RESEARCH IN VETERINARY HERBAL DRUGS

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Herbal medicine is the use of plant remedies in the treatment of diseases. The Rigveda, the oldest document of human knowledge, written between 4500 and 1600 BC mentions the use of medicinal plants in the treatment of man and animals. India has one of the richest traditions in herbal drugs in the world. In our tradition, local communities in every eco-system have discovered the medicinal uses of thousands of plant. The last two decades have seen tremendous interest in the area of medicinal and aromatic plants. The role of plants derived drugs has been emphasized both National and International levels. Accordingly in this compilation the emphasis has been given on following topics.

1. Important facts about indigenous drugs-research.
2. Present status of research in veterinary herbal drugs.
3. Herbal drugs used in veterinary practices with their pharmacological action.
4. Detailed research information about some medicinal herbs.
5. Use of whole herbs vis-à-vis single active constituent.
6. Thrust areas in herbal research (Pharmacokinetics & Pharmacodynamics).

Important facts of herbal drugs and their research findings

1. 25% of drugs prescribed worldwide comes from plants.
2. 121 such active compounds are in current use.
3. As per WHO, 80% of population depends on plant for their primary health care.
4. Out of 252 drugs considered as basic and essential by WHO, 11% are exclusively of plant origin and 28% are of the synthetic origin but obtained from natural precursors.
5. India is one of the 12 region of world that have the largest flora biodiversity. It has 45000 plant species.
6. In 1997, the world market for phytomedicinal product was US $ 10 billion with an annual growth of 6.5%.
7. Out of the 250,000-500,000 plant species only 500 have been studied for medicinal use. Only 120 with detailed pharmacological action.
8. Almost 75% of the medicinal plants, grow naturally in different states of India.
10. India has 45,000 plant species out of which 15,000-20,000 have active principles of proven medicinal values.
12. Studies between 1992-95 indicated that India exported about 32,600 tones of crude drugs (values US $ 46 million) per year and dominate International market.
13. Total annual export of Herbal drugs (medicinal plants, crude/trade drugs) from India is about US $ 1200 million.

14. Scope in Herbal Medicine: India ranks second in the world & there is enormous scope to emerge as a major player.

15. The forests of India are rich in medicinal plants. They harbour 90% of India's medicinal plant diversity.

16. There are estimated to be 25,000 effective plant based formulations, known to rural community and used in folk medicine in India.

17. There are 1.5 million practitioners of traditional medical system using medicinal plants.

18. There are about 7800 medicinal drug manufacturing units in India, which consumes about 2000 tones of herbs annually.

19. Some drugs which are synthesized chemically, are found naturally in plant eg. Aspirin, which is a safer analogue of salicylic acid, is an active ingredient of willow bark.

20. In 5th century BC, Hippocrates used powder extracted from willow bark to treat pain and reduce fever.

21. 2000 year later, the chemical compound salicin, was isolated from willow bark. Salicin is the precursor of active compound found in modern aspirin.

22. Today approximately 300 billion aspirin tablets are used each year in India.

**Documentation of herbal research data:**

Research report indicated that out of 20,000 medicinal plants. Only 2,500 are studied and established to be of medicinal value. The percent of medicinal plants, which were studied for different chemical and pharmacological studies are:

<table>
<thead>
<tr>
<th>Study</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phytochemical</td>
<td>60.15</td>
</tr>
<tr>
<td>Pharmacological</td>
<td>16.31</td>
</tr>
<tr>
<td>Cultivation aspect</td>
<td>8.53</td>
</tr>
<tr>
<td>Pharmacogonosy</td>
<td>13.11</td>
</tr>
<tr>
<td>Clinical trials</td>
<td>1.90</td>
</tr>
<tr>
<td>Detailed pharmacology</td>
<td>1.36</td>
</tr>
<tr>
<td>Pharmacokinetics/Pharmacodynamic</td>
<td>0.13</td>
</tr>
</tbody>
</table>

The present status of research on veterinary herbal drugs indicated that

1. The research conducted by various organizations (Govt./Non-Govt.), specialists (ethnopharmacologist, ethnomedicine expert, ethnobotanists) are invariably in isolation and lack of inter-disciplinary and inter institutional approaches. Further

2. Various NGO’s working in different regions of the country also suffers from insufficient linkages and interaction amongst them.
Future needs for research in veterinary herbal drug: To strengthen the research on Herbal medicine emphasis should be given on following aspects.

1. Network research programming: There is need for evidence based medicine.
2. Cultivation of herbs likely on verge of extinction
3. Availability of genuine raw materials should be to pharmaceuticals.
4. Avoidance of contamination of herbs with pesticides, heavy metals, microbial and radioactive contaminants.
5. Genetic improvement of medicinal plants.
6. National drug policy for herbal drugs must be chalk out.
7. Licensing policy of indigenous drugs should be made.
8. Herbal veterinary pharmacopoeia be developed.

Herbal drugs used in veterinary practice: Table 1 detailed some very important herbal drugs which are being routinely used in veterinary medicine.

<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
<th>Pharmacological Action</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia catechu</td>
<td>Katha</td>
<td>Astringent</td>
<td>In persistent diarrhoea &amp; dysentery</td>
</tr>
<tr>
<td>Acidum ariticum towards</td>
<td>Sirka</td>
<td>Rumen acidifer</td>
<td>Indigestion where rumen pH is alkaline</td>
</tr>
<tr>
<td>Adhatoda vasica</td>
<td>Arusha</td>
<td>Expectorant, diuretic and anti spasmodic</td>
<td>Cold, cough, bronchitis &amp; catarrhal affections</td>
</tr>
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</tr>
<tr>
<td>Aniseed</td>
<td>Souf</td>
<td>Aromatic, stimulant and lessen gripping effect of cathartics</td>
<td>Indigestion and tympanites</td>
</tr>
<tr>
<td>Caster oil</td>
<td>Arandi Ka Tel</td>
<td>Puragative External Protective</td>
<td>Constipation, indigestion and impaction</td>
</tr>
<tr>
<td>Asafoetida</td>
<td>Hing</td>
<td>Carminative, stimulant and anti spasmodic. Externally antiseptic &amp;</td>
<td>Flatulence, colic indigestion cough bronchitis, asthma, chills</td>
</tr>
<tr>
<td>Plant Name</td>
<td>Part</td>
<td>Active Principle</td>
<td>General Information</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Camphora officinarum</td>
<td>Bulb</td>
<td>Stimulant, carminative and antispasmodic externally antiseptic</td>
<td>Cough, tympany, stimulant to heart and brain, wounds, ulcer &amp; sprains</td>
</tr>
<tr>
<td>Liquorice glycyrrhiza</td>
<td>Mullatti</td>
<td>Expectorant &amp; demulcent</td>
<td>Cough, bronchitis and asthma</td>
</tr>
<tr>
<td>Cephaelis ipecacuahha</td>
<td>Ipecace</td>
<td>Antibacterial, emetic, diaphoretic</td>
<td>Amoebic dysentery, loss of appetite, cough</td>
</tr>
<tr>
<td>Catharanthus roseus</td>
<td>Sadabahar</td>
<td>Stomachic, sedative &amp; tranquilizing property</td>
<td>Loss of appetite, hypertension sedation</td>
</tr>
<tr>
<td>Cassia fistula</td>
<td>Amaltas</td>
<td>Laxative</td>
<td>Constipation, impaction</td>
</tr>
<tr>
<td>Piper longum</td>
<td>Pipal pipali</td>
<td>Anti-inflammatory analgesic loss of appetite</td>
<td>Pneumatic pains chronic bronchitis,</td>
</tr>
</tbody>
</table>

**Research information of some important herbal drugs:**

1. **Allium Sativum** (Garlic, Lasan)

   **Part:** Bulb and oil

   Active principle: More than 160 compounds, acrid volatile oil, allicin (allyl propyl disulphide and other organic sulphide and sulphur compounds)

   **General Information:**
   1. Sale of garlic product in Germany: $ 40 million per year.
   2. Garlic is one of the two best selling herbal dietary supplement products in USA (approx. $80 million).
   3. 1990s have been the hey day of Garlic Research.
   4. The intact cell of garlic contain an adorless sulfur-containing amino acid–Allin (+s-allyl-l-cysteine sulfoxide) when these cells are crushed, the allin combines with allinase in the neighboring cells to produce allicin (diallyl thiosulfinate), which is very potent antibiotic. It is penicillin like antibiotic.
   5. Fresh Garlic contain 1% of allin. 1mg allin is converted into 0.458 mg of allicin by allinase enzyme.
   6. Aged Garlic contain only 3% of allin of fresh Garlic preparation.

   **Pharmacological action and therapeutic uses:**
   1. Good antibacterial, antifungal and antiparasitic.
      - In China: garlic is being frequently used against fever.
      - Louis Pasteur: first recognized its anti bacterial activity in 1858. Till date there are 2,500 scientific reports.
      - Garlic has successfully been used in dysentery, typhoid, cholera and bacterial food poisoning.
• Mustard or coconut oil in which garlic is fried is an excellent antiseptic and used for scabies, maggots infesting ulcers.

• Garlic juice mixed with 3 or 4 parts of distilled water is used as a lotion for washing wounds and foul ulcer.

• This used to prevent fungal infections, cold and flu.

**Possible mode of action of Garlic as Antibacterial:**

1. It contains germanium and glucokinins which act as antipathogenic.
2. The allyl disulfide, present in garlic is also antibacterial.
3. Allicin also has antibiotic like action.

2. **Effect on blood Pressure & vascular System:**

• It reduces cholesterol and triglycerides and increases HDL (good cholesterol) in blood.

• It act as a vasodilator and, reduces blood pressure, improves circulation and food nutrient to tissues.

• It protects the blood vessels from deleterious effects of free radicals.

• The allicin is unstable and decomposes to other strong smelling ‘S’ compound including ajoenes, which is responsible for antithrombotic action.

• Allicin also has antiplatelets and antilipaemic properties.

• Mechanism of action: probably it influences calcium dependent process. It also effect thiol group found in many enzyme.

• Total effect on lipid profile: It decreases:

<table>
<thead>
<tr>
<th>Lipid Profile</th>
<th>Percentage Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol</td>
<td>6-9 %</td>
</tr>
<tr>
<td>Low density Lipoprotein</td>
<td>11 %</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>17 %</td>
</tr>
</tbody>
</table>

3. **Effect on Gastrointestinal & respiratory System:**

• Garlic decreases GIT cancer, if taken regularly.

• It stimulates digestive secretion including bile.

• It reduces irregularity in gut motility

• It stimulate pancreas to release insulin for the treatment of hyperglycaemia.

• It possess, expectorant property.

• Garlic is volatile oil, excreted through lung, thereby sterilizing the bronchial tube and lung

• Allicin, present in garlic acts as pulmonary arterial vasodilator.

• Allicin is transformed in intestine in allyl mercaptan, which is absorbed into blood stream and reaches to lung, producing garlic breath.

4. **Other Pharmacological Action of Garlic:**

1. It is good antioxidant, anti-inflammatory and immuno stimulant.
• Garlic juice mixed with salts is applied to bruises, sprains and to relieve neuralgia and ear ache.
• Freshly crushed Garlic mixed with coriander in wine is an aphrodisiac.

2. Garlic also acts as Anti Cancer agent

Mode of Action: It lowers the nitrate level in body. And it is established nitrate is high in meat & other food. In body nitrate is converted into nitrosamine, which is carcinogenic.

5. Preparation & Dose of Garlic:
• Dose: 4 g of fresh garlic cloves daily.
• Preparation: 100, 200, 400 mg tablets (enteric coated).
• Raw garlic should be taken with meal as it causes irritation of digestive system.
• Allin and Allicin are unstable in gastric fluid. The best formulations of garlic are enteric coated tablets or capsules of dried garlic powder.

6. Side Effect of Garlic: Excess use of garlic may decrease the sight, cause flatulence, injure the stomach and cause thirst. High doses not used in children & pregnant (increase uterine contraction).

7. Superstition: In some part of Europe, man running in race, chew garlic to win the competition.

Azadirachata Indica (Neem)

Parts: Every part of the plant (Bark, leaves, flowers, seed oil) is used as medicine.

Chemical contents:

Bark: Penta-nortriterpene, Nimbin
Trunk wood: Nimbolin A & B
Leaf: Penta-nortriterpene, Nimbadinol, Mimbinena
Fruit: Azadirone

Neem oil contains: Margosic acid, glycosides of fatty acid, butyric acid, traces of valeric acid

Oleic acid = 61.9%, Palmitic acid = 14.9%, Stearic acid = 14.4%, Linolic acid = 7.5%, Arachidic acid 1.3%

Pharmacological activities of Neem: Antifungal, insecticidal, antiseptic, anthelmintic, spermicidal, diuretic, antipyretic, antiviral, antimalarial, antineoplastic, hypoglycaemic, antipyretic.

Clinical therapeutic uses:
Neem is being successfully used in the treatment of Glandular tumor, postural eruption, itching, eczema, ring worm, scabies, mange, boils, ulcer, liver ailments, leucoderma, diabetes, tuberculosis, leprosy, pruritis, loss of hair, night blindness, piles.
**Allium Cepa (Onion or Piyaz)**

Part: Bulb and seeds

Pharmacology: Oil contained in bulb is stimulant, diuretic and expectorant.

**Clinical therapeutic uses:** Piyaz is routinely used

- Locally in insect bites, scorpion bites and other skin diseases. In highly infected and inflammatory swelling (it is applied mixed with mustard oil)
- Acts as demulcent both (internally and externally) if used roasted.

**Ocimum album (Tulsi):**

Part: leaves and seed.

- Leaves contain a yellowish green essential oil and known as 'Basil camphor'. Essential oil contains a new terpene.
- The leaves made into paste are used to cure parasitic diseases of skin especially the ring worm.
- 12% decoction of the Tulsi plant is used as parasiticide and antiseptic.

**Use of whole herbs vis-à-vis single active constituent:**

- The advantage of isolating the active ingredient from a plant is that
  (I) It eliminates variation in dose of drug and pharmacological action.
  (II) It removes any possibility of contamination and
  (III) It enables accurate administration

- However, further there are good evidence for the whole plant therapy: In few cases, whole plant therapy is preferred than isolated ingredients. It results into
  (a) Fewer side effects than isolated constituents.
  (b) Synergism of various constituents within a complex plant.
  (c) Interdependence: presence of one constituent is necessary for pharmacological action of other.

**Example of whole plant therapy:**

1. **Ephedra sinica**: source of ephedrine, used in asthma and nasal congestion, but also raise blood pressure. Within the whole plant, other alkaloids are present, one of which prevent the rise in B.P.
2. **Dandelion leaves**: which are potent diuretic contain potassium to replace loss of potassium reduced in many diuretic therapy.
3. **Berberine**: an alkaloid obtained from plant berberis has antibacterial action. Crude plant extract is more effective than isolated alkaloid, it is due to cumulative effect of other alkaloids.
Use of herbal research in modern medicine:

Researchers today examine herbs to find new drugs to treat the diseases ranging from common cold to cancer and AIDS.

Most important life saving herbal drugs which are in current use in modern medicine are:

1. Atropine : Atropa belladona
2. Ephedrine : Ephedra sinica
3. Pilocarpin : Pilocarpus jaborandi
4. Morphine : Opium plant
5. Cardiac dogitalis : D. purpurea
6. Arecholine : Arecha catachye
7. Reserpine : Rowalfia surpentina

Misconception about herbal medicine: Generally it is said that herbs are weak and slow in action which gets translated into "not very effective". It is true for many herbal drugs but note that *Atropa belladona* is a powerful antispasmodic.

1. Slow and mild actions of useful herbs are due to crude nature of the formulation that interfere rapid and complete bioavailability of active ingredient at target organ.
2. Extraction and purification of herbs created new dimension in herbal medicine.

Herbal based pharmaceuticals: In India there are many pharmaceuticals dealing with herbal drugs, out of these few are solely manufacturing plant medicines. Some of the important pharmaceuticals dealing with medicinal plants are:

I. Public sectors:
   1. Dabur Research Foundation
   2. Zandu’s Research and Development
   3. Avestha Gengraine Technologies
   4. Indian Herbs
   5. Reliance Life Sciences
   6. Natural Remedies
   7. Dr. Reddy’s Laboratories
   8. Sun Pharmaceuticals

II. Government research & development institutions:
   1. Central Drug Research Institute
   2. Regional Research Laboratory
   3. National Medicinal Plant Board

Laws pertaining to manufacturing & sale of Indigenous drugs in India: Following are some important points regarding law pertaining to indigenous drugs:
1. The department of “Indian System of Medicine and Homeopathy”: dealing with the rules and regulations (along with drugs and cosmetic act), for the herbal drugs.

2. At present following acts and rules govern:
   I. The Drugs and Cosmetics Act, 1940.
   II. The Pharmacy Act, 1948.
   III. The Drugs and Magic Remedies Act, 1954.
   IV. The Narcotic Drugs and Psychotropic Substances Act, 1985.
   V. The Medicinal and Toilet Preparations Act, 1956.
   VI. The Drugs (Prices Control) Order 1995.

3. Besides these, following are other important laws which have bearing on manufacture, sale, import, export and clinical research of drugs (including herbals) and cosmetics in India.
   I. The Industries (Development and Regulation) Act, 1951.
   II. The Trade and Merchandise Marks Act, 1958.
   III. The Indian Patent and Design Act, 1970.
   IV. Factories Act.

**The drugs and cosmetics act 1940:**

- Main objective of this act is to regulate the import, manufacture, sale and distribution of drugs.
- It is prime concern of state authorities.
- The central authority is responsible for approval of new drug, clinical trials, quality control, coordination of the activities of State Drug Control Organizations, providing expert advice for the enforcement of Act.
- Under provision of this act central government may appoint “Drug Technical Advisory Board”. The board can constitute “sub committees” for consideration of a particular matter.
- Drug Controller General of India is responsible for approval of licenses of specified categories such as: blood & blood products, IV fluids, vaccine & sera, plant products etc.

**Main organization for drug standard control** is: “Central drugs Standard Control Organization”. It is located in Nirman Bhawan, New Delhi and Function Under Director General of Health Service. It has four zonal offices.

**Four zonal offices:**

1. East Zone, Kolkata: covers Andaman & Nicobar, AP, Assam, Bihar, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura & West Bengal.
2. West Zone, Mumbai: covers Chattisgarh, Goa, daman & Diu, Gujarat, MP and Maharashtra.
4. South Zone, Chennai: Its areas are AP, Karnataka, Kerala, Pondicherry and TamilNadu.
Laboratories for quality control of drugs: There are five main laboratories, which control quality of drugs.

1. Central Drugs Laboratory (CDL), Kolkata
2. Central Drugs Testing Laboratory (CDTL), Chennai
3. Central Drugs Testing Laboratory (CDTL), Mumbai
4. Central Drugs Testing Laboratory (CDTL), Guwahati
5. Central Indian Pharmacopoeia Laboratory (CIPL)

Central Drugs Laboratory, which is located at Kolkata, is National Statutory Laboratory of Government of India for quality control of drugs & cosmetics. The Statutory functions of these laboratories are:

1. Analytical quality control of majority of important drug available in Indian market.
2. Analytical quality control of drug and cosmetics manufactured within the country on behalf of the Central and State Drug Controller Administrations.
3. Acting as an Appellate authority in matters of disputes relating quality of Drug.

Thrust areas of herbal research:

1. The therapeutic efficacy of herbal drugs is mainly dependent on the dosage regimen of active compounds and its efficient delivery in the body.
2. Since herbal drugs contain numerous chemical constituents, the calculation of pharmacokinetic parameters and dosage regimen of whole drug is as such very difficult.
3. Recently, a method for calculating the pharmacokinetics and dosage regimen of herbal drug has been developed by selecting few marker compounds of a herbal drugs.
4. Detailed pharmacodynamic evaluation. As for other drugs, following pharmacokinetic parameters are also important to be evaluated for any indigenous herbal drugs.

Important pharmacokinetic parameters for herbal drugs:

1. Ka : Absorption rate constant
2. α : Distribution rate constant
3. β : Elimination rate constant
4. t½Ka : Absorption half life
5. t ½ α : Distribution half life
6. t½ β : Elimination half life
7. Vd(area) : Volume of distribution
8. ClB : Total body clearance
9. Kel : Elimination from central compartment
10. F : Bioavailability
11. AUC : Area under curve
12. td : Duration of therapeutic level

Pharmacodynamic Study (Laboratory Research) of some herbal drugs: Following four medicinal plants have been extensively studied and evaluated for their pharmacological activities.
Material from Plants used:

<table>
<thead>
<tr>
<th>Plant</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A. vasica (vasaka)</td>
<td>Leaves</td>
</tr>
<tr>
<td>2. L. reticulata (Jivanti)</td>
<td>Whole plant</td>
</tr>
<tr>
<td>3. G. qummifera (Dikamali)</td>
<td>Gum</td>
</tr>
<tr>
<td>4. V. stellulatum</td>
<td>Stem bark</td>
</tr>
</tbody>
</table>

Procedures: The detailed procedures involved in these experiments are

1. Preparation of Materials: (a) Dried in the shade under running fan (b) Powdered in grinding machine.
2. Extraction: Serially extracted in Petroleum ether, Absolute alcohol, Distilled water
3. Preparation of stock solution:
   (a) Alcoholic extract: Homogeneous suspension in 5% gum acacia (not soluble in water) (b) Aqueous extract: solution in water (c) Concentration: 10 mg.ml-1 (d) Storage: 4°C

Various techniques to evaluate pharmacological activities of herbal medicine:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Method</th>
<th>Species/Preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-inflammatory</td>
<td>Formaldehyde induced arthritis</td>
<td>Rat</td>
</tr>
<tr>
<td>Antipyretic</td>
<td>Yeast induced pyrexia</td>
<td>Rat</td>
</tr>
<tr>
<td>Analgesic</td>
<td>Hot plate test/tail clip test</td>
<td>Mouse/Rat</td>
</tr>
<tr>
<td></td>
<td>Tail flick response/Tail immersion test</td>
<td>Mouse/Rat</td>
</tr>
<tr>
<td>Antiulcer</td>
<td>Histamine induced gastric ulceration</td>
<td>Guinea Pig</td>
</tr>
<tr>
<td>Anti allergic</td>
<td>Skin permeability (autacoid test)</td>
<td>Rat</td>
</tr>
<tr>
<td></td>
<td>Mast cell study</td>
<td></td>
</tr>
<tr>
<td>CNS</td>
<td>Spontaneous motor activity</td>
<td>Mouse</td>
</tr>
<tr>
<td></td>
<td>Hexobarbital sleeping time</td>
<td>Mouse</td>
</tr>
<tr>
<td></td>
<td>Anticonvulsant activity</td>
<td>Mouse</td>
</tr>
<tr>
<td>Antifungal</td>
<td>Corneal infection</td>
<td>Rabbit</td>
</tr>
<tr>
<td></td>
<td>Vulvo-vaginal candidiasis</td>
<td>Mouse</td>
</tr>
<tr>
<td>Antibacterial</td>
<td>Disc diffusion technique</td>
<td>In vitro</td>
</tr>
<tr>
<td>Hypoglycaemic</td>
<td>Alloxan-induced diabetes</td>
<td>Rat/monkey</td>
</tr>
<tr>
<td></td>
<td>Glucose loading</td>
<td>Rats</td>
</tr>
<tr>
<td>Hepatoprotective</td>
<td>Carbon tetrachloride induced hepatotoxicity</td>
<td>Rat</td>
</tr>
<tr>
<td></td>
<td>Paracetamol induced hepatotoxicity</td>
<td>Rat</td>
</tr>
</tbody>
</table>
Pharmacological effects;

1. **Uterotonic Activity:**
   
   **Oestrus:**
   1. *A. vasica* (0.1-0.3 mg.kg-1): Increased rhythmic contraction, Dose dependent and Abolish after washing
   2. *L. reticulata*: Milder as compared to *A. vasica*
   3. *G. qummifera*: Decrease the contraction
   4. *V. stellulatum*: No effect

   **Pregnant Uterus (late stage):**
   1. *A. vasica*: Increase tone and reduce amplitude, response overcome after wash
   2. *L. reticulata*: Increase tone and amplitude
   3. *G. qummifera*: No effect
   4. *V. stellulatum*: No effect

2. **Effect on Dog Blood Pressure:**

<table>
<thead>
<tr>
<th>Plant (Dose : mg.kg-1)</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>A. Vasica</em> (0.4)</td>
<td>Biphasic (Sharp fall then rise)</td>
</tr>
<tr>
<td></td>
<td>Repeated dose: tachyphylaxis</td>
</tr>
<tr>
<td></td>
<td>Not alter hypotension of Ach</td>
</tr>
<tr>
<td><em>V. stellulatum</em> (0.6)</td>
<td>Biphasic (fall then rise)</td>
</tr>
<tr>
<td></td>
<td>No tachyphylaxis</td>
</tr>
<tr>
<td></td>
<td>Hypotension not blocked by ATPR</td>
</tr>
<tr>
<td><em>L. reticulata</em> (1.0)</td>
<td>Sharp fall</td>
</tr>
<tr>
<td></td>
<td>No tachyphylaxis</td>
</tr>
<tr>
<td></td>
<td>Not alter hypotension and hypertension of many drugs</td>
</tr>
<tr>
<td><em>G. qummifera</em> (0.3)</td>
<td>Triphasic (rise, fall and rise)</td>
</tr>
<tr>
<td></td>
<td>No tachyphylaxis</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

3. **Analgesic activity:**

<table>
<thead>
<tr>
<th>Group</th>
<th>Reaction Time</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (Vehicle)</td>
<td>15.5-16.5</td>
<td>-</td>
</tr>
<tr>
<td>Morphine</td>
<td>21-60</td>
<td>-</td>
</tr>
<tr>
<td><em>A. Vasica</em></td>
<td>15.2-16.8</td>
<td>Devoid of action</td>
</tr>
<tr>
<td><em>G. qummifera</em></td>
<td>17.7-22.8</td>
<td>More potent</td>
</tr>
<tr>
<td><em>L. reticulata</em></td>
<td>14.8-16.0</td>
<td>Devoid of action</td>
</tr>
<tr>
<td><em>V. stellulatum</em></td>
<td>18.6-24.2</td>
<td>Most potent</td>
</tr>
</tbody>
</table>
4. **Effect on pentobarbitone hypnosis:**
   *L. reticulata* and *V. stellulatum* produced varying degree of potentiation of pentobarbitone induced hypnosis

5. **Effect on respiration:**

<table>
<thead>
<tr>
<th>Plant (Dose: mg.kg⁻¹)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>A. vasica</em> (0.4)</td>
<td>Increase amplitude (15-20%) and rate (30%)</td>
</tr>
<tr>
<td><em>L. reticulata</em> (1.0)</td>
<td>Inhibit amplitude (20-40%)</td>
</tr>
<tr>
<td></td>
<td>No effect on rate</td>
</tr>
<tr>
<td><em>V. stellulatum</em> (0.6)</td>
<td>Inhibit amplitude (20-40%)</td>
</tr>
<tr>
<td></td>
<td>No effect on rate</td>
</tr>
<tr>
<td><em>G. qummifer</em> (0.3)</td>
<td>Reduced amplitude (30-45%)</td>
</tr>
<tr>
<td></td>
<td>No effect on rate</td>
</tr>
</tbody>
</table>

6. **Effect on nictitating membrane:**
   1. These way no effect of any of these plants on nictitating membrane.
   2. These plants did not alter the epinephrine induced contractions.

**Herbal medicine for possible use in veterinary practice:** These are many indigenous recipes which used for human ailments and do not figure in ethnoveterinary practice but may lead to prospective veterinary medicine. Following are some examples of plants which are to be included in veterinary practice.

1. **Achillea millefolium** (Gundna - Hindi; Milfoil-English)
   Use: reported in Ladakh:
   (i) Whole plant is used for killing intestinal worms
   (ii) Ethno Veterinary Practice: may be recommended for liver ailment.

2. **Achyranthes bidentata** (Amaranthaceae)
   Use: reported in UP
   (i) Leaf juice is effectively used for blister in mouth
   (ii) Leaf juice with onion juice is frequently given in the treatment of cholera
   (iii) Ethno Veterinary Practice: It is found very useful Galactagogue (whole plant)

3. **Bauhinia purpurea** (Singara-Hindi; Camel’s Foot tree - English) Uses:
   (i) Leaf paste mixed with milk is found effective in the treatment of Jaundice
   (ii) Ethno Veterinary Practice: Bark may be employed swelling in neck, bone fracture and rinder pest.

4. **Elytraria acaulis** (Ho-muli) Uses: in Gujarat
   It is regularly used for colic pain and for respiratory diseases & sore (leaves) Ethno Veterinary Practice: Broken horn (plant powder in paste form is applied as plaster)
Areas of potential interests in veterinary herbal:
1. Growth promoter
2. Anti stress & adaptogens (Herbs like Ashwagandha, Tulsi, Amla, Ginseng enhance non-specific resistance of the body)
3. Immune modulators (Herbs like Tinospora, Cordifolia, Withania somnifera, Ocimum sanctum, Andrographis paniculata, Azadirachta indica)
4. Prevention and control of metabolic disorders
5. Maintenance of reproductive health

Future vision:
Indian is the second largest exporter of medicinal plants. Instead of exporting such a large amount of valuable resource with very low return, it is thought of developing its own research and development capabilities and produce finished goods in the form of modern medicines and health care products.

Summary:
1. Herbs and medicinal plants are now properly identified. The active ingredients in desired parts are isolated and pharmacological actions are evaluated. The biological activities of these plants are standardized.
2. The great challenge: to educate researchers to apply research standard in herbal medicine to provide valid and reliable data and (to follow GLP).
3. Since herbal medicine is new area of research, one need to train, encourage and support skilled investigators.
4. Attempts are being made to compute the exact dosage regimen of herbal drugs.

Conclusion:
In veterinary practice, the research programs on herbal medicine, is now successfully bridging the gaps in modern medicine, to promote animal health in Nature way.