A Review on Anthelmintic Synthetic Drugs and Anthelmintic Medicinal Plant

Satkar Prasad 1*, Anand Chaurasiya 2, Ravindra Pal Singh 1
1. School of Pharmacy, Suresh Gyan Vihar University Mahal Jagatpura, Jaipur, 302017 Rajasthan (INDIA)
2. Millennium College of Pharmacy, Bhopal, M.P. (INDIA)

ABSTRACT
Helminthic infections are among the most widespread infections in humans, distressing a huge population of the world. Normally, the worm lives in GI tract and liver. Most of the synthetic medicine is curing helminthiasis, Synthetic anthelmintic drugs Albendazole, Mebendazole, Niclosamide, Piperazine, Praziquantel, Diethyl carbamazine, Levamisole, Ivermectin, Oxamniquine are generally using for helminthiasis, but they also have too much adverse effect and toxicity i.e. vomiting, nausea, diarrhea, edema, peptic ulceration etc. So it has been observed alternate / herbal medicine system having beneficial effect on human being to minimize the drawback over synthetic drugs. Hence this review focuses on helminthes, different type of worm, synthetic anthelmintic drug & herbal medicinal drug to treat helminthiasis.

Key Word: Helminthic, Albendazole, Mebendazole, Niclosamide, piperazine.

INTRODUCTION
Nature was the main source of drug in ancient times, the progress and growth of the human race is inseparably linked to the increasing scientific knowledge, man has been able to obtain over the centuries. Green plants are necessary for all animal life on earth, since they convert solar energy into organic carbon compounds which is used as a basic energy for animals. The curiosity of the man now a day’s probes into the past and brings to light even fragmentary information about traditional method of our ancestors, and it makes a fascinating study. (1) All medicinal plants and their derived medicines are widely used as natural alternatives to synthetic chemicals in traditional cultures in the world and they are becoming most popular in modern society. (2) In the herbal medicine field of there has been an exponential development in last few decades in developed and developing countries. Herbal medicine is increasingly most popular due to its natural origin and lesser side effects. (3) Historically, all medicinal preparations are originate from plants, either in the simple form of raw plant materials otherwise in the refined form of crude extracts, mixtures, etc. (4) Most of
the developing countries have assumed traditional medical practice as an integral part of their
culture. Traditional medicines include -Ayurveda, Siddha medicine, Unani, Ancient Iranian
medicine, Islamic medicine, Irani medicine, Traditional Korean medicine, Traditional
Chinese medicine, Acupuncture, Traditional African medicine. The Indian traditional
medicines have had practiced successfully in modern age, have hardly been studied for
scientific validation. India is a rich cultural heritage of traditional medicines, Ayurveda and
siddha system of treatments which is chiefly comprised two widely flourishing system of
treatments.(5)

Helminthic infections are among the most widespread infections in humans, distressing a huge
population of the world. Although the majority of infections due to helminthes are generally
restricted to tropical regions and cause enormous hazard to health and contribute to the
prevalence of under nourishment, anaemia, eosinophilia and pneumonia. Parasitic diseases
cause ruthless morbidity affecting principally population in endemic areas. The gastro-
intestinal helminthes becomes resistant to currently available anthelmentic drugs therefore
there is a foremost problem in treatment of helminthes diseases. Hence there is an increasing
demand towards natural anthelmintics.(6)

Soil-transmitted helminthiasis
Soil-transmitted helminthiasis (STH) is a group of parasitic infections of the intestine caused
by nematode worms usually transmitted by soil. STH is the most prevalent of neglected
tropical diseases and is responsible for significant morbidity and, indirectly, mortality in poor
developing countries. STH contributes to general weakness, malnutrition, iron-deficiency
anemia, and impaired physical and intellectual development in school-age children.(7) the
three main causative worms of soil-transmitted helminthiasis of public health importance are:

a) Whipworm
The human whipworm (Trichuris trichiura or Trichocephalus trichiuris), is the third most
common roundworm found in humans. The name "whipworm" refers to the shape of the
worm; the worms look like whips with wider "handles" at the posterior end. There is an
estimated 800 million people infected worldwide. It is also highly prevalent in children. Co-
infection of whipworm with Giardia, Entamoeba histolytica, Ascaris lumbricoides, and
hookworm is common. Symptoms range from asymptomatic through vague digestive tract
distress for light infestations to emaciation with dry skin and diarrhea (usually mucoid and/or
bloody) for heavy infestations. In children, heavy infections could lead to growth
retardation.Whipworm infestation is detectable by stool examination, which can detect eggs
and charcot-leyden crystals. The Kato-Katz is the technique of choice for diagnosis and
quantification of infection with T. trichiura. Adult worms may be seen in a prolapsed rectal
mucosa.(8)

b) Hookworm
Human hookworm infection is a soil-transmitted helminthiasis infection caused by nematode
parasites Necator americanus, Ancylostoma duodenale or both. Mild infections with
hookworm cause mild diarrhea and abdominal pain. More severe infections with hookworm
can create serious health problems for newborns, children, pregnant women, and persons who
are malnourished. Hookworm infection is the leading cause of anemia and protein
malnutrition in developing nations, afflicting an estimated 740 million people. Hookworm
infection may be associated with dermatitis, eosinophilia, pulmonary infiltrates, pneumonitis,
and urticarial rash. Gastrointestinal symptoms would include mild abdominal pain, nausea, vomiting, and anorexia. Iron-deficiency anemia due to blood loss is often associated with hookworm.\(^{(9)}\)

c) Round worm (Ascaris)

*Ascaris*, one of the most common human helminthic infections, is caused by the intestinal parasite *Ascaris lumbricoides* (*A. lumbricoides* [large roundworm], affecting an estimated one billion persons at any one time worldwide. It affects 50 percent of populations in tropical and subtropical areas. Globally, *Ascariasis* causes an estimated 20,000 deaths per year. The clinical effects include a wide range of manifestations. Most potential and common complications comprise pneumonia due to passage of worms in the lungs, with pulmonary eosinophilia (Loeffler’s syndrome); intestinal obstruction by mass of worms; biliary obstruction and pancreatic obstruction by worms. Infection with *A. lumbricoides* may contribute substantially to child morbidity when associated with malnutrition, pneumonia, enteric diseases and vitamin A deficiency. *Ascariasis* adversely affects children’s growth and development.

**Drug Used as Anthelmintic\(^{(10)}\)**

Following drugs are used as a anthelmintic which have various mechanism of action

**Albendazole**
A broad spectrum oral anthelmintic Albendazole is a drug of choice and its mechanism of action is through inhibitory microtubule synthesis in nematodes, thus irreversibly impairing glucose uptake. As a result intestinal parasites are immobilized.

**Mebendazole**
It is broad spectrum anthelmintic which selective and irreversibly block glucose uptake by adult intestinal – dwelling nematodes and cestodes and their tissue- dwelling larve. Inhibition of glucose uptake appears to lead to endogenous depletion of glycogen stored within the parasite. The lack of glycogen result in a decreased formation of adenosine triphosphate, required for survival and reproduction of the helminth. As Mebendazole acts by affecting the entire energy metabolism, it is used as a standard drug for anthelmintic activity.\(^{(10)}\)

**Niclosamide:**
Niclosamide was the drug of choice for tapeworm infections and which is inversely damage proximal segment separating worms from the intestinal wall and thus expelling them out of the host body. (Rang and Dale2003).

**Piperazine**
Piperazine can be used to treat infection with the common round worm and the thread worm. It reversibly inhibits neuromuscular transmission in the worm, probably by acting like GABA, on GABA-gated chloride Channels in nematode muscle. As a result paralysed worm are expelled alive.

**Praziquantel**
It is broad spectrum anthelmintic drug, which acts by altering calcium homeostasis in parasite cells causing contraction of the musculature and eventually result in paralysis and death of the worm.

**Diethyl carbamazine**
A piperazine derivative, it is active in filarial infections. It has been suggested that it modifies
the parasite so that it becomes susceptible to the host’s normal immune response. It may also interfere with the parasite’s arachidnate metabolism.

**Pyrantel Pamoate**
A derivative of tetrahydropyrimidine that act by depolarizing the helminth neuromuscular junction, causing spasm and paralysis. It also has some anticholinesterase activity.

**Levamisole**
A drug effective in common round worm infection, acts by stimulating and subsequently blocking the neuromuscular junctions. This paralyzing the worms to be expelled out.

**Ivermectin**
A semisynthetic agent, obtained from an actinomycye, is thought to paralyse the worm by opening chloride channels and increasing chloride conductance.

**Oxamniquine**
Active against schistosoma mansoni, it affects both mature and immature form of parasite. It’s mechanism of action may involve interaction in the DNA and its selective action may be related to the ability of the parasite to concentrate the drug.

**Metriphonate**
It’s action is thought to be due to an inhibitory effect on cholinesterases in the helminth causing paralysis.

**Thiabendazole**
It is benzimidazole poly anthelmintic, which covered practically all species of nematodes i.e round worm, hook worm, pin worm, Trichuris Strongyloides and trichinella spiralis. It inhibit development of eggs of worm and kills larve.

**Herbal drug Used as Anthelmintic**
Helminthes infections are the most common infection in man affecting the large proportions of the world population. The synthetic anthelmintic drugs are having too much adverse effect and toxicity and many of them are not recommended for young children and pregnant ladies. In the treatment of parasitic disease, the anthelmintic drugs are used indiscriminately. Recently the use of anthelmintic produces toxicity in human beings hence the development and discovery of new substance which acting as anthelmintic are being derived through plants. Various plants were used in venereal diseases to promote healing of wounds, swelling, abscesses, rheumatism and treating pain in lower extremities, skin diseases, leucorrhoea, dysentery, and fever.\(^{(11)}\)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of Plants</th>
<th>Family</th>
<th>Part used</th>
<th>Effective against</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Allium sativum (12)</td>
<td>Lillaceae</td>
<td>Bulb</td>
<td>Round-worms</td>
</tr>
<tr>
<td>2</td>
<td>Annona senegalensis(13)</td>
<td>Annonaceae</td>
<td>Leaf, bark, root</td>
<td>Nippostrongyllus brasiliensis</td>
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<tr>
<td>3</td>
<td>Acacia albida(14)</td>
<td>Fabaceae</td>
<td>Seeds</td>
<td>Sheep, goat</td>
</tr>
<tr>
<td>4</td>
<td>Adhatoda vesica(15)</td>
<td>Acanthaceae</td>
<td>Roots</td>
<td>GI nematodes</td>
</tr>
<tr>
<td>No.</td>
<td>Species</td>
<td>Family</td>
<td>Parts</td>
<td>Uses</td>
</tr>
<tr>
<td>-----</td>
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<td>-------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Ageratum conyzoides(16)</td>
<td>Asteraceae</td>
<td>Leaves, flowers</td>
<td>Tape-worms</td>
</tr>
<tr>
<td>6</td>
<td>Alangium lamarckii(17)</td>
<td>Alangiaceae</td>
<td>Roots and bark</td>
<td>Hook-worms, ascarids</td>
</tr>
<tr>
<td>7</td>
<td>Albizia anthelmintica(18)</td>
<td>Fabaceae</td>
<td>Bark</td>
<td>Anthelmintic</td>
</tr>
<tr>
<td>8</td>
<td>Azadirachta indica(19)</td>
<td>Meliaceae</td>
<td>Cake and leaves</td>
<td>Anthelmintic</td>
</tr>
<tr>
<td>9</td>
<td>Bixa orellana(20)</td>
<td>Bixaceae</td>
<td>Seeds</td>
<td>Ascaridia galli, Ascaris suum</td>
</tr>
<tr>
<td>10</td>
<td>Butea frondosa(21)</td>
<td>Fabaceae</td>
<td>Seeds</td>
<td>Ascaridia galli</td>
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<tr>
<td>11</td>
<td>Calliandra calothyrsus(22)</td>
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<td>Haemonchus contortus, Trichostrongylus, Strongyloides papillosus</td>
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<td>12</td>
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<td>Pheretima posthuma</td>
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<tr>
<td>13</td>
<td>Carum copticum(24)</td>
<td>Umbellifera</td>
<td>Seeds</td>
<td>Ascaris lumbricoides;</td>
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<tr>
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<td>Chenopodium album(25)</td>
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<td>Leaves</td>
<td>Nematodes</td>
</tr>
<tr>
<td>15</td>
<td>Commiphora mukul(26)</td>
<td>Burseraceae</td>
<td>Oleo-gum resin</td>
<td>Tape-worms, hookworms</td>
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<td>Cucurbita moschata(27)</td>
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<td>Seeds</td>
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<tr>
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<td>Cyathocline lyrata(28)</td>
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<tr>
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<tr>
<td>19</td>
<td>Diospyros scabra(30)</td>
<td>Ebenaceae</td>
<td>Seeds</td>
<td>Fasciolosis, lungworms</td>
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<tr>
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<td>Dodonea viscosa(31)</td>
<td>Sapindaceae</td>
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<td>Intestinal-worms</td>
</tr>
<tr>
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<td>Embelia ribes(32)</td>
<td>(Myrsinaceae</td>
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<td>Tape-worms</td>
</tr>
<tr>
<td>22</td>
<td>Eupatorium triplinerve(33)</td>
<td>Asteraceae</td>
<td>Flowers</td>
<td>Ascaris lumbricoides and Taenia solium</td>
</tr>
<tr>
<td>23</td>
<td>Gardenia lucida(34)</td>
<td>Rubiaceae</td>
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<td>Tape-worms, earthworms</td>
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<tr>
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<td>Rosaceae</td>
<td>Fruit</td>
<td>Round-worms</td>
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<tr>
<td></td>
<td>Plant Name</td>
<td>Family</td>
<td>Part Used</td>
<td>Parasite</td>
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</tr>
<tr>
<td>25</td>
<td>Helleborus niger(36)</td>
<td>Ranunculaceae</td>
<td>Stem</td>
<td>Ascaris lumbricoides</td>
</tr>
<tr>
<td>26</td>
<td>Hyoscyamus niger(37)</td>
<td>Solanaceae</td>
<td>Seeds</td>
<td>Nematode</td>
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<tr>
<td>27</td>
<td>Lagenaria siceraria(38)</td>
<td>Cucurbitaceae</td>
<td>Seeds</td>
<td>Cestodes, moniezia</td>
</tr>
<tr>
<td>28</td>
<td>Lantana trifolia(39)</td>
<td>Verbenaceae</td>
<td>Fruit</td>
<td>Fasciolosis, lungworms</td>
</tr>
<tr>
<td>29</td>
<td>Lawsonia inermis(40)</td>
<td>Lythraceae</td>
<td>Leaves</td>
<td>Fasciolosis</td>
</tr>
<tr>
<td>30</td>
<td>Mitragyna stipulosa(41)</td>
<td>Rubiaceae</td>
<td>Roots</td>
<td>Guinea-worm</td>
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<tr>
<td>31</td>
<td>Moringa oleifera(42)</td>
<td>Moringaceae</td>
<td>Seeds</td>
<td>Ascaris suum</td>
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<tr>
<td>32</td>
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<td>Rubiaceae</td>
<td>Seeds</td>
<td>Earth-worms, tapeworms</td>
</tr>
<tr>
<td>33</td>
<td>Swertia chirata(44)</td>
<td>Gentianaceae</td>
<td>Whole plant</td>
<td>Ascaridia galli</td>
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<td>34</td>
<td>Trichilia emetic(45)</td>
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<td>Bark</td>
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</tr>
<tr>
<td>35</td>
<td>Uvaria hookeri(46)</td>
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<td>Root, bark</td>
<td>Haemonchus contortus</td>
</tr>
<tr>
<td>36</td>
<td>Vernonia amygdalina(47)</td>
<td>Asteraceae</td>
<td>Stem, bark</td>
<td>Haemonchus contortus</td>
</tr>
</tbody>
</table>

**CONCLUSION**

Ancient classical literature and ethno medical surveys describe the use of plant in traditional medicine or the treatment of helmintic infection. Most of the developing countries believed in traditional medicine and folk medicine because having no side effect over the synthetic drugs. Consequently, the demand for the herbal formulation is increasing day by day. The main goal of medicinal plants and traditional health systems is solving the health care problems of the world are gaining increased attention. Because of this resurgence of interest, Hence this review concluded that the herbal drug possesses the anthelmintic activity it has been proved by earth worm model give many link to develop future trial.

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