Veterinary herbal medicines in India

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ABSTRACT

India has a rich and diversified flora. It is seen that synthetic drugs could pose serious problems, are toxic and costly. In contrast to this, herbal medicines are relatively nontoxic, cheaper and are eco-friendly. Moreover, the people have used them for generations. They have also been used in day-to-day problems of healthcare in animals. 25% of the drugs prescribed worldwide come from plants. Almost 75% of the medicinal plants grow naturally in different states of India. These plants are known to cure many ailments in animals like poisoning, cough, constipation, foot and mouth disease, dermatitis, cataract, burning, pneumonia, bone fractures, snake bites, abdominal pains, skin diseases etc. There is scarce review of such information (veterinary herbals) in the literature. The electronic and manual search was made using various key words such as veterinary herbal, ethno-veterinary medicines etc. and the content systematically arranged. This article deals with the comprehensive review of 45 medicinal plant species that are official in Indian Pharmacopoeia (IP) 2014. The botanical names, family, habitat, plant part used and pharmacological actions, status in British Pharmacopoeia 2014, USP 36 are mentioned. Also, a relationship between animal and human dose, standardization and regulatory aspects of these selected veterinary herbals are provided.

Key words: Indian Pharmacopoeia 2014, standardization, veterinary herbals

INTRODUCTION

Herbal medicines are being used by an increasing number of people as these products are considered to have no side effects or minimum side effects. In Asian and African countries, 80% of the population depends on traditional medicine for their primary health-care needs. Herbal medicines are the most lucrative form of traditional medicines, generating billions of dollars in revenue. Researchers look to traditional medicines as a guide to help, as 40% of the plants comprise key ingredients that can be used for prescription drugs.[1] It is reported that in 2011-2012, the herbal global market was worth $80 billion. India's herbal industry is worth around Rs 16,000 crores or US$ 4,000 million.[2]

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The World Health Organization (WHO) defines traditional medicine (herbal medicine) as "the sum total of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness".[3]

It is seen that about 25% of modern medicines have come from plants first used traditionally. In Africa, North America, and Europe, three out of four people living with human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) use some form of traditional medicine for various symptoms and conditions. In China, traditional medicine accounts for 30-50% of the total consumption. There are around 800 manufacturers of herbal products with a total annual output of US$ 1.8 billion in China. Traditional medicine is widely used in India, particularly in rural areas, where 70% of the country's population lives.[1]

Veterinary herbal medicines comprise plant-based medicines and their therapeutic, prophylactic, or diagnostic application in animal health care. The application of herbal medicines in human health care and animal health care has a long history that can be traced back over millennia. In the rural areas of India, the veterinary medicines cover knowledge, skills, methods, practices, and beliefs of the smallholders about caring for their livestock. These smallholders are unable to spend on quality health of

their livestock, mainly due to non-affordability, whereas high-end health care is mainly met by expensive yet effective synthetic drugs. The side effects of the synthetic drugs such as presence of antibiotic residues leads to antibiotic resistance in humans; the toxic metabolites remain in meat, and the byproducts of synthetic drugs become a matter of concern in the long-term usage of such drugs. Issues like these have prompted the search for the use of alternatives such as herbal preparations, as these are cheap and safe as compared to modern animal health-care systems.[4-6]

Indian Pharmacopoeia (IP) is an official regulatory document meant for overall quality control and assurance of pharmaceutical products marketed in India and thus, contributing to the safety, efficacy, and affordability of medicines. IP is published by the Indian Pharmacopoeia Commission on fulfillment of the requirements of the Drugs and Cosmetics Act 1940 and Rules 1945 under it. It contains a number of carefully chosen herbal monographs, extracts, and formulations. Each monograph of a herb in the IP specifies the botanical name according to the binomial system of nomenclature, specifying the genus, species, variety, and the quality specifications.[7]

Medicinal herbs contain a vast range of pharmacologically active ingredients and each herb has its own unique combination and properties. Many herbs (whole plants) contain ingredients which have several effects that are combined in the one medicine. It would be appropriate to weigh the risk-benefit ratio based on the scientific evidence and experience of a prescriber while prescribing such herbal medicines in the interest of animal health.

Relationship between animal dose and human dose

The appropriate translation of drug dosage from one animal species to another and the translation of animal dose to human dose are both very important from the point of safety and efficacy of drugs. Moreover, forced administration and mixing of drug with fodder are usually done to administer the drugs to animals. The Food and Drug Administration[8] has suggested that the extrapolation of animal dose to human dose is correctly performed through normalization to body surface area (BSA), which often is represented in mg/m^2. The human dose equivalent can be more appropriately calculated by using the formula shown in Table 1.

Preparation of veterinary herbal medicines

Herbal medicines for veterinary use can be given or prepared in a number of ways:

- Fresh herbs are chopped and mixed with food. It is perhaps the ideal way to give herbs when they are available
- Dried herbs can be administered by their addition to food or making them into infusions or decoctions by adding hot water for internal or external use
- Alcoholic tinctures are given directly or diluted in water, and given orally carefully using a syringe or dropper
- Oil infusions or lotions are given externally, for example, by rubbing on sore joints
- Commercially prepared tablets or powders are the most commonly seen form of herbal remedy.

Herbal drugs used in veterinary practice

Medicinal plants for various animal diseases in different parts of India are compiled in IP 2014. Also, the official statuses of the herbs in the British Pharmacopoeia (BP) 2014 and the United States Pharmacopeia (USP) 36 are summarized in Table 2.[7,9-44]

Standardization and regulatory aspects of veterinary herbal medicines

Standardization of veterinary herbal medicines (crude drugs/extracts) is necessary to establish their quality, consistency, and reproducibility to ensure that one or more of the veterinary herbal medicine's key phytochemical ingredients or other ingredients are present in a defined amount. It is also necessary to implement quality control for batch-wise consistency, uniformity of dosage, stability, and for the detection of contamination/adulteration.[45] The identification of biologically active compounds in herbs is essential for quality control and also for determining the dose of the plant-based drugs. Also, knowledge of the appropriate dosage of these plant-based drugs is needed, as certain plants when used in small quantities are useful as veterinary medicines, whereas in large quantities are poisonous, e.g., *Abrus precatorius*.

Standardization of herbal medicines is a difficult process because these medicines contain complex mixtures of different compounds. Thus, the herbs responsible for the medicinal effect are often unknown. Knowledge of the physicochemical properties of herbal medicines, along with other preformulation data, is necessary for the standardization and validation of active constituents. Various chemical, spectroscopic, and biological methods are also employed for the standardization. Some examples include infrared spectroscopy, liquid chromatography, high performance thin layer chromatography (HPTLC), nuclear magnetic resonance, mass spectroscopy, etc.[46] [Figure 1].

Good manufacturing practices (GMP) is a system that ensures that the products manufactured are consistently produced, are controlled according to quality standards, and that they minimize those risks involved in production that cannot be eliminated through testing of the final product. GMP covers all

Table 1: Conversion of human equivalent dose to animal dose

Species	Weight (kg)	BSA (mg/m^2)	K_m factor
Human			
Adult	60	1.6	37
Child	20	0.8	25
Baboon	12	0.6	20
Dog	10	0.5	20
Monkey	03	0.24	12
Rabbit	1.8	0.15	12
Guinea Pig	0.4	0.05	8
Rat	0.15	0.025	6
Hamster	0.008	0.02	5
Mouse	0.02	0.007	3

Table 2: Crude and processed herbs in IP 2014

Botanical name/ local name of the plant	Family	Habitat	Parts of plant used	Reported indications	Authors	References	Pharmacopoeial status	
							BP 2014	USP 36
Acacia nilotica (Indian gum)	Leguminosae, Mimosaceae	Throughout the drier parts of india	Seeds and bark	Acidity, foot disease	Takhar, Pande *et al*.	11, 12	-	-
Adhatoda vasica (Vasaka)	Acanthaceae	Throughout India, up to an altitude of 1,300 m	Leaf	Cough and cold, tissue healing	Pandit, Jaiswal *et al*.	13, 14	-	-
Allium sativum (Garlic)	Liliaceae	Native to Central Asia cultivated all over India	Leaf	Snake bite	Phondani *et al*.	4	√	√
			Bulb	Cold, cough, fever, swollen throat, hemorrhagic septicemia, arthritis, foot and mouth disease, skin infection, itching, pruritis, snakebite	Pande *et al*, Pandit, Galav *et al*, Sadangi *et al*, Mulay *et al*	12, 13, 15, 16 17,		
Andrographis paniculata (Kalmegh)	Acanthaceae	Northeast India	Whole plant	Dysentery, fever	Pandit, Chakraborty and Pal	13, 18	-	√
			Root	Insect bite	Kumar	19		
			Leaf	In babesiosis	Sadangi *et al*.	16		
Asparagus racemosus (Shatavari)	Liliaceae	Found wild in tropical and subtropical parts of India, including the andaman's and ascending in the Himalayas to 1,500 m	Root	Milching disorder, diarrhoea, dysentery, indigestion, haemachuria	Pande *et al*, Galav *et al*, Mulay *et al* , Kumar, Pal and Jain, Bharati and Sharma, Ashok and Reddy, Kiruba *et al*.	12, 15, 17,19, 20, 21, 22, 23	-	-
Azadirachta indica (Neem)	Meliaceae	Native to Burma; found all over India	Leaf	In swellings and inflammation constipation, dyspepsia, ulcer, prolapsed uterus, as mosquito repellent, Indigestion, liver disorders, tissue healing, small pox	Phondani *et al*, Pandit, Varshney, Takhar, Pande *et al*, Jaiswal *et al*, Galav *et al*, Sadangi *et al*, Mulay *et al*, Chakraborty and Pal, Pal and Jain, Varshney, Borthakur and Sharma	4, 11, 12, 13, 14, 15, 16, 17, 18, 20, 24, 26	√	-
			Seed	Parasitic skin diseases	Dey and De	25		
Bacopa monnieri (Brahmi)	Scrophulariaceae	Throughout the plains of India in damp marshy areas	Whole plant	In paralytic attack	Galav *et al*	15	√	√
Berberis aristata (Daaruharidra)	Berbridaceae	Northwestern Himalayas, Nilgiris, Kulu and Kumaon	Root, stems	Cataract, wounds, food poisoning	Phondani *et al*, Pande *et al*	4, 12	√	-
Boerhavia diffusa (Punarnava)	Nyctaginaceae	Throughout India as a weed	Leaves	Improve vitality	Ashok and Reddy	22	-	-
			Root	Jaundice	Singh *et al*	27		
Carica papaya (Papain)	Caricaceae	Cultivated in Uttar Pradesh, Punjab, Rajasthan, Gujarat, Maharashtra and South India	Latex	Eczema	Galav *et al*	15	-	-

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Table 2: Contd...

Botanical name/ local name of the plant	Family	Habitat	Parts of plant used	Reported indications	Authors	References	Pharmacopoeial status	
							BP 2014	USP 36
Cassia angustifolia (Indian senna)	Caesalpineaceae	Cultivated mainly in Tirunelveli and Ramnathpuram districts and to a lesser extent in Madurai, Salem and Tiruchirapalli districts of Tamil Nadu. Also grown on a small scale in Cuddapah district of Andhra Pradesh and certain parts of Karnataka	Pods and leaf	Acidity	Takhar	11	√	-
Cassia fistula (Amaltas)	Caesalpineaceae	Cultivated as an ornamental throughout India	Leaf	Tongue sore, Purgative, constipation, to reduce swelling due to cold	Phondani *et al*, Pandit, Galav *et al*, Sadangi *et al*, Dey and De	4, 13, 15, 16, 25	-	-
			Seed	emetic	Singh *et al*	27		
Centella asiatica (Mandukaparni)	Apiaceae	Marshy places throughout India up to 200 m	Leaf	Fever, dysentery	Pandit	13	√	√
Claviceps purpurea (Ergot)	Clavicipitaceae	A fungous parasite on a number of grasses particularly in rye, cultivated in the Nilgiris and at Chakrohi farm in Jammu	Sclerotium	Uterine stimulant, oxytocic, abortifacient	Sharma and Singh	28	-	-
Coleus forskohlii	Lamiaceae	The sub-tropical Himalayas of Kumaon and Nepal; cultivated in Andhra Pradesh	Root and leaf	Spasmolytic, antithrombotic, anti inflammatory	Sudarsanan *et al*	29	-	√
Coriandrum sativum (Coriander)	Apiaceae, Umbelliferae	Cultivated chiefly in Madhya Pradesh, Maharashtra, Rajasthan, Andhra Pradesh, Tamil Nadu, Karnataka and Bihar	Seed oil	Constipation, haematuria, indigestion, poisoning, chicken pox, fever, dehydration	Phondani *et al*, Pande *et al*, Pandit	4, 12, 13	√	-
Curcuma domestica (Haridra)	Zingiberaceae	Cultivated all over india, particularly in West Bengal, Tamil Nadu and Maharashtra	Rhizome	Constipation, food poisoning, indigestion, neck sore, skin disease, bone fracture, ulcer dysentery, dislocation of bone, mastitis, expectorant, yoke galls, tissue healing	Phondani *et al*, Pandit, Jaiswal *et al* , Varshney, Mishra *et al*, Kumar and Kumar, Bhattarati, Chintu *et al*	4, 13, 14, 24, 30, 31, 32, 33	√	√
Cyamopsis tetragonoloba (Guar gum)	Fabaceae	Cultivated throughout India, particularly in Haryana, Punjab, Rajasthan, Uttar Pradesh and Orissa	Endosperm	Laxative	Pande *et al*	12	-	-

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Table 2: Contd...

Botanical name/ local name of the plant	Family	Habitat	Parts of plant used	Reported indications	Authors	References	Pharmacopoeial status	
							BP 2014	USP 36
Eclipta alba (Bhringraj)	Asteraceae	Throughout India, up to 2,000 m on the hills	Leaf	Wound, antiseptic, swelling	Pandit, Mulay *et al*, Dey and De, Singh *et al*	13, 17, 25, 27	-	-
Embelia ribes (Vidanga)	Myrsinaceae	Throughout India	Seed	Diuretic, astringent, anti-inflammatory, antibacterial	Pandit	13	-	-
Foeniculum vulgare (Saunf)	Apiaceae	Native to the Mediterranean region; now cultivated mainly in Punjab, Assam, Maharashtra and Vadodra	Seed	Diarrhoea	Pandit, Borthakur *et al*	13, 34	√	-
Gymnema sylvestre (Gudmar)	Asclepiadaceae	Central and Peninsular India	Leaf	Eye discharge, anti-diabetic	Pandit , Wynn	13, 35	-	√
Hemidesmus indicus (Anantmula)	Asclepiadaceae	The Himalayas, from Kashmir to Nepal and Meghalaya, ascending to 1,800 m	Leaf	Convulsive seizure	Pandit	13	-	-
Mangifera indica (Amra)	Anacardiaceae	Found in Uttar pradesh., Punjab, Maharashtra, Andhra Pradesh, West Bengal and Tamil Nadu	Bark	Diarrhoea, eye disease, during food poisoning	Galav *et al*, Pande *et al*	12, 15	-	-
Mentha arvensis (Mint)	Lamiaceae	Cultivated in Jammu and Kashmir	Leaf	Fever, dysentery	Pandit, Phondani *et al*	4, 13	-	-
Mucuna pruriens (Kaunch)	Fabaceae	Throughout India, including Andaman and Nicobar Islands	Leaf Pods	Diarrhoea Ouster induction, wounds, cholera	Pandit Galav *et al*., Kumar, Singh *et al.*	13 15,19,27	-	-
Ocimum sanctum (Tulasi)	Lamiaceae	Throughout India; grown in houses, gardens and temples	Leaf	Cough and cold, rhinitis, body ache, purulent disease	Pandit, Sudarsanam *et al*	13, 29	-	-
Picrorhiza kurroa (Kutki)	Scrophulariaceae	The Alpine Himalayas from Kashmir to Sikkim	Roots	Digestive troubles, dysentery, alimentary disorders, intestinal worm, tonsil, diarrhoea	Pande *et al*, Sharma *et al*	12, 36	-	-
Phyllanthus amarus (Bhuiamla)	Euphorbiaceae	Throughout the hotter parts of India, particularly on cultivated land, up to 1,000 m.	Whole plant	In malaria	Singh *et al*	27	-	√
Phyllanthus emblica (Amalaki)	Euphorbiaceae	Native to tropical Southeast Asia; distributed throughout India, also planted in public parks	Fruit	Chicken pox, intestinal parasites, dyspepsia, diarrhoea, eye disease	Pande *et al*, Sharma *et al*	12, 36	√	-

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Table 2: Contd...

Botanical name/ local name of the plant	Family	Habitat	Parts of plant used	Reported indications	Authors	References	Pharmacopoeial status	
							BP 2014	USP 36
Piper nigrum (Maricha)	Piperaceae	Native of the Indo-Malaysian region; cultivated in Western Ghats, Karnataka, Maharashtra, Assam and Kerala	Seed	Mastitis, cough, cold, fever, indigestion, throat swelling, intestinal disorder, blood in excreta, food poisoning	Pandit, Phondani *et al*, Mishra *et al* , Sharma *et al*, Choodnal	4, 13, 30, 36, 37	-	√
			Flower, fruit	Diarrhoea	Pandit , Mishra *et al*	13, 38		
Psoralea coryfolia (Bakuchi)	Fabaceae	Found in many parts of India	Seeds	In leukoderma, antibacterial, antihelmintic	Wynn,Rajan and Sethuraman	35, 39	-	-
Ricinus communis (Castor seed)	Euphorbiaceae	Cultivated chiefly in Andhra Pradesh, Maharashtra, Karnataka and Orissa	Seed oil	Acidity, throat problem, constipation, intestinal worms	Takhar, Galav *et al*, Mulay *et al*	11, 15, 17	-	-
Rubia cordifolia (Manjistha)	Rubiaceae	Throughout India, ascending to an altitude of 3,700 m	Stem	Astringent, diuretic, antidysenteric, antiseptic	Pandit	13	-	-
Sida acuta (Bala)	Malvaceae	Throughout the warmer parts of india	Whole plant	Shivering, joint pain	Jaiswal *et al*, Mulay *et al*, Sharma, Sebastian	14, 17, 40, 41,	-	-
Syzygium aromaticum (Lavang)	Myrtaceae	Cultivated in Tamil nadu and Kerala	Flower bud	Carminative, anti inflammatory, antibacterial, in dyspepsia, gastric irritation	Choodnal	37	√	-
Terminalia arjuna (Arjuna)	Combretaceae	Throughout the greater part of India, also grown as an avenue tree	Bark	Haemostatic property, tissue healing, heart diseases	Jaiswal *et al* , Singh *et al*	14, 27	√	-
Terminalia bellirica (Bhibhitaki)	Combretaceae	Throughout deciduous forests of India	Fruit	Diarrhoea, dyspepsia	Pande *et al*	12	√	-
Terminalia chebula (Haritaki)	Combretaceae	Abundant in Northern india. Also occurs in the forests of Assam, West Bengal, Bihar especially in Konkan	Fruit	Diarrhoea, anthrax, dysentery, ulcer, stomachache, anorexia	Pandit, Phondani *et al*, Sadangi *et al*, Pal and Jain, Varshney, Sudarsanam *et al*, Chintu *et al*, Rajan and Sethuraman	4, 13, 16, 20, 24, 29, 33, 39	√	-
Trachyspermum ammi (Ajwain)	Apiaceae	Cultivated in Madhya Pradesh, Andhra Pradesh, Gujarat, Maharashtra, Uttar Pradesh, Rajasthan and Bihar	Seeds	Hypocalcemia downer cow syndrome, expectorant, appetizer, indigestion, dysentery, stomachache, fever, blot	Pandit, Phondani *et al*, Takhar, Varshney, Mishra *et al*, Yadav and Gupta, Geetha *et al*	4, 11, 13, 24, 38, 42, 43	√	-

Contd...

Table 2: Contd...

Botanical name/ local name of the plant	Family	Habitat	Parts of plant used	Reported indications	Authors	References	Pharmacopoeial status	
							BP 2014	USP 36
Tinospora cordifolia (Guduchi)	Menispermaceae	Tropical India and the Andamans	Whole plant	Tonsillitis, foot and mouth disease, anthrax, bone fracture, blood purification,	Ashok and Reddy, Galav *et al*, Ashok S, Kumar, Mulay *et al*	15, 17, 19, 22,	-	-
			Stem	Skin disease	Pandit	13		
Tribulus terrestris (Gokhru)	Zygophyllaceae	Throughout India, up to 5,400 m	Root	Dysentery	Ashok and Reddy	22		
			Fruits	Diuretic	Chakraborty and Pal	18	-	-
Trigonella foenum-graecum (Methi)	Fabaceae	Widely cultivated in many parts of India	Seeds	Urinary disorder, appetizer, diarrhoea, galactagogue, fertility regulation and in the treatment of gastric troubles, tetanus, and food poisoning, pneumonia	Phondani *et al*, Takhar, Varshney, Singh *et al*, Sudarsanam *et al*, Wanzala *et al*	4, 11, 24, 27, 29, 44	√	-
Withania somnifera (Ashwagandha)	Solanaceae	Distributed throughout the drier region of India, especially in Wasteland ascending to an altitude of 2000 m in the Himalaya	Root	Fever, ulcer, expulsion of placenta, convulsive seizures, tissue healing, antibacterial, improve sexual vitality	Jaiswal *et al*, Pandit , Galav *et al*, Pal and Jain, Ashok and Reddy, Mulay *et al*, Mishra *et al*, Wanzala *et al*	13, 14, 15, 17, 20, 22, 24, 30, 44	√	√
Zingiber officinale (Ginger)	Zingiberaceae	Native to Southeast Asia; cultivated mainly in Kerala, Andhra Pradesh, Uttar Pradesh, West Bengal, Maharashtra	Rhizome	Blood purifier, expectorant, fever, indigestion, anthrax, constipation, stomachache, tetanus, food poisoning	Sudarsanam *et al*, Varshney, Chintu *et al*, Wynn, Wanzala *et al*	24, 29, 33, 35, 44	√	√
			Flower, fruit	Bone fracture, diarrhoea	Pandit	13		

aspects of production from the starting materials, premises, and equipment to the training, safety measures and personal hygiene of the staff. It also ensures that proper standard operating procedures are followed; the work environment is controlled; and quality assurance, packaging, and labeling are done in accordance with the requirements.[47,48] Various pharmacopoeias including the IP, Chinese Herbal Pharmacopoeia, British Herbal Pharmacopoeia, BP, USP, European Pharmacopoeia, Japanese Standards for Herbal Medicine, and the Ayurvedic Pharmacopoeia of India have monographs of many herbs used for human care, but none of them state the herbal monographs used as veterinary medicines. Thus, these pharmacopoeias may also consider laying down monographs for herbs and herbal preparations specifically used in veterinary medicines so as to maintain their quality.

CONCLUSION AND PROSPECTS

It is evident that most medicines mentioned in this review for animal health care are derived from leaves. Generally, fresh collected plant or plant parts are used for treatment. Figure 2 illustrates the percentage of different parts of plants used as veterinary medicines. Out of 57 crude herbs and 47 processed herbs/excipients in IP 2014, 40 crude herbs and 5 processed herbs/excipients are covered here. Among the 45 herbs mentioned, 18 are official in BP 2014 and 11 in USP 36. Thus, this article covers the wide scope of herbal drugs that can be used in the treatment of human diseases. Manufacturers are encouraged to use the IP standards with respect to these herbal medicines for the manufacture of veterinary herbal formulations.

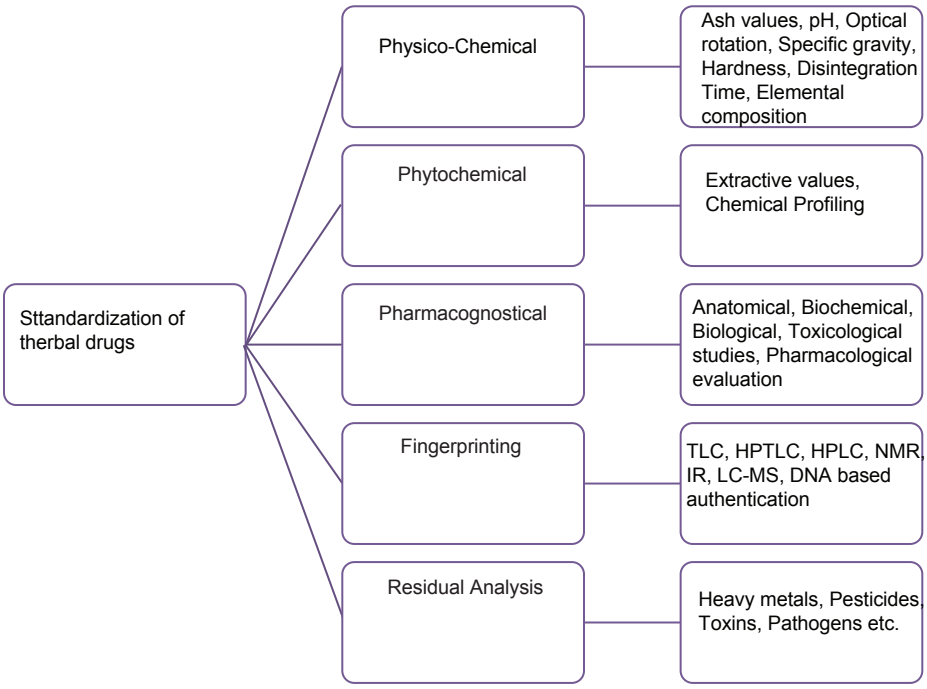

Figure 1: Standardization of herbal drugs

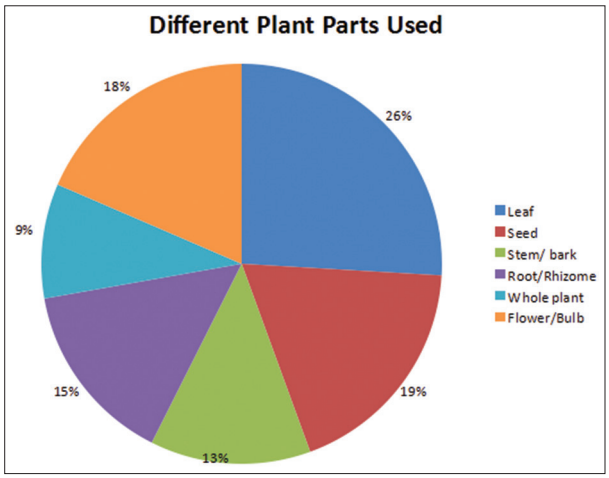

Figure 2: Pie diagram showing different plant parts used in veterinary

The data also revealed that plant preparations were used to treat a wide range of conditions such as cough, cold, diarrhea, dysentery, bone fractures, wounds, rheumatism, hair loss. Some of the drugs also have multiple indications in animal health care (*Allium cepa, Azadirachta indica, Curcuma domestica, Piper nigrum, Trachyspermum ammi, Trigonella foenum-graecum, and Zingiber officinale).*

In spite of the extensive modern programs implemented by government organizations and hospitals to uplift rural health care, these traditional treatments have remained popular. In some remote areas, people have great undocumented traditional knowledge about animal diseases, herbal treatments, formulations, etc., But due to modernization, this traditional veterinary knowledge is on the verge of extinction. The only means of acquisition of this knowledge is from what has been passed down over the generations and the lack of interest for traditional veterinary knowledge in the present generation is leading to its extinction.

Therefore, there is a need to prioritize the veterinary herbal sector. The herbal veterinary medicines are mainly sold at a relatively low cost as compared to modern medicines. While the herbal products are cheaper, the active ingredients of the medicinal plants are becoming increasingly expensive. As a result, herbal veterinary medicines are losing their edge over the allopathic drugs. Thus, there is also an urgent need to encourage research in this sector. Moreover, the quality specifications of veterinary herbal medicines need to be developed and the possibility of harmonization/collaboration efforts may be explored to take care of animal health care at the national and international levels. It can thus be concluded that there is still a need for both the validation of traditional claims (detailed pharmacognostical, phytochemical, and pharmacological investigations, etc.) and safety evaluations in appropriate models of these medicinal plants for their development and use as veterinary medicines.

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