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## Antihelminthic medicinal plants used for animals in Ethiopia: A review

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### ABSTRACT

Gastrointestinal helminthosis is major constraint to health and productivity of domestic animal and is responsible for substantial and insidious economic losses. A wide variety of anthelmintic are used for the treatment and control of helminthes in animals. However, along with other drawbacks of the use of anthelmintics, the development of resistance in helminthes of farm animals worldwide. Therefore, to alleviate the aforementioned problems associated with the use of anthelmintics, information on the potential contribution of anthelmintic medicinal plants is very important. In this review paper an attempt was made to give information on the traditional knowledge, practice and validation methods of activity of medicinal plants against helminthes of animal. In addition, the list of the community used and those with tested activity of anthelmintic medicinal plants in Ethiopia is presented.

**Keywords:** Animals, Antihelminthic activity, Ethiopia, Helminths, Medicinal Plants.

### INTRODUCTION

Medicinal plants have been used to combat parasitism and other human and veterinary ailments for centuries and in many parts of the world (Including Ethiopia), they are still used for this purpose. According to the World Health Organization, in 2015 there were approximately 1.5 billion persons suffering from soil-transmitted helminthiasis (STHs) <sup>[1]</sup>. STHs infections cause chronic debilitating diseases affecting human (ankylostomoses, blindness, schistosomes, filarial worms, malnourishment, anemia, retard growth, mental incapacity) and animals (canine ankylostomoses, helminthes of the cattle) <sup>[2, 3]</sup>. Ethiopia owns huge livestock population but the productivity of these farm animals is very low. The major factors for low productivity are malnutrition, low genetic potential and health problems. Among the livestock health problems parasitic disease are highly prevalent and economically important in many parts of the country. Gastrointestinal helminths infection is a major constraint to health and productivity of animal and is responsible for substantial and insidious economic losses <sup>[4]</sup>. Helminthosis is of considerable economic significance in all agro climatic zones and livestock production systems in Ethiopia. The disease is especially prevalent in developing countries in association with poor management practices and in adequate control measures <sup>[5]</sup> Many species of gastrointestinal and pulmonary nematodes, trematodes and cestodes are known to be prevalent in many parts of the country <sup>[5, 6, 7, 8, 9]</sup>.

The widespread and multiple occurrences of helminth parasite are not only important in inducing mortalities but are also associated with loss of production, Organ condemnation and the cost of anthelmintics. There are few estimates of economic losses due to heminth parasite infection <sup>[10]</sup>. Reported a yearly loss due to endoparasite in Ethiopia is about 700 million Ethiopian birr.

Different methods that can be used to control gastrointestinal helminthosis includes the use of anthelmintics, management of grazing lands, control of stocking rates and appropriate rotational grazing <sup>[11]</sup>. However, the extent of implementing these methods is limited by many factors. Although Ethiopia expend large amount of foreign currency to import anthelmintics, the use of these drugs is restricted by high cost, inadequate and irregular supply at the resource poor farmer level. Moreover, the irrational and in appropriate use of these drugs, when available, has favored the emergence of anthelmintic resistance. Therefore, research should be conducted so as to generate important information on the contribution of medicinal plants with anthelmintic activity. Many modern drugs such as guanine, curare, ephedrine and aspirin were originally discovered through ethnomedical research. For instance, in china, out of the 104 modern drugs developed over the last 40 years, 60 originated from plants used in traditional medicine <sup>[12]</sup>.

Ethiopia has a very conducive weather and climatic condition that are support a wide variety of natural

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resource including various plant and animal species [13]. Like many African countries, a traditional veterinary practice in Ethiopia is deep-rooted and well-grounded [14]. For instance, year's people of Ethiopia have used enormous empirical knowledge concerning therapeutic value of the local indigenous plants. This suggests that medicinal plants have great contribution to the control and treatment of parasitic helminthes of farm animal. In spite of all these facts there is a paucity of information on medicinal plants with anthelmintic activity in Ethiopia. Therefore, the main objective of this review paper is (i) to review the current status in the use of medicinal plants against helminth parasite of animal, (ii) to highlight the potential role of plants with anthelmintic activity in the control and treatment of helminth parasite

## HISTORICAL BACKGROUND OF MEDICINAL PLANTS

Plant have been used by man to cure disease and heal injuries since time immorial [15, 16]. Due to the presence of accumulated knowledge over years, the indigenous people are able to distinguish various plant including their medicinal value [17].

The knowledge of medicinal herbs came from an empirical method which is proven as result of accumulated knowledge of trial error [15, 18] and on the basis of the "low of signature". This "low of signature" is an old belief that nature has provided plants for every disease and has indicated an obvious sign of the body parts to be treated by the plant. According to this belief, the shape of the plant or one of its components may suggest a cure. This belief existed in many parts of the world including Europe in the middle Ages. The classical example is walnut that has the shape of brain which should, thus, be used for disease affecting the brain [15].

Theophrastus (370-287 B.C) described the natural history of plants including those that were used in the treatment of illnesses [19]. The Chinese (100B.C), the Romans (100A.D.) and the Indian were known to use medicinal plants for a variety of ailment [18]. Before the advent of modern medicine, people all over the world relied on traditional (Folk) medicine for their day to day health care. In the early 1900 before the synthetic Era, eighty percent (80%) of all medicines were obtained from roots, barks and leaves of plants [20]. Over 7000 medical compounds in modern western pharmacopoeia are derived from plants with an estimated retail value of US\$ 43 billion [18]. For instance, of the important drugs originally discovered through ethnomedical research are: quinine, picrotoxine, a powerful stimulant of the respiratory center; strophanthine for heart disease; salicylic preparation (e.g aspirin) for rheumatism and as a general analgesic and opium, hashish, ephedrine, curare and Rauwolfia serpentina, used as hypotensives and tranquilizers [21].

The pharmacological studies and clinical trials going on in different parts of the world indicate that a significant percentage of indigenous remedies of plants origin have shown promising biochemical activity and clinical effects [17]. In Africa, studies indicated that as much as 30% of ethno botanicals are probably effective against treated disease of livestock [22].

In Ethiopia the knowledge of naturally occurring drugs are acquired by trial and error method [23]. The knowledge is transmitted orally and passed on as series of "hearsay" accounts and gets recorded similar to other countries [24]. For instance, during the reign of Menelik II, the branch of Menelik II hospital was opened at Areda where many traditional medical practitioners served to the community [25].

Due to the fact that tropical countries are considered as the home of most species of plants than countries in the temperate region [26] and and as the rainforest plants are considered the "complex chemical store houses" containing thousands of natural compounds with unrealized potential for modern medicine [27]. studying the Ethiopian medically useful plants and compiling related information is of paramount importance.

## Short Account on Ethnoveterinary Medicine

Ethno veterinary medicine deals with Folk, beliefs, knowledge, skills, methods and practices regarding the health care of animals. Ethno veterinary medicine comprises traditional, surgical and manipulative techniques, traditional immunization, magico-religious practice and belief, management practices and herbal remedies to treat and prevent a range of livestock disease. Many of these practices have been developed and tested over countries and accepted by stock raisers for their curative or prophylactic value [17].

Many of the valuable drugs of today came in to use through the study of traditional remedies. of all modern drugs in use today, at least 50% contain substance of natural origin and most of these substances were first identified and used by local peoples [28]. Most of these traditional remedies are plant origin. Traditional medical practice has been serving as the basis of scientific resource. Many plants used in traditional medicine have valuable potential applications in conventional medicine and a number of drugs have been developed from traditional practices.

In Ethiopia ethnoveterinary medicine is widely used in treatment and prevention of both human and animal disease. A survey in central highlands of Ethiopia, where there is better modern veterinary infrastructure and service, indicate that 40% of livestock owners frequently use traditional veterinary medicine and 60% take their animal to veterinary clinics. For some health problems, traditional methods of treatment are preferred to their conventional counterparts [29].

## TRADITIONAL KNOWLEDGE AND PRACTICES

Like many African countries, people in Ethiopia have traditional methods of health care for both human and animals, which are widely practiced in a country side where modern public health and veterinary service are limited. Plants are core of such traditional practices. The use of medicinal plants for religious ceremonies is quite universal and has been practiced for many years. But, the use of local medicinal plants varies from disease to disease, from place to place, from clan to clan and even from one traditional healer to the other [30].

During preparation of drugs from medicinal plants, traditional healer follows the steps [31].

- Identify the right plant type
- Collect correct part of the plant (seed, root, leaves, etc).
- If necessary, they clean, dry and store the plant parts so that they retain medicinal properties and do not rot
- Constitute the drug as deemed necessary and apply the drug on the animal.

In most cases, however, traditional healer is blamed for lack of idea in standardizing the dosage for a particular medicinal plant [32].

## Plants of Plant Used Against Helminths

Depending on varies structure of plants, this varies species and includes whole plant, leaves, pad, tubers, barks, stems, flowers and seeds. For trees and shrubs, the common practices are to use the barks, roots or sometimes both (Carissa edulis root is used for treatment of endoparasite). Less commonly used in this group are leaves (*Mentha cordifolia* leaves are used in the treatment of *Ascaris suum*) and the fruit of *Erebelia schaperi* is used for the treatment of *Taenia saginata*. On the other hand the leaves of herbaceous plants are the most widely used, followed by their roots and there is a tendency to up root and use the whole plant (e.g *Phytolacca dodecandra*). with succulents leaves and the whole stem are commonly used, especially in cases where treatment require poultice [30].

## Preparation of Medicinal Plants

There are several methods by which medicinal plants or their parts are prepared for use [22, 30].

### Boiling

Roots and barks of trees are commonly boiled and the resulting decoction (Liquid product) is used either externally or internally. Boiling extracts the active ingredients from plants and decoction is prepared from the solid part by straining [31].

### Soaking

Soaking in cold water can be used in extracting active ingredients from root or stem of a plant. Soaking is especially important for hard and dry plant material which must be soaked in water for up to 1-hour boiling. The length of time needed for soaking depends on a state of water: hot or cold (cold water needs longer) and the type of plant material (roots need longer). Following soaking, a liquid is strained through a sieve before use as a drug [22, 30].

### Pounding

This involves grinding a plant material in to a coarse, intermediate or fine particle size pounding normally precedes other methods like and soaking depending on the structure of the plant under preparation [22, 30].

### Pelleting

A "pellet" or "bolus" is a solid ball of medicine. It is made by pounding of fresh or dried plant material and adding honey, molasses or substance that adheres together the particles, and the rolled or shaped with hand to make around or oval ball [31, 33].

### Paste Formation

A paste is moist semisolid preparation made by grinding plant material (either fresh or dry), sometimes with little oil, water, molasses or honey [31, 34, 35].

### Juice preparation

Juice is extracted by squeezing parts of plant or by pounding plants material then passing them through strain or cloth [31, 35].

## Application of Anthelmintic Medicinal Plants

Medicinal plants with anthelmintic activity can be administered by several methods to sick animal depending on particular helminths to be treated. Application also depends on the method of preparation of the drug [30].

### Drenching

Drenching is done by administering a plant material in liquid form via mouth or nostril. It is practiced for all livestock species. For large animal species a piece of rolled hide, soft drink bottle or a bottle is willing to drink by itself, there is no need of forcing it otherwise different type of straining techniques are practiced by traditional healer to restrain the animal [31].

### Mixing with Food and Water

Quite often the drugs are mixed with feed and water after they were prepared from medicinal plants in various forms. An ideal base feed frequently used by traditional healer in East Africa is gravel, preferably that is made from African millet or maize flour, which is known to stimulate the appetite of the patient [30].

## Steaming

Many aromatic drugs are used in a steam form, first by boiling then letting the patient inhale the vapor from the boiling medicinal plant [34].

## ANTHELMINTIC MEDICINAL PLANTS

### Athelmintic Compounds in the Plants

The method by which the utilization of certain plant extracts and plants can affect parasite mobility, viability and fecundity both in vivo and in vitro are not completely undetermined. For some species of plants, it has suggested that their consumption could be associated with an improved immune response of the host against the parasite. in consequence of nutrient supplementation and thus improved nutrition [36]. It is known that high nutritional protein intake in animal can improve the immune response of ruminants against parasite [37].

On the other hand, it appears that most of the plants that have been reported to possess anthelmintic activity actually hold compounds that are directly against parasite. The active compounds of some plants have already been recognized, whereas for others they are still unknown. In many cases these active compounds are plant secondary metabolites (PSM) like plant products that have been related with defensive mechanisms of plant against grazing herbivores [38]. Non protein amino acids, tannins, Saponins, alkaloids and other polyphenols, lignins, glycosides, are all examples of PSM and some of them have been reported to possess anti parasite effects. For example, garlic contains a sulphric compound, which has been significant responsible for the anthelmintic effect, where the contains naphtha quinine, the active compounds against worms [39].

In some cases, anti-parasitic plant secondary metabolites might have direct toxic effects against herbivores whereas in other cases they can act as contaminant. for instance, *Leucana leucocephala* is measured a high-quality perennial legume in the subtropics and tropics with condensed tannin content and high crude protein [40]. Though, *Leucana leucocephalla* contains mimosine, which is an antimetabolic and non-protein amino acid and delibatory agent that is toxic to non-ruminant and ruminant's animal as they do not have the ability to degrade these compounds [41]. Polyphenols and other tannins at high intake rates can also have a detrimental effect on herbivores. The utilization of tannins has been related with a reduction of food intake and dry matter digestibility, and the impairment of rumen metabolism when included in the diets of ruminants at more than 4-5% of dry matter [42]. Some of the type of condensed tannins can also highly affect the mucosa of the digestive tract of sheep and rats and as a result it reduces the absorption of nutrients [43, 44].

### Methods of Validation of Anthelmintic Properties of Plants

#### *In vitro* methods

Scientific confirmation of anthelmintic activity has mainly based on in vitro studies. There are different types of parasite models like the free-living nematodes such as *Rhabditis pseudoelongata*, *Caenorhabditis elegans* have been utilized [45]. Some studies showed that in Asia have used the *Pseudoelongata* have used the earth worm *Pheritima posthuma* [46]. For other parasite like Ascorid the rodent nematode *Heligmosomoides polystrus* and cestode *Hymenlepis dimniuta* and the trematode *Schistosoma mansoni* have also been employed. The assumption completed in these in vitro studies is that the intensity and type of effects observed against the model nematodes will be similar against ruminant parasite nematodes. For instance, 60 plants reported for their anthelmintic activity in Africa by [47], were evaluated using a larval mortality test. In this study, half of the plant products tested had little or no effect on larval mortality when compared to control expected to plant product [48].

In vitro egg hatch assay [49] is frequently used to determine the effects of plants products against eggs of *Haemovhus contortus*. Other in vitro

studies have been used as an adaptation of the larval motility test which is commonly used for testing of resistance of parasite against anthelmintics [50]. In addition to the above, a number of in vitro studies have been employed to assess the anthelmintic efficacy of plants against adult nematode parasites. These studies have evaluated the mortality and motility of the parasite following incubations in serial concentration of the plant products [51].

Main advantages of using in vitro assays is to test for the anti-parasitic properties of plants are the rapid turnover and low cost and which allows large scales screening of plants. For instance, water extracts of a variety of Sudanese plants with potential anthelmintic properties were tested against the free-living nematode *Caenorhabditis elegans* [52]. In order to test a similar number of extracts in vivo, a large number of animals with a high financial and time expenditure would be required. Out of 14 plant extract tested Sesbana extract and Balanites aegyptiana demonstrated the highest dose dependant inhibitory activity on nematode viability.

Additional advantage of in vitro assays is the opportunity to activity guided fractionation and test purified compounds. Examination purified compounds enables one to quantify their efficacy without the intervention of other plant components. The most essential oil of *Ocimum gratissimum*, a tropical plant recognized for its ethno veterinary use showed strong anthelmintic activity using in vitro studies against *Haemonchus contortus*. In Vitro tests are important for initial screening, identifying and establish biologically realistic drug concentration for further animal testing [53].

#### In vivo methods

When you see the vivo studies are more reliable than in vitro methods although costs of large-scale screening of plant extracts is probably inhibitory. In general, the plant product preparation may be plant parts, whole plant, extract, or chemicals isolated from plants. The in vivo methods normally required parasitized hosts that are treated with known quantities of plant products compared with in treated controls or controls treated with commercial anthelmintics. Parameters usually recorded to determine activity of plants includes counting of parasites in faces and expulsion of worms [54, 55]. Worms counts in necropsied animal, daily fecal egg extraction after administration of plant products. For example, in pig experimentally infected with *Ascaris Suum*, oral administration of Papaya (*Cericea Papaya*) latex, reduced up to 100% the parasitic burden in only 7 days post treatment in Indonesia [56]. Likewise, [57] reported a 100% reduction in fecal egg counts and in 72 and 88% reduction of adult *Haemonchus contortus* and *Trichostrongylus colubriformis* in sheep treated with other plant extract.

The main anthelmintic activity of *Khaya aenegalensis*, a plant recognized for its ethnoveterinary use, has been determined both in vivo and in vitro [58]. A few of the in vivo trial has been carried out in goat and sheep infected with *Haemonchus contortus*. However, in the common of cases the anthelmintic activity of some plant is lower than reported for chemical anthelmintics in tropical and sub-tropical areas where *Haemochus contortus* is the major parasite in sheep and goat. The number of *Haemochus contortus* egg per gram(egp) of faces is

considered as light or low (1-500 egp), moderate (500-1500) and high or heavy (>1500) [59].

WAAVP guidelines is used for testing anthelmintics in naturally infected animal should be followed due to short of alternative guideline for evaluating plant anthelmintic product [60]. Higher in Fecal egg (FEC) count is considered to be highly efficacious, whereas an 80% reduction is assumed adequate. Their products result in such high efficacies, as a consequence, the total number of animals that need to be used for plant efficacy evaluation should probably be higher than that used for drugs due to similar difference between treated and controls and generally higher-level variance [61].

#### ADVANTAGE AND LIMITATION OF ANTHELMINTIC MEDICINAL PLANTS

Some of the advantages in the use of anthelmintic medicinal plants in the area of animal health care system are [30, 62];

- Cost effective, easily accessible and better adapted to particular locality than modern veterinary drugs.
- Less toxic and side effects on the environment, residues in food and to animals than modern drugs.
- Natural medicine is safer than synthetic drugs
- Synthetic drugs are often less effective against many chronic disease and resistant strains.

Some of the limitations of anthelmintic medicinal plants are:

- Poor means of knowledge transfer

The knowledge of medicinal plants is normally passed or orally from one generation to the next. But lots of valuable information can be lost or distorted whenever the healer dies without transferring his knowledge to another [30, 63].

- Lack of standardized dosages

Most of had result obtained through use of herbal medication are basically due to over dosage and also a lack of adequate knowledge of other deterrental by products contained in some plant [32].

- Vernacular nomenclature of Anthelmintics Medicinal plants;

In local society names, unlike scientific botanical names, plants have more than one name in some languages and thus create difficulties in matching local medicinal plants with botanical taxonomis. On the other hand, some name in local language covers several species of plants [31, 64].

- The collection, preparation and administration of anthelmintic medicinal plants can sometime be more inconvenient and time consuming than the modern one. There might have been lack of knowledge on which plant material to collect and how to prepare. For example, drenching with product of animal and plant origin usually causes aspiration pneumonia that leads to death due to rough application by grasping the tongue [62, 65].

**Table 1:** List of Medicinal plants reported to possess anthelmintic activity in Ethiopia

No	Local name	Botanical name	Parts used	Routes of Administration	Disease condition treated
1	Hawacho(or)	<i>Albezia anthelmintica</i>	Root bark	Oral	Helminths
2	Shasho(wel)	<i>Albezia Caria Vera</i>	Bark		Lung worm
3	Harbahinee(or) Neem(AM)	<i>Azardirachta indica</i>	Roots	Oral	Endoparasite
4	Dhagamasa(or)	<i>Carissa edulis</i>	Roots	Oral	Endoparasite
5	Bisana(AM)	<i>Croton Macrostactyum</i>	Bark	Oral	<i>Taenia saginata</i>
6	Duba Duba Fre(AM)	<i>Cucuribita Pepo</i>	Seed	Oral	<i>Taenia saginata</i>
7	Oochoo(Or)	<i>Diospyros Scabra</i>	Branches	Tropical	Liverfluke
8	Enkoko(AM)	<i>Erebellia schlaperi</i>	Fruits	Oral	
9	Adaamaa(Or)	<i>Euphorbia abyssinica</i>	Youngatem	Tropical	<i>Git helminth</i>
10	Koso (AM)Heto(or)	<i>Hagenia abyssinica</i>	Flower bark	Oral	<i>Taenia saginata</i>
11	Tembelel	<i>Jasminum mertinicensis</i>	Root	Oral	Endoparasite
12	Ras kimir Baku Ferda(or)	<i>Leucas Martinicensis</i>	Root	Oral	Endoparasite
13	Tembo(or)Timbaho(AM)	<i>Nicatana tebacum</i>	Leaf	Oral	<i>Endoparasite</i>
14	Endod(AM)(or)	<i>Phytolacca dedecandra</i>	Root,seed,leaf flower(whole)	Oral	Asvorid, round worm and tape worms
15	Telachuta (Kem)	<i>Pumpkin</i>	Fruit seed	Oral	Round worm
16	Debo becha(or)	<i>Rhus Vulgare</i>	Fruit seed	Oral	Round worm
17	MMekmeko(AM)Guddu(or)	<i>Rumex abyssinicu</i>	Leaf	Oral	Endoparasite
18	Telba(AM)	<i>Ruta chale pensis</i>	seed	Oral	Helminth
19	Nech hareg(AM)ido-antuata	<i>Stephania abyssiniac</i>	Leaf	Oral	Endoparasite
20	Gizawa(AM)Whale(or)	<i>Witharia sominifera</i>	whole	Oral	Endoparaite

Source: [66, 67, 68, 69]

**Table 2:** List of medicinal plants with tested anthelmintic activity in Ethiopia

No	Local name	Botanical name	Parts used	Routes of administration	Disease condition treated
1	-----	<i>Albizzia aummifera</i>	Leaf	Oral	Nematode
2	Bisana(AM)	<i>Croton macrastactiyum</i>	Bark	Oral	T.saginata
3	Yemidir embay(AM)	<i>Cucumis spp</i>	Root leaf fruit	Oral	Helminths
4	Dubafre(AM)	<i>Cucurbilo pepo</i>	seed	Oral	T.saginata
5	Kikita	<i>Dodonea vicose</i>	Leaf	Oral	Nematode
6	Enkoko(AM)	<i>Erebeliaschlaperi</i>	Fruit	Oral	T.saginata
7	Metere(amkin)(AM)	<i>Glynus iotoides</i>	Seed	Oral	H.contortus
8	Kosso(AM)(Heto(or)	<i>Hagenia abyssinica</i>	Flower	Oral	T.saginata
9	Tembelel(AM)	<i>Jasminium martinicensis</i>	Leaf	Oral	Helminths
10	Years kimir(AM)	<i>Linum usitatissimum</i>	Leaf	Oral	Helminth
11	Telba(AM)	<i>Ruta cahle pensis</i>	Seed	Oral	Helminths
12	Tenadam(AM)	<i>S.oxyacantha</i>	Leaf	Oral	Helminths
13	Grawa(AM)	<i>Vernonia amygdalina</i>	Leaf	Oral	Nematode

Source: [69, 70].

### STRATEGIES TO PROMOTE ANTHELMINTIC MEDICINAL PLANTS FOR FUTURE USE

The integrated and buildup of the complementary aspects of traditional practices needs different measures such as collection and documentation of traditional knowledge and practice, initiation of involvement of local people and preparation of manual about traditional practice [62].

#### Collection and Documentation of Traditional Knowledge Practices

Local veterinary Knowledge and practices should be gathered and documented systematically so as to serve as baseline information for veterinary science and pharmacological studies on traditional practice

[30, 31]. For this purpose, collection of appropriate medicinal plants is indispensable and mandatory [62].

Effective collection of medicinal plants with their reputed use require consideration of the following points as suggested by [62, 63].

- Prior arrangement with local authorities should be made to guide in the collection by providing accommodation and transportation.
- To liaise with local herbaria that will aid in the botanical survey for ease of location of particular species.
- The geographical location and prevailing climatic condition of the time of visit should be known.
- Scientists and developers should collaborate with healers or communities to help organize the controlled harvesting or

cultivation of medicinal plants to ensure adequate and equitable supplies. Therefore, attempts should be geared towards cultivation and processing (Packaging, extraction, distillation, etc) of medicinal plants.

### Initiation of the Involvement of Local Peoples

There is a general agreement among researchers on the need for local people participation in formal research and on potential contribution of different parts like researchers, farmers and extension workers [71].

Instead of employing livestock personnel from urban or other culture backgrounds, working with native para veterinarians has better advantages for the following reasons [62].

Native para vets speak the local language

- They know the stock owner life ways and ethno veterinary system
- They can usually win client confidence more easily, especially when the local community has had a direct hand in their selection.
- Increased two way communications between stock owners and government
- The incorporation of useful traditional knowledge and practice into training for both paravets and vets.

### Preparation of Manual

A manual that provides a range of traditional herbal medicinal practices in localities could act as practical guideline for field staffs and local people who work with livestock. The manual should be written in simple language and structured so as to enable readers to identify and treat easily [31]. Therefore, the purpose of preparing the manual is:

- To generate interest in the use of indigenous knowledge in veterinary medicine and traditional livestock production
- Provide source of traditional drugs that can be incorporated in to paraveterinary service.
- Service as a source of practical information for veterinary and pharmacy education in Ethiopia.
- Encourage the development of alternative animal health care education in schools, training and higher learning institutions.

### CONCLUSION

Helminthosis is one of the major constraints to health and productivity of animal and responsible for substantial and insidious economic losses. The principal method of control of helminthes infection is by the use of commercial anthelmintics. Other alternative control option like management of grazing land, control of stocking rate and rational grazing are used by some countries especially in developed parts of the world. But the applicability of these methods in developing countries is limited by many factors. Although Ethiopia expend large amount of foreign currency to import anthelmintics, the use of these drugs by resource poor livestock owners is confirmed by several factor like high cost, inadequate and irregular supply. Moreover, irrational and inappropriate use of these drugs, when available, favored emergence of anthelmintics resistant helminth, resurgence of certain disease, accumulation of drug residues in food and environment. Due to these adverse effects associated with the use of commercial drugs, the scientific community is compelled to search for other alternative of helminth control strategies including strategies including medicinal plants. Among those alternative methods, there is considerably growing interest in medicinal plants with anthelemintic activities. Anthelmintic medicinal plants are cost effective, more accessible, easily understandable and better adapted to particular locality compared to commercial anthelmintics. As result traditional anthelmintic medicinal plants could contribute a lot to the treatment, control and prevention of parasitic helminths in animals.

Based on the concluding remarks the following points are recommended:

- Cultivation of plants with anthelmintic medicinal value should be encouraged at all levels.
- Documentation and preparation of manual on anthelmintic medicinal plants so as to preserve local knowledge and practice should be encouraged.
- Nationwide scientific *in vitro* and *in vivo* studies on the efficacy of traditionally used anthelmintic medicinal plants should have to be initiated and encouraged by veterinary facilities, regional laboratories, research institutions and interested individuals.
- Policy on the conservation, management and judicious use of anthelmintic medicinal plants should be put in place.
- Promote community education to create awareness that enable the traditional healers to transfer their knowledge and practice to the next generation.

### Conflict of interest statement

- We declare that we have no conflict of interest.

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