open forum for farmer-scientist interaction and exhibition of technological developments in animal husbandry. GADVASU organizes two such Melas in the months of March and September on its campus in Ludhiana. Farmers from all over the state can consult experts from the university and private firms to obtain the required information on animal husbandry. Moreover the Department of Animal Husbandry also organizes district-level and national-level livestock championships every year. Such kinds of championships are also a major source of flow of information.

3 MASS MEDIA

Mass media has a positive influence on increasing knowledge of innovations in the livestock sector. Mass media can be printed, spoken, visual or a combination of the three. Radio, television, cinema and newspapers have a huge audience base with very low cost of contact per person reached and adoption of innovations.

a) Television (TV)-Television has come up as a very important and major source of information for the farmers. Doordarshan, the national broadcaster has a long running tv programme "KrishiDarshan" which covers various aspects of agriculture and animal husbandry. DoordarshanJalandhar has a telecast programme called "KhetiKhabranAtteMandiBhaa" dedicated to dissemination of information regarding agriculture and animal husbandry. DD Kisan, a 24 hour television channel was launched in May 2015 dedicated to agriculture and allied sectors.

b) Radio- All India Radio (AIR) is broadcasting "Kisanvani" programme from over 90 Local Radio Stations focussing on various issues regarding agriculture, animal husbandry, poultry farming, and fisheries. The programme also covers information regarding employment schemes, training and loan facilities. The kisanvani programme is broadcast in all the major languages in the area of its coverage. CCS Haryana Agricultural University is running a community radio station which broadcasts programmes on Agriculture, Veterinary Sciences and Animal Husbandry, Farm Women and Agricultural Engineering related programmes. This model must be replicated by rest of the Veterinary Universities elsewhere in the country.

c) Newspapers Newspapers are considered important for relaying farm information to millions of farmers distributed across the country. Newspaper articles provide general information on livestock farming in the form of news, advertisements, marketing, process guides, views, reports, success stories, featured articles, editorials etc. Kheti Duniya is an exclusive agricultural weekly circulated in Punjab, Haryana, Rajasthan and western U.P. The newspaper publishes latest information on Agriculture and allied fields. Dailies including The Tribune, Ajeet and Jagbaani publish articles regarding latest developments and innovations in the field of agriculture and livestock farming. Daily columns in The Tribune publish news regarding latest developments in the Veterinary University. Besides, these newspapers also publish news regarding the conduct of training programmes and recommendations made by the Veterinary University. In this way, newspapers also act as a line of information.

d) Magazines-There were around 561 farm magazines published in India a decade ago. The total circulation of agricultural publications stood at about 8,86,000. Today more magazines have come up which cater to the specific information needs of the farmers. To fill the knowledge gap and to equip the livestock owners with latest information about livestock procedures, Guru Angad Dev Veterinary and Animal Sciences University Ludhiana publishes a monthly magazine titled "*Vigyanak Pashu Palan*" the magazine provides latest and useful information about dairy, piggery, goat and fish farming. Other popular magazines include "*Pashudhan Punjab*" by Department of Animal Husbandry, Punjab, "*Dairy Sandesh*" by Progressive Dairy Farmers' Association (Punjab) and "*Modern Kheti*" by Mehram publications. "*Indian Farming*" published by ICAR covers various aspects of agriculture and animal husbandry, poultry and fish.

4 INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

ICT users are making significantly better quality decisions as compared to non-users. Radio, TV, newspapers, magazines and telephones, the ICT tools of the earlier decades have now made way for modern means such as mobile phones and computers.

a) Kisan Call Centre (1800 180 1551) - It is a call centre based extension approach to deliver knowledge and information services as per the requirements of the farming community. The purpose of these call centres is to respond to issues raised by farmers, instantly, in the local language. At present the Call Centre services are available at a common toll free telephone number (1800 180 1551) which can be dialled from anywhere in the country. The calls are received at 13 Call Centres wherein 116 Agriculture Graduates attend to answer the query of the farmer in the local language. 123 experts located in different parts of the country at State Agriculture Universities, ICAR institutes, State Department of Agriculture, Horticulture and other developments are answering the calls at Level –II.

b) Mobile phones Mobile enabled information services are a medium to overturn the information imbalance with a potential to overcome a major constraint to the growth of agricultural productivity in India. The increasing penetration of mobile telephony across the farming communities has a huge potential to impact the rural productivity in the future. A variety of services are available through mobile phones for taking information to the livestock owners.

IFFCO has promoted Kisan Sanchar Limited services (IKSL) together with Bharti Airtel and Star Global Resources Ltd. with an aim to supply economical communication to

farmers in local language with value addition of content and services on a diverse list of subjects including dairy and animal husbandry. The services include free voice messages, helpline number (534351) to answer queries, and a call back number (534359). IKSL also provides opportunity to organizations to interact with like-minded communities or farmer groups involved in activities such as sheep and goat rearing, dairy and fisheries through its Green Sim Card platform. KrishiDarshan app on mobile phones allows users to connect with krishidarshan programme on Doordarshan.

c) Cyber extension- Cyber extension is extension of agricultural development with the help of Information and Communication Technologies over cyber space. Cyber space is an imaginary space behind networked computers through telecom means. This kind of a strong information sharing network is made possible through power of networks, computer communications and interactive multimedia. (www.krishijagran.com) is a web based portal from the krishi jagran media group which provides detailed information-news, updates and database on livestock and agriculture sector.

Following is a list of the important internet resources related to Information and consultancy services in Veterinary and Animal husbandry sector:

Central Avian Research Institute (CARI)	www.icar.org.in/cari/index.html
Central Institute for Research on Buffaloes (CIRB)	www.cirb.gov.in/
Central Institute for Research on Goats (CIRG)	www.cirg.res.in/
Central Sheep & Wool Research Institute (CSWRI)	www.cswri.ernet.in/
Dept. of Animal Husbandry, Dairying & Fisheries	dahd.nic.in/
Indian Veterinary Research Institute (IVRI)	www.ivri.nic.in/
National Dairy Research Institute (NDRI)	www.ndri.res.in/
National Institute of Animal Nutrition & Physiology	www.nianp.res.in/
National Research Centre on Camel (NRCC)	www.nrccamel.com/
National Research Centre on Equines (NRCE)	nrce.nic.in/index1.htm
National Research Centre on Mithun (NRCM)	www.nrcmithun.org/
National Research Centre on Yak (NRCY)	www.nrcy.org.in/
State Agricultural Universities (SAUs)	www.icar.org.in/sau.htm

5 NON-GOVERNMENTAL ORGANIZATIONS (NGO)

NGO sare mainly working in association with poor and marginal farmers with an aim to create opportunities of gainful self-employment for the rural families, especially disadvantaged sections, ensuring sustainable livelihood, enriched environment, improved quality of life and good human values. Many NGOs are promoting livestock farming as a primary occupation to achieve these goals.

Bharatiya Agro Industries Foundation (BAIF), now BAIF Development Research Foundation is operating across 17 states to provide sustainable livelihood to rural poor through agriculture and livestock farming. BAIF has its presence in over 800 villages in Punjab. It offers advisory services to such farmers on various management practices of animal husbandry including genetic improvement, nutrition and feeding, deworming, vaccination etc.

6 PROGRESSIVE FARMERS

Farmers who are involved in livestock farming rely heavily on progressive farmers of their respective fields for information and recommendations. Dairy Farmers Associations across various states including Punjab are leading the line in dairy farming. The association maintains contacts with various stakeholders in Livestock rearing. It also organizes an annual animal fair.

Similarly there are other farmer associations like Goat Farmers' Association, Progressive Pig Farmers' Association and Fish Farmers' Association which have been fostered by GADVASU. These associations are working in close contact with scientists, researchers and extension department of the university. These members of these associations are thus an excellent source of obtaining information on the latest practices regarding livestock rearing.

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WOMEN IN VETERINARY PROFESSION- EQUAL NOT SEQUEL

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Today women are contributing in every walk of life as Engineers, Army, Navy, Air Force, Astronauts, Mountaineers, Medical doctors, Extension Workers and Veterinary doctors. During World War II, there was more scope for women to enter Veterinary profession as most of the men joined the military forces, thereby causing a shortage of students in veterinary colleges. Women graduates took the responsibility of treating sick war animals and excelled with their performance.

The first lady veterinarians from India were Dr. Kalyani and Dr. Sakkubai from Madras Veterinary College in the year 1948. Dr. S. Sulochana was the first lady Dean of Kerala Veterinary College. All these women have proved their metal in the field of Veterinary and have excelled as veterinarians. Only motivation and encouragement can lead to higher determination in work and better standards of life.

A lady veterinarian is been proven a boon to the traditionally poor farmers and have played a substantial role in the transformation of poor livestock farmers. As we know that most of the livestock rearing practices are managed by the farm women and they act as support system of the livestock rearing. Therefore, having their gender similarity the lady veterinarians are able to fetch more valuable information with them, which aid in the correct diagnosis of the problem. It aids in the prompt solution of the disease problem. Therefore, with the caring and kindness in attitude which is well known inherited factor of lady veterinarians give them edge to their counterparts. Such qualities of a women and their adaptability to the field livestock farming conditions have directed a greater inflow of women in the profession. Active participation of lady veterinarian in the developmental activities and in the policy development would be helpful in changing face of rural India.

It is a universal truth that women as compared to men are more animal lovers, caring, helping and being soft hearted. These qualities of women make them more concerned to animal sufferings. A lady veterinarian appointed in village being a scientific person can understand the owner's psychology and can deliver effectively for home management as well.

Women have developed high self- esteem in this profession. They had driven towards the core competency with this profession. So, gone are the days when professionals were seen according to their gender. In spite of the fact that women are better suited in livestock improvement programmes yet social stigma, poor facilities of communication as well as residential facilities at remote areas and insufficient support system are some of the setbacks to female veterinarians. But in spite of all these lacunas, women are still the incarnation of tolerance and therefore emerging studies suggest that women in India are major producers of food in terms of value, volume and hours of work. Hence it can be said very easily that lady veterinarians are an economic asset to the livestock farming and a huge support system in the up liftment of livestock rearing.

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