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A review on status of ethnoveterinary medicine and challenges it faces in Ethiopia

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Abstract

The purpose of this review is to give an overview on the status of Ethnoveterinary medicine (EVM) in Ethiopia and to highlight its advantages, limitations, challenges it faces and make readymade document available for users. EVM comprises of traditional surgical techniques and immunization, magic religious practices and the use of herbal medicines to treat livestock diseases. Peoples in different locations with different religious, linguistic and cultural backgrounds have their own specific knowledge about use of plants which in part has gradually entered wide circulation in the country. Ethiopian farmers and pastoralists rely on traditional knowledge, practices and locally available materials, plants in particular, to control and manage domestic animal diseases. Ethiopian plants have shown very effective medicinal value for some ailments of human and domestic animals. These medicinal plants (MPs) and knowledge of their use provide a vital contribution to human and livestock health care needs throughout the country. Ethnoveterinary (EV) drugs are prepared in various dosage forms and can be administered in different ways. It is not enough that traditional medicinal plants (TMPs) are useful but has disadvantages. Some MP species of Ethiopia are reported to have been threatened. Environmental degradation, agricultural expansion, loss of forests and woodlands, over use and over harvesting, fire, cultivation of marginal lands, overgrazing and urbanization appear to be the major threats to the MPs of Ethiopia. Ethiopians have used traditional medicines (TMs) as early as the 17th century; however, very little is documented. The knowledge of traditional uses of MPs in Ethiopia has mostly been passed on by verbal communication. This method of information conveyance has probably resulted in distortion or loss of indigenous knowledge. To solve such problems and to keep the practice in hand, there must be ongoing research and documentation.

Keywords: challenges, ethnoveterinary, livestock diseases, medicinal plants, traditional knowledge

Introduction

Ethnoveterinary medicine (EVM) is the use of medicinal plants (MPs), surgical techniques and traditional management practices to prevent and treat spectrum of livestock diseases^[21]. It is a holistic interdisciplinary study of the local knowledge and the sociocultural structures and environment associated with animal health care and husbandry^[22]. EVM is mainly concerned with folk beliefs, knowledge, skills, methods and practices which are used in the healthcare of animals. The knowledge varies from region to region, and from community to community^[10]. Traditional medicine (TM) has maintained its popularity in all regions of the developing world and its use is rapidly spreading in the industrialized countries^[21]. In developing counties, people rely on MPs for the healthcare of animals^[10].

Ethiopia, is a country characterized by a wide range of climate and ecological conditions, possesses enormous diversity of fauna and flora^[29]. The country possesses a wide range of potentially useful MPs, more extensive indeed than available in many other parts of the world^[14]. It has rich MP lore and points out that almost all plants of the Ethiopian flora are used somewhere somehow medicinally^[5]. Diversity of plant species which have pharmacological activities were identified so far and the active ingredients are extracted mainly from the root, stem, and leaf parts that processed to administer through appropriate routes^[31]. The plant materials include seeds, berries, bark or flowers are used for medicinal value^[21]. Ethiopian farmers and pastoralists rely on traditional knowledge (TK), practices and locally available materials, plants in particular, to control and manage domestic animal diseases^[10, 21]. In Ethiopia, most of MPs used by the herbalists are collected from the natural vegetation.

Home based MPs use relies on plants of the home garden crops, weeds and that grow wild around human habitation. MPs obtained from wild habitats are found in different natural ecosystems of the forests, grasslands, woodlands, wetlands, in field margins and garden fences, as weeds and in many other microhabitats from where they are harvested when the need arises. Indigenous knowledge of MPs in Ethiopia is unevenly distributed among community members. The distribution of knowledge and services are hierarchically placed. Services are obtained from the family, the neighborhood, the village or beyond [5].

Ethiopian TM has played a significant role in treating health problems in both livestock and humans. Ethiopians have used TMs for many centuries, the use of which has become an integral part of the different cultures in Ethiopia, due to cultural acceptability, efficacy against certain diseases and economic affordability. TK of MPs and their use by indigenous healers and drug development in the present are not only useful for conservation of cultural tradition and biodiversity but also for community health care and drug development in the local people [29]. The livestock or EVM provides TMs which are locally available and usually cheaper than standard treatments. It is not enough that traditional medicinal plants (TMPs) are useful but has disadvantage. [21] Ethiopians have used TMs as early as the 17th century; however, very little is documented [24]. Unless the plants are conserved and the ethnomedicinal knowledge is documented, there is a danger that both the valuable MPs and the associated indigenous knowledge of the ethnic groups could vanish forever due to lack of documentation [29]. Therefore, the objective of this review is to give an overview on the status of EVM in Ethiopia and to highlight its advantages, limitations, challenges it faces, and to make readymade document available for users.

Ethnoveterinary Medicine (EVM)

The application of TM to veterinary medicine has been termed as EVM [11]. It is the use of MPs, surgical techniques and traditional management practices to prevent and treat spectrum of livestock diseases [21].

EVM is the scientific study of the relationships between livestock and plants [27]. It is a holistic interdisciplinary study of the local knowledge and the sociocultural structures and environment associated with animal health care and husbandry [22]. EVM is mainly concerned with folk beliefs, knowledge, skills, methods and practices which are used in the healthcare of animals [10]. It comprises of traditional surgical techniques, traditional immunization, magic religious practices and the use of herbal medicines (HM) to treat livestock diseases [11, 21]. The knowledge varies from region to region, and from community to community [10]. In general, ethnoveterinary practices (EVPs) have been developed by trial and error and by actual experimentation [11, 21]. The study of EVPs is a growing area of interdisciplinary research having immense potential to understand various nuances of folk knowledge on domesticated animals. In Ethiopia, about 80% of the human population and 90% of livestock rely on TMs. TM is an integral part of the culture, belief, structure and lifestyle of Ethiopian people's [21].

Ethnoveterinary Medicine Practice in Ethiopia

For generations, the use of EVPs to treat and control livestock diseases is an old practice in a large part of the world, particularly developing countries where animal health services are still very poor and/or are found scarcely located

at urban areas [13]. TM has maintained its popularity in all regions of the developing world and its use is rapidly spreading in the industrialized countries [21]. In developing countries, people rely on MPs for the healthcare of animals [10]. There are a number of traditional medicinal practices that reflect the diversity of Ethiopian cultures [24]. The indigenous knowledge on MPs appears when humans started and learned how to use the TK on MPs [19]. Ethiopians have used TMs as early as the 17th century [24].

In Ethiopia, people have been using both plant and animal species for medication of different animal and human diseases over centuries when there was no modern health service delivery. The practice was not stopped with introduction of the modern pharmacotherapy, and plant remedies are still the most important and sometimes the only sources of therapeutics for nearly more than 90% livestock population [26]. Due to incomplete coverage of modern medical system, shortage of pharmaceuticals and unaffordable prices of modern drugs, the majority of Ethiopians still depends on TM [14]. Plants comprise the largest component of the diverse therapeutic elements of traditional livestock health care practices [25]. Research into EVM is often undertaken as part of a community based approach that serves to improve animal health and provide basic veterinary services in rural areas [21]. Few scientific studies or evaluations have been conducted in Ethiopia. Of the well documented studies, Lemma reported *Phytolacca dodecandra* to be an effective molluscicidal which helps in the control of schistosomiasis and fasciolosis in humans and animals. Even the raw berry of this plant proved effective in the reduction of schistosomes in a five-year study conducted in Adwa on human patients. *Kosso (Hagenia abyssinica)* was found to be effective against *Moniezia* spp. in sheep in an experiment carried out in the Asela Regional Veterinary Laboratory [20].

It is widely believed in Ethiopia that the skill of traditional health practitioners is 'given by God' and knowledge on TMs is passed orally from father to a favorite child, usually a son or is acquired by some spiritual procedures. Traditional healing knowledge is guarded by certain families or social groups. Traditional spiritual healers are known by different names,

depending on the communities where they practice including *debtera*, *tenquay* (witch doctors), *weqaby and kalicha* [21]. Many veterinarians do not recognize the importance of traditional veterinary practices. Some think of traditional practices (TPs) as mere superstition. Others see TM as the domain of 'quacks'. Some veterinarians even argue that the active ingredient of a particular herb should be known before it may be used as a treatment. On account of these views, little work has been done to promote TM. However, experience in other countries has shown that TM could be useful if applied as an integral part of modern veterinary medicine. After all, several modern treatments are simply pharmacological formulations of crude plant extracts [20].

Ethnoveterinary Medicine Practitioners

In Ethiopia EVM is highly practiced by various local groups. Peoples in different locations with different religious, linguistic and cultural backgrounds have their own specific knowledge about use of plants which in part has gradually entered wide circulation in the country. Indigenous knowledge of MPs in Ethiopia is unevenly distributed among community members. The distribution of knowledge and services are hierarchically placed and services are obtained from the family, the neighborhood, the village or beyond. A

common saying related to the knowledge goes as follows “leave alone human beings, even a goat knows which twig to nibble when bitten by snake”^[5]. Peoples of all cultures depend on plants for their primary requirements and learned diverse applications of plants. Pastoralists, agropastoralists and other small-scale farmers in the East Africa region have engaged in a long tradition of EVPs to care for their animals involving the use of many plants to prevent and treat different diseases and health conditions^[11].

The majority of livestock raisers in Ethiopia are geographically removed from the sites of veterinary stations and those that are closer to the sites may not afford the fees for services. The inadequate funding at the national level for the prevention and control of animal diseases adds to the burden, especially among pastoralists who live in the remote arid and semiarid lowland parts of the country. Therefore, a reasonable solution would be to complement modern veterinary health care with traditional care. Ethiopian farmers and pastoralists rely on TK, practices and locally available materials, plants in particular, to control and manage domestic animal diseases^[10, 21]. Stock raisers, both farmers and herders have developed their own ways of keeping their animal health and productivity. They treat and prevent livestock diseases using sometimes age-old homemade remedies, surgical and manipulative techniques. Taken together, these indigenous local animal health care beliefs and health care practices constitute an EVM. Like other kind of local technical knowledge, EVM practice and skills are built up on over time empirical observation, mainly through trial and error and sometimes through deliberate or even desperate experimentation and innovation^[3]. Modern livestock health care in pastoral community of Ethiopia is still at its lowest stage due to limited veterinary services and supply of drugs. Besides, most modern drugs are expensive and, as a result, not affordable by the majority of Ethiopian farmers and pastoralists. As a result, pastoral and agropastoral communities heavily rely on their TK and practices on locally available materials mainly plants in the management of animal diseases^[23].

Medicinal Plants in the Etnoveterinary Medicine in Ethiopia

Nature has been the source of therapeutic agents for treating human and livestock diseases since the dawn of civilization^[30]. A great variety of traditional materials are used to treat and prevent livestock health problems; MPs which have been used both for prevention and cure of various diseases of humans and animals from time immemorial occupy the largest portion^[13]. Nature is provided with a lot of herbal medicinal plants which play a major part in the treatment of diseases. Plants are considered as the significant and elemental sources of medicinal traits. MPs form the richest entity in medicines, food supplements, nutraceutical, pharmaceutical and chemical industries for manufacturing drugs^[4].

Ethiopia, is a country characterized by a wide range of climate and ecological conditions, possesses enormous diversity of fauna and flora^[29].

The country possesses a wide range of potentially useful MPs, more extensive indeed than available in many other parts of the world^[14]. Ethiopia is believed to be home for about 6, 500 species of higher plants with approximately 12% endemism, and hence one of the six plant biodiversity rich countries of Africa. Ethiopian plants have shown very effective medicinal value for some ailments of human and domestic animals.

These MPs and knowledge of their use provide a vital contribution to human and livestock health care needs throughout the country. Many species of Ethiopian MPs have a long history of use as remedies.^[5] Some MPs in the EVM of Ethiopia are listed here under in the following figures (1-124).

Medicinal Plants (MPs) and Animal Diseases they cure in Ethiopia

Medicinal plants (MPs) have a long history of use in the treatment of both human and animal diseases. A large number of modern drugs have been isolated from natural sources particularly from the plant world^[30]. MPs form the basis of traditional healthcare systems for the majority of the population of developing nations^[18]. The plant based TM systems continue to play an essential role in health care, with about 80% of the world’s farmers, shepherds and animal growers relying mainly on TMs for treating routine maladies for their livestock^[30]. Popular knowledge of plants used by humans is based on thousands of years of experience^[14]. At least 80 percent of the Ethiopian people depend on TM for their health care, and more than 95 percent of traditional medicinal preparations in Ethiopia are made from plant origin. MPs and knowledge of their use provide a vital contribution to human and livestock health care needs throughout the country^[24]. EVM is frequently used for treating of livestock diseases by many different ethnic groups in Ethiopia^[32]. In some parts of the country, livestock diseases such as anthrax, black leg, anaplasmosis, ascariasis, abscess, leeches, trypanosomiasis, lymphangitis, stomatitis, and coccidiosis have been treated using various natural plant product combinations^[10]. MPs used for EVM in Ethiopia being discussed with their common name, scientific name, traditional therapeutic use accordingly in table 1.

Availability and Distribution of Medicinal Plants (MPs)

Ethiopia has rich MP lore and points out that almost all plants of the Ethiopian flora are used somewhere somehow medicinally. About 60% of the flora to be medicinal and most sources give about 10% of the vascular flora to be medicinal. The list cover plants that are widely used by the local communities in lowlands and highlands for treating human ailments and some of them for livestock ailments as well as for prevention of pests and vectors.^[5] There are about 887 plant species recorded as having medicinal uses for people. The majority of the MPs are herbs, followed by shrubs and trees^[24]. In Ethiopia, most of MPs used by the herbalists are collected from the natural vegetation. Home based MPs use relies on plants of the home garden crops, weeds and that grow wild around human habitation. MPs obtained from wild habitats are found in different natural ecosystems of the forests, grasslands, woodlands, wetlands, in field margins and garden fences, as weeds and in many other microhabitats from where they are harvested when the need arises. These are free access resources to all with appropriate knowledge and who want to use them for the family for practicing TM or for sales. Different vegetation types that are found in the various agro ecological zones of Ethiopia accommodate various types of MPs^[5].

Parts of Medicinal Plants (MPs) Used

Livestock are facing various life-threatening hazards notably infectious (parasitic, bacterial, viral, protozoal, fungal) and non-infectious like metabolic diseases, poisoning and other miscellaneous origin. Ethiopian people especially farmers and traditional animal healers have been using traditional methods

to treat both human and their livestock diseases for generations. TM is still widely practiced in areas where modern health care services are limited [2]. Diversity of plant species which have pharmacological activities were identified so far and the active ingredients are extracted mainly from the root, stem and leaf parts that processed to administer through appropriate routes [31]. The plant materials include seeds, berries, bark or flowers are used for medicinal [21]. Traditional animal healers can use plant parts like seeds to treat cattle with abdominal distension, leaves for different treatment of diseases and other parts of the plants [2]. Parts of medicinal plant used in the EVM are listed in table 2.

Methods of Preparation and Routes of Administration

Preparations of EVM

Drugs are prepared in various dosage forms including liquids, ointments, powders and pills. Drugs are also prescribed in a non-formulated form and additives are usually incorporated and more than one drug is used in a single dosage form [21].

Leaves: All over the world communities, utilized for the preparation of herbal medicine using leaves. The reason why leaves were used mostly is that they are collected very easily than underground parts, flowers and fruits etc. and in scientific point of view leaves are active in photosynthesis and production of metabolites. The medicinal use of pounded leaves of *Nicotiana*

tobacum in order to treat tick and leech infestation (have been reported in various parts of the country), snake biting, internal parasite, fever, wound infestation. And also, dried leaves of *Nicotiana tobacum* are soaked overnight with water, squeezed and given to cure black leg in cattle. It is also used in combination with dried and crushed fresh leaf paste of *Camellia sinensis* and applied topically for external parasite treatment. *Croton macrostachys* leaves are pounded and squeezed with water to relief bloat and black leg. Likewise, leaves are crushed and rubbed on infected lesion and applied topically to cure ring worm. Fresh leaves of *Croton macrostachys* together with *Trichilia spp.* and *Rhamnus prinodes* crushed and mixed with water and given orally 4 cup per day (morning and evening) for 3-4 days and applied topically for diarrhea (dysentery) and external parasite. The crushed fresh leaf of about ¼ kg *Vernonia amygdalina* added to 3 L of water. It is administered orally for GIT problem about 1 L for 3 days, 2 days interval and applied topically for skin problem. Crushed leaves also used to cure internal parasite, diarrhea, and colic. On other hand, its leaves just mixed with salt and given to treat retained placenta in cow. Beyond treatment of livestock ailments, fresh leaves are pounded with salt, then water is added and given to cow for 3 days in the morning to improve milk production in cows. Crushed leaves of *Calpurnia aurea* plant species mixed with water and used to treat mastitis, dermatophilosis and ectoparasites, *Oestrus ovis*, trypanosomiasis and internal parasite. Leaves of *Hagenia abyssinica* chopped, mixed with water and after sieving filter is used to treat internal parasite in livestock and pets. Leaf paste of *Azardracha indica* applied topically for healing ectoparasite. Leaf decoction of *Sesbania sesban* and *Clotalaria natalatia* used to cure sudden illness. The fresh leaves of *Maesa lanceolata* and *Nicotiana tabacum* are pounded together, water added and then 1 cc filtrate is administered through nose for 2 days to cure leech infestation. Crushed leaves of *Maesa lanceolata* mixed with water and then filter used to cure leech infestations and bloat. Chopped leaves of *Solanum incanum* mixed with water and

after sieving, filter used for treatment of skin disease, eye diseases and problems, general treatment; eye worms (thelaziosis); ticks and wound. Similarly, the leaf of the *Oliniario chetiana* is used as spray in treating eye disease. *Aloe scundiflora* leaf to relief ear pain, ophthalmia, wounds, burns, leaf paste of *Coes edulis* to cure mastitis, leaf paste of *Ficus sycomoros* to treat contagious camel skin necrosis, leaf paste of *Rhus abyssinica* to cure skin and eye problems, *Ricinus communis* used to treat retained fetal membrane and rabies; infusion made from leaf of *Sphaeranthus steetzii* is used to relief bloat. Leaves of *Ageratum conyzoides*, *Conyza sp* and *Ehretiacymosa Thonn*, *Acmella caulirhiza*, *Brucea antidysenterica*, *Triumfetta sp*, *Justicia schimperian* and *Asystasia gangetica* crushed singly and after adding water used to cure coccidiosis, internal parasite, New Castle disease, epizootic lymphangitis, trpanosomiasis, circling diseases and pasteurellosis respectively. For treatment of pasteurellosis, leaf of the *Xanthium strumarium* is dried, pounded and then soaked in water for some time is administered orally. Crushed leaves *Plecthranthus (Pycnostachyus sp.)* mixed with water and used for treatment of mastitis, blackleg and anthrax. Crushed leaves of *Kalanchoe sp.* mixed with water and used to cure disorder like abscess, low libido and blackleg. Crushed leaves of *Withania somnifera* mixed with water and filter used for blackleg, trypanosomiasis and snake bite. Crushed leaves of *Shrebera alata* and *Sida schimperian* mixed with water and used for treatment of black leg and diarrhea. Crushed leaves of *Artemisia sp.* mixed with water and used for treatment of diarrhea and bottle jaw in cattle. Chopped leaves of *Dodonea angustifolia* mixed with water and filtered for treatment of retained fetal membrane and easing dystocia, wound and lice infestation. In treating retained fetal membrane, leaf of *Ensete ventricosum* is also given for cow. Leaf of the *Juniperus procera* and *Prunus Africana* are crushed and mixed with water in preparation. Herbalists use this plant to treat trypanosomosis. *Prunus Africana* is also used for wound infection. The leaves of *Calpurnia aurea*, *Millettia ferruginea* and *Teradenia riparia* chopped and mixed with water for use as tsetse fly repellent. Nine potential medicinal plants were identified that could be used to kill or repel ticks in Northern Gondar. Among this, most commonly used plant parts for remedy preparations were leaves of *Calpurnia aurea*, *Millettia ferruginea*, *Grewia ferruginea*, *Phytolacca dodecandra*, *Silene macroserene*, *Cucumis prophetarum*, *Euphorbia abyssinica* to kill or repel ticks. The leaves *Phytolacca dodecandra* plant species is also used to cure gastrointestinal parasite and rabies. Crushed leaves of *pentas sp.* mixed with water and filtrate used for treatment of blackleg, fractured bone, internal parasite and constipation [11].

Bark: The bark is most commonly used in the treatment of diarrhoea, dysentery and other gastrointestinal disorders of animals including flatulence, constipation, bloat etc. Bark paste with or without butter or infusion prepared from *Accacia busei* used to treat wounds and burns, mastitis, swollen teats, retained fetal membrane; *Accacia melifera* infusion for diarrhea; *Accacia brevispica* infusion for cowdriasis, 3-day sickness, diarrhea; bark infusion of *Accacia tortilis* for diarrhea; bark decoction of *Albezia anthelimentic* for helminthiasis and infusion as tsetse fly repellent; bark infusion of *Comiphora erythrea* for retained fetal membrane; bark infusion of *Grewia bicolar* for retained fetal membrane; bark decoction of *Salvadora persica* for trypanosomiasis, anthrax; *Sesbania sesban* infusion for mastitis; bark decoction

of *Zizyphus Mauritian* for bloat. The local healer chew fresh bark of the root of the *Albizia anthelmentica* and then spit to the mouth of the animal about 1 teaspoonful, every day for 2 day to treat internal parasite. A Chopped bark of *Croton macrostachyus* is mixed with water and filter then orally drenched for treatment of equine colic, abdominal pain and bloat. Bark of *Albizia anthelmentica* and *Myrica salicifolia* grinded and mixed with water used for tsetse fly repellent and trypanosomiasis treatment respectively [11].

Flower: The fresh vegetative part of *Basella alba* and the flower of *Acmella caulirhiza Del.* are pounded, mixed together and squeezed, given 3 times/day until recovering from bloat, eye problem, wound. Crushed flower of *Vernonia sp.* mixed with water is used for treatment of babesiosis in cattle [11].

Fruit: Infusion prepared from *Solanum incanum* fruit is used to treat dermatophilosis in Borana pastoralists, Southern Ethiopia. Fruit of *Citrus aurantifolia (Christm.)* is squeezed and given to hen till recovery from disease and also used to cure tick infestation as well as wound in Western part of Ethiopia. Fruit of *Citrus aurantifolia, Piper. L (Piperaceae), Lepidium sativum* chopped and mixed with water then used for trypanosomiasis treatment and as tsetse fly repellent. Fruit of *Brucea antidyserterica* used to cure ring worms and rabies [11].

Roots: After drying the root of both *Solanum incanum* and *Withania somnifera*, pounded, 1 teaspoonful from each plant mixed together and water added to make solution; 1 teaspoonful of the mixture is given as a drink for 3 days/animal daily to cure most diseases especially anthrax and three-day sickness. The local healer chew fresh root and spit to the nose of the animal immediately after biting and the dose is probably 1 teaspoon for snake bite and also the root is used to treat pastuerellosis. Root infusion of *Accacia nilotica, Coes edulis, Cissus rotundifolia* and *Azardracha indica* are used to cure diarrhea, *cowdirosis*, snake bite and ect-endoparasite respectively. The bulb (root) of *Allium sativum* pounded, water added and filters then given to cure mastitis, diarrhea, internal parasite and others. Root of *Allium sativum, Aeschnomene elaphroxylon* and *Echinops ('kebericho')* grinded separately and mixed with water used for trypanosomiasis treatment and tsetse fly repellent. Root of *Allium sp.* and *Milletia ferruginea* were grinded and mixed with water are used to treat trypanosomiasis. The root of the *Rumex nervosus* is dried, chopped and crushed into powder. It is used to treat internal parasite. The root of the *Allium sativum* is chopped and mixed with water used to treat (control) colds, coughs and pneumonia; lice; stomach and intestinal worms and ringworm; chopped or crushed root of *Cynoglossum lanceolatum* and dried one mixed with butter is used to treat mastitis and black leg. Mostly the root of the *Echinops (Asteraceae)* is grinded and mixed with water is used to treat trypanosomiasis in Amaro district and skin infection in sheep and cattle in Jimma zone, southwestern part of Ethiopia. Root decoction of *Carissa edulis, Clotalaria natalatia (Grewia villosa), Salvadoria persica, Solanum incanum* and *Woodfordia unifilora* are used to treat helminthiasis, sudden illness, trypanosomiasis; anthrax, blackleg and 3-day sickness; and sudden illness respectively. *Aloe scundiflora* infusion for relief of ear pain, ophthalmia, wounds and burns. Root paste of *Cissus adenocaulis, Croton dichogamous, Rosa abyssinica* used to treat snake bite, for

poor mothering and skin problems respectively. Root of *Helinus mystacinus* and *Dodonea angustifolia* were grinded separately and mixed with water is used for treatment of black leg; grinded root of *Stephania abyssinica* also mixed with water and used as remedy for black leg and others like mastitis, trypanosomiasis etc.. Root of *Tragisa sp.* grinded and mixed with water is used to cure blackleg, anthrax, internal parasite and also bloat relief through use of grinded root of *Acalypha spp.* mixed with water [11].

Seeds: Seeds of *Solanum incanum L.* and *Rutaceae* after grinding mixed with water and used for treatment of leech infestations and colic. Grinded seed of *Brucea antidyserterica* left to dry and mixed with water to treat epizootic lymphangitis. Crushed seed of *Vernonia amygdalina Del* mixed with water and filtrate used to treat (control) conditions such as bloat; broken bones; FMD; foot rot. Roots of *Zanthoxylum chalybeum* infusion for pneumonia and diarrhea. Crushed seed of *Vernonia amygdalina* mixed with water and filtered for use of filtrate in treatment of equine colic, pastuerollosis and abdominal pain. One liter of water is added to the ground fresh seed of *Brucea antidyserterica* and given orally once per day for 3 days to treat mastitis in cattle. Seeds of *Ricinus communis* contain around 50% oil, ricinine (an alkaloid) and ricin, which is a very toxic glycoprotein and is used to treat constipation, dermatophilosis (streptothricosis, lumpy wool), LSD, retained placenta and wounds [11].

Routes of Administration of EVMs

EVMs can be administered in many different ways including drenching, bath, fumigation, spray, injection [21] and topical application [21,8], on surface wounds and making incisions into the skin and burying the medicine under the skin or muscle. Another method of traditional treatment includes different surgical techniques and branding. These techniques assist in the healing processes of bone fractures and chronic ailments particularly swellings on the skin [8].

EVM is mainly administered to livestock orally as decoctions, liquid in that the plants have been steeped, vaccination, suppositories, through smoke, vapors, massage, intranasal or applied topically on the skin or as a bathe in skin problems. [32] Common methods for administering EVM are described below □

Drenching: This involves the oral administration of a medicine in liquid form [9, 21, 17], through the mouth using a spoon, dropper or sorghum straw [21]. After measuring the medicine it can be given to an animal using a plastic drink bottle, a bottle gourd or with a calabash spoon [9, 17]. Large animals should first be tied to a tree or pole, or sheep and goats can be restrained between the legs of the administrator. With cattle, placing fingers in the nostrils can help restrain the animal. Raise the animal's mouth upwards and hold the upper jaw with one hand to open its mouth. Insert the bottle, gourd or spoon sideways into the mouth with the other hand. Without removing the drenching instrument, gently pour the liquid into the mouth at intervals. Give the animal enough time to swallow to prevent the medicine from entering the lungs. Do not hold the animal's tongue. For camels, make the animal sit down and hobble it to prevent it from getting up. Hold the lower jaw and head and pour the liquid into the animal's mouth as above [9].

Adding medicine to feed and drinking water: Medicines can be added to the feed and water of sick animals that are

kept isolated from other animals while they eat and drink. To ensure the full dose is taken, medicine may be mixed with or sprinkled on an initial portion of feed that is offered to the animal, which is then followed by the remainder of the feed. Similarly, liquid medicines may be mixed with an initial quantity of drinking water^[9, 17].

Fumigation: The use of smoke or fumes to drive away or kill insects and other pests is common. Powdered material or dried leaves, dung, bark, etc., are burnt in clay pots or on the open ground. The smoke engulfs the sick animal or the entire herd. Animal houses may also be fumigated^[9, 17]. Hanging bouquet; when plants parts are bound in to a bouquet and hanged inside poultry house)^[21].

Steam application: MPs can be added to boiling water and the animal exposed to the steam^[9, 17]. (applied to affected part).^[21] Placing a hot rock into the water will keep it on the boil in order to maintain steam production^[9, 17].

Nasal and eye drops: Liquid medicines can be applied to eyes or nostrils with a dropper, straw or folded leaf^[9, 17].

Skin application: Various methods are used^[9, 17], a poultice, soft heated preparation (applied to a sore or abscess using wet cloth), warm stone or direct application^[21]. Techniques include the following: *Poultices*; a paste is made by grinding seed, fruit, leaves and/or roots, etc., and adding a small quantity of water. The paste is applied to the skin and sometimes covered by bandages or strips of banana leaf. Applications may be renewed at regular intervals. *Compress*; a piece of cloth impregnated with medicine is pressed to the skin. The cloth may contain a warm stone for 'warm' treatments. *Powder*; an animal may be dusted with a powdered medicine. *Lotions and ointments*: Lotions and ointments may be massaged into the skin. Ointments are traditionally prepared by mixing plant materials with animal fat. However, vegetable oils, vaseline and lanoline can also be used. *Bathing*; animals may be washed with liquid medicines, either their whole bodies or just the affected areas. *Spraying*; animals can be sprayed with liquid medicines^[9, 17].

Anal application: To protect against infection, the administrator should wear plastic gloves or put clean plastic bags over their hands, having first washed their hands and clipped their nails (hands should be washed after administration also). Powdered medicine made into a small ball is carefully pushed into the animal's anus. If the ball is dry, it may be dipped in water or oil to ease entry. Today, young EV practitioners sometimes use needleless syringes to introduce liquid medicines into the anus^[9, 17].

Vaginal application: To protect against infection, the administrator should take the same measures as with anal application. Wash the animal's birth opening (vulva) with soap and warm water. Take the medicine in one hand and, cupping this hand into a cone shape, push it gently into the vagina. Leave the medicine in the vagina and slowly withdraw the hand^[9]. When side effects became severe, antidotes were claimed to be used. The healers-imposed restriction when certain types of drugs were taken by patients. Drugs are stored usually in containers such as bottles, papers, pieces of cloth, leaves and horns, and were kept anywhere at home^[21].

A single medicinal plant was found to be applied in different routes depending up on the preparation and type of the disease needed to be treated. Of these, oral complementing each other, application was the highest and most commonly used route of application followed by topical and nasal application. Oral route is considered to have rapid physiological reaction with the causative agents and increase the curative power of the medicinal plant remedies.²¹ Routes of administration of medicinal plants used in the EVM are listed in table 2.

Economic Significance of EVM in Comparison with Modern Medicine

Like any other developing and least developed nations, the available modern health care services of the country are not only insufficient but also inaccessible and unaffordable to the majority. In Ethiopia, TM has played a significant role in treating health problems in both livestock and humans. Ethiopians have used TMs for many centuries, the use of which has become an integral part of the different cultures in Ethiopia, due to cultural acceptability, efficacy against certain diseases and economic affordability. TK of MPs and their use by indigenous healers and drug development in the present are not only useful for conservation of cultural tradition and biodiversity but also for community health care and drug development in the local people^[29].

In Ethiopia, conventional veterinary services have been playing a paramount role in the control and prophylaxis of livestock diseases in the last three decades. However, they cannot yet deliver complete coverage in preventive and curative health care practices because of inadequate labor, logistical problems, an erratic supply of drugs, and the high cost of drugs and equipment. Consequently, the majority of those raising stock in rural areas are far from the site of veterinary stations, and those who have access to veterinary services may not be able to afford to pay for them. Additionally, reduced funding for animal disease control is an issue in Ethiopia and is likely to influence the incidence of some serious livestock diseases. Cutbacks in modern veterinary services mean that livestock owners cannot rely on veterinary services for control of various important livestock diseases. Thus, the pastoralists who occupy remote, inaccessible areas of the arid and semi-arid lowlands are highly vulnerable to such problems. A practical solution to this problem is to develop socially acceptable and effective remedies from reasonably inexpensive sources that can complement modern medicine. The practice of traditional veterinary medicine provides such a short cut^[25]. Most modern drugs are expensive and not affordable by the majority of Ethiopian farmers and pastoralists; most of them rely on their TK practices and locally available materials, mainly plants, in the control of diseases of their domestic animals^[27].

Medicinal plants products are part of the natural products that have been in use in TM are also a source of novel drugs. Therefore, the use of MP products would be a rational alternative to synthetic drugs^[12]. The dependence of the plant-based health care system could partly be attributed to under developed infrastructures and modern medical health care system in the general area. Scientific veterinary medicine, have been developed through trial-and-error and deliberate experimentation. But, EVM is developed by farmers in fields and barns, rather than by scientists in laboratories and clinics. Livestock owners have an excellent knowledge of EV, which has formed the basis for screening plant materials as potential sources of medical drugs^[29]. EVM provides valuable

alternatives to and complements western-style veterinary medicine. EVMs are accessible and easy to prepare and administer, at little or no cost to the farmer. It provides TM, which are locally available and usually cheaper than standard treatments. Livestock holders can prepare and use homemade remedies with minimum expense ^[21].

Advantages and Limitations of EVM

Advantages of Ethnoveterinary Medicine

The animal health service in Ethiopia is gradually being improved but cannot yet deliver complete services. One of the constraints on the national veterinary services is the lack of available drugs due to the limited foreign currency which the country can afford to spend on imported veterinary drugs. In some instances, modern medicine may not be very precise in action ^[20]. The livestock or EVM provides TMs which are locally available and usually cheaper than standard treatments ^[21]. (Pharmacotherapy) ^[6]. the traditional practitioners can prepare and use homemade remedies without any expenditure ^[6]. The plants are generally readily available, have minimal side effects and are free and/or affordable. They are an important component of the agricultural and environmental sectors and have the potential to make major contributions to both macro and economic growth and rural poverty reduction in the country ^[24]. EVM has many advantages; as source of modern medicine (drugs), affordability, locally available and easily accessible, culturally appropriate and understood, effective, comfortably animal metabolize plants and plant extracts and user friendly. For common diseases and more chronic conditions such as colds, skin diseases, worms, wounds, reproductive disorders, nutritional deficiencies and mild diarrhea, EVM has much to offer and can be a cheap and readily available alternative to costly imported drugs ^[21]. In Ethiopia, TM has played a significant role in treating health problems in both livestock and humans ^[29].

Limitations of EVM

It is not enough that TMPs are useful but has disadvantage. One of the main disadvantages of TM is the lack of scientific proof of its efficacy. Lack of precise dosage which could lead to toxicity is also the other disadvantage of TM. Indigenous TM practices were carried out essentially based on private practice, i.e. private agreement between consenting parties, and the knowledge of traditional practice in most cases has descended through oral folk lore. The secret of information retained by traditional healers is relatively less susceptible to distortion but less accessible to the public ^[21]. The fact that some herbs are available only in certain seasons often limits the application of TM. Moreover, some of the preparations are mixtures of many kinds of plants which may be difficult to find at the same time. TM is sometimes also combined with supernatural practices such as prayer, incantation and chanting which give power to *tenkuwais*, *kallichas* and *debiteras* ^[20].

Some of the disadvantages of EVM are; EVMs are often not as fast working and potent as allopathic medicines, time consuming and inconveniences involved in their preparations and use. They may therefore be less suitable to control and treat epidemic and endemic infectious diseases (e.g., FMD, rinder pest, hemorrhagic septicemia, anthrax, black quarter, rabies), and acute life-threatening bacterial infections (e.g., generalized cases of coli or pyogenic mastitis). For these problems, modern drugs might be the best choice. Paucity of treatment against the infectious epidemic diseases such as rinder pest and FMD, existence of inappropriate practices like

cauterizing the vulva of the cows (to induce heat or treat urinary blockages, and for the treatment of the infectious diseases), difficulty in standardizing herbal therapies as the concentration of active ingredient varies in different parts of the plants, some treatments are ineffective, some practices are harmful, traditional diagnoses may be inadequate (typically identifying symptoms rather than underlying causes of a disease), dosages are uncertain and remedies are not standard and the resource base is deteriorating, making ingredients unavailable for preparing medicines ^[17]. In the absence of regulatory control, product quality is variable. Inadequate post-harvest storage and processing techniques often lead to high levels of microbial contamination and significant stock losses. Little attention is paid to product packaging and marketing, and the most significant value adding takes place when the remedies are prescribed by traditional healers. Consumer safety is also an issue, although largely unmonitored at present ^[5].

Challenges to EVM

The TK on EVPs by local healers who are knowledgeable and experienced in traditional systems of treatment is important, but their knowledge are not documented and is dwindling fast ^[21]. Ethiopians have used TMs at least as early as the 17th century; however, very little is documented ^[24]. The local indigenous knowledge on MPs is being lost at a faster rate with the increase of modern education, which has made the younger generation to underestimate its traditional values. In addition, the increase in population growth rate would result in the intensification of agriculture in marginal areas which would lead to deforestation with decrease in number or loss of MPs in the wild ^[29]. Some MP species of Ethiopia are reported to have been threatened by the overuse and over harvesting for marketing as medicine. Environmental degradation, agricultural expansion, loss of forests and woodlands, over harvesting, fire, cultivation of marginal lands, overgrazing and urbanization appear to be the major threats to the medicinal plants of Ethiopia ^[5]. The knowledge of traditional uses of MPs in Ethiopia has mostly been passed on from generation to generation by verbal communication. This method of information conveyance has probably resulted in distortion or loss of indigenous knowledge ^[29].

In Ethiopia, even though the traditional medical practitioners are the best sources of information about the knowledge of the MPs, it was found very difficult to obtain their traditional medicinal information as they considered their indigenous knowledge as a professional secret, only to be passed orally to their older son, at their oldest age ^[14]. The oral transmission of knowledge from generation to generation gives rise to the possibility of incompleteness, omission, misrepresentation or distortion of the original MP cure as time goes by. The other problem with attempting to preserve TK through the oral tradition is that it leaves no written record for posterity. Thus, the oral tradition does not only risk misinterpretation, it also risks losing crucial information ^[24].

In spite of the promulgation of the necessary policies, little has been done in recent decades to enhance and develop the beneficial aspects of TM including related research and its gradual integration into modern medicine. There are many gaps between policy and actual practices. There are clear deficits in the organized approach towards ensuring an optimal contribution of TM to the national health system. For example, there were no regulations to the safety and efficacy, licensing, as well as the registration and guidelines for clinical trials involving TMs. The knowledge and uses of specific

plants for medicinal purposes (often referred to as TM) is an important component of TK. But Western intellectual property regimes have focused on protecting and promoting the economic exploitation of inventions with the rationale that doing so promotes innovation and research. For any invention to be patentable it has to satisfy three criteria, i.e., novelty, inventiveness and industrial applicability (utility). TM does not satisfy any of these criteria thus making it unique and a special case of study is required^[24]. Moreover, the knowledge of EV is still mainly orally transmitted from generation to generation, consequently, it remains fragile and threatened, and presents an urgent need for being recorded and documented for prospect utilization^[23].

Conclusion and Recommendation

The application of TM to veterinary medicine is termed as EVM. It has been developed by trial and error and by actual experimentation. In Ethiopia it is highly practiced by various local groups. Ethiopian people especially farmers and traditional animal healers have been using traditional methods to treat both human and their livestock diseases for generations. Ethiopia possesses a wide range of potentially useful MPs which were shown to have very effective medicinal value for some ailments of human and domestic animals throughout the country. The active ingredients are extracted mainly from the root, stem and leaf parts, and the plant materials include seeds, berries, bark or flowers that processed to administer through appropriate routes for treatment of different animal diseases. Traditional veterinary drugs are prepared in various dosage forms; liquids, ointments, powders and pills, and May also prescribed in a non-formulated form and additives are usually incorporated, and more than one drug is used in a single dosage form. It can be administered in many different ways; drenching, bath, fumigation, injection, topical application, spray, on surface wounds, and making incisions into the skin and burying the medicine under the skin or muscle, different surgical techniques and branding. In Ethiopia, conventional veterinary services have been playing a paramount role in the control and prophylaxis of livestock diseases in the last three decades. However, they cannot yet deliver complete coverage because of inadequate labor, logistical problems, an erratic supply of drugs, and the high cost of drugs and equipment. Consequently, the majority of livestock raiser in rural areas are far from the site of veterinary stations, and those who have access to veterinary services may not be able to afford to pay for them. Additionally, reduced funding for animal disease control is an issue in Ethiopia and is likely to influence the incidence of some serious livestock diseases. Cutbacks in modern veterinary services mean that livestock owners cannot rely on veterinary services for control of various important livestock diseases. EVM has many advantages; source of modern drugs, affordability, locally available and easily accessible, culturally appropriate and understood, effective, comfortably animal metabolize plants and plant extracts and user friendly, cheap and readily available alternative to costly imported drugs. But it is not enough that TMPs are useful but has disadvantage. These are; it is often not as fast working and potent as allopathic medicines, time consuming and inconveniences in their preparations and use, difficulty in standardizing herbal therapies, some treatments are ineffective, some practices are harmful, traditional diagnoses may be inadequate, dosages are uncertain and remedies are not standard and the resource base is deteriorating, making ingredients unavailable for preparing medicines. In the

absence of regulatory control, product quality is variable. Inadequate post-harvest storage and processing techniques often lead to high levels of microbial contamination and significant stock losses. Little attention is paid to product packaging and marketing, and the most significant value adding takes place when the remedies are prescribed by traditional healers. Consumer safety is also an issue, although largely unmonitored at present. In spite of the promulgation of the necessary policies, little has been done in recent decades to enhance and develop the beneficial aspects of TM including related research and its gradual integration into modern medicine. The local indigenous knowledge on MPs is being lost at a faster rate with the increase of modern education, which has made the younger generation to underestimate its traditional values. Some MP species of Ethiopia are reported to have been threatened by environmental degradation, agricultural expansion, loss of forests and woodlands, over harvesting, fire, cultivation of marginal lands, overgrazing and urbanization. The oral transmission of TK from generation to generation gives rise to the possibility of incompleteness, omission, misrepresentation or distortion of the original MP cure as time goes by. Having all these in mind, the following recommendations are forwarded:

- The oral transmission of TK on EVM give rise to the possibility of incompleteness, omission, misrepresentation or distortion of the original MPs as time goes on, therefore, it presents an urgent need for being recorded and documented for future utilization.
- Little has been done to enhance and develop the beneficial aspects of TM, so, detail research is needed to standardize the safety, efficacy, frequency of treatment, doses, concentrations, dosage forms, packaging and labeling, and to assess and determine the side effects and contraindications of such remedies.
- Some MP species of Ethiopia are reported to have been threatened by various human activities, so to prevent valuable MPs from loss, conservation is therefore highly recommended.

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