



Review article

Herbal medicine in the treatment of poverty associated parasitic diseases: A case of sub-Saharan Africa

Victor Irungu Mwangi^{a,*}, Ruth Mwendu Mumo^b, Atunga Nyachio^a, Nyamongo Onkoba^a^a Institute of Primate Research, P.O. Box 24481-00502, Nairobi, Kenya^b National Public Health Laboratory Services, P.O. Box 20750-00202, Nairobi, Kenya

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ABSTRACT

In sub-Saharan Africa, parasitic diseases including neglected tropical diseases (NTDs), account for the largest portion of its disease burden. This is due to lack of effective drugs and reduced funding of disease management and control making traditional medicine (TM) the better option. However, TM has a paucity of information on its efficacy and safety. This review explores the use of medicinal plants against parasitic diseases, highlighting current information available while identifying gaps in research that can be explored to establish the use of African medicinal plants against parasitic infections in Africa. Information on medicinal plants and their use against protozoan and helminthic infections was retrieved from online bibliographic databases like MEDLINE/PubMed, EMBASE, Web of Science, Cochrane Library, DOAJ and Google Scholar[®]. In Africa, medicinal plants are widely used to treat malaria, Leishmaniasis, Trypanosomiasis, Helminthic infections, Onchocerciasis, Lymphatic filariasis, Schistosomiasis, Toxoplasmosis and Echinococcosis infections. However, safety, efficacy and dosage of these medicinal herbs have not been investigated fully. In addition, no value addition venture has been undertaken to develop herbal natural products into tablets, pills and formulations. In conclusion, African medicinal plants are a potential source of lead compounds for drug discovery and the production of phytopharmaceuticals in the management of devastating parasitic diseases. There is a need to apply traditional medicine knowledge in clinical applications via value addition.

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Abbreviations: TM, traditional medicine; SSA, sub-Saharan Africa; NTD, neglected tropical diseases; HAT, Human African Trypanosomiasis; DALYs, disability adjusted life years; DOAJ, Directory of open access journals; IC₅₀, 50% inhibitory concentration; AAT, African animal trypanosomiasis; KETRI, Kenya Trypanosomiasis Research Institute.

* Corresponding author.

E-mail addresses: mwangiv@gmail.com (V.I. Mwangi), ruth3mumo@gmail.com (R.M. Mumo), nyachio@yahoo.com (A. Nyachio), bwonkoba@gmail.com (N. Onkoba).

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1. Introduction

In sub-Saharan Africa (SSA), parasitic infections caused by protozoa and helminths are responsible for a large portion of the continent's morbidity and mortality (Fakae, 1990). Poverty, dilapidated infrastructure and inaccessibility have contributed to the decreased usage of conventional or chemically synthesized medicines (Fakae, 1990). This has led to reliance on traditional medicine (TM), also known as alternative medicine, for treatment (Ndjonka et al., 2013). TM involves the utilization of indigenous knowledge of natural products obtained from plants, herbs and other materials to treat various diseases (Kasilo et al., 2010). In SSA, TM has largely contributed in the reduction of the continents' neglected tropical diseases' (NTDs) burden (Ndjonka et al., 2013). Effectiveness of TM in management of some infections varies due to the plant material or herbs being obtained from different geographic regions with different climatic conditions, hence varying in their medicinal properties (Cragg et al., 1997). However, biodiversity and cultural practices have immense influence on which medicinal plants or herbs are used for treatment of specific parasitic diseases (Kasilo et al., 2010). For instance, medicinal herbs have proven to be safe in treatment of Human African Trypanosomiasis (HAT) and nagana in cattle whose conventional drugs are highly toxic (Atawodi, 2003; Welburn et al., 2009). This has contributed to reduction in disability-adjusted life years (DALYS) and treatment costs. This has also necessitated ethnobotany and ethnomedicine to be explored in respect to conventional drugs (Schmidt et al., 2012a, 2012b; Christen and Cuendet, 2012; Ioset, 2008). Several scientific studies on safety, efficacy and dosage have been conducted, but there is still lack of a comprehensive review that amalgamates all the study findings relating to safety and efficacy of the medicinal herbs that are used in SSA for management of malaria, leishmaniasis, trypanosomiasis, toxoplasmosis, schistosomiasis, echinococcosis, lymphatic filariasis, onchocerciasis, and other helminthic infections. The object of this review is to discuss efficacies and dosages of several medicinal herbs that have been utilized in SSA to manage some of the major parasitic infections and NTDS while highlighting their geographical distributions and formulation.

2. Review methods

2.1. Information sources

The online bibliographic databases, MEDLINE/PubMed, EMBASE, Web of Science, Cochrane Library, DOAJ and Google Scholar were searched for studies on parasitic diseases and African medicinal plants (up to June 2016). Bibliographic lists and references of the selected papers and previous reviews were used as leads for identification of additional studies.

2.2. Literature search

The search was conducted using predefined medical subject heading (MeSH) terms, Boolean operators (OR, AND) and truncation symbols used in combinations of direct key words: Safety;

curative; prophylactic; African medicinal plants; herbal treatments; traditional healers; parasitic diseases (malaria; leishmaniasis; trypanosomiasis; helminths; onchocerciasis; schistosomiasis; filariasis; echinococcosis); scientific evaluation; potency AND all permutations of MeSH terms in all fields.

2.3. Study selection

Studies were included in the review if they explicitly reported on plant extract use in respect to (i) safety, (ii) extraction and fractionation, (iii) parasitic infections, (iv) *in vitro* and *in vivo* activity and (v) future use and conservation. All articles selected were managed using EndNote reference manager version X7 (PA, USA). The results of the analysis of the full papers read are described below.

3. Results and discussion

3.1. Malaria

Malaria has always been a major public health concern in SSA, where about 90% of the estimated 584,000 worldwide deaths occur (WHO, 2014). The greatest disease burden is borne by children aged under 5 years and primigravidae (Willcox and Gilbert, 2005).

Various plants from across Africa have been investigated and documented to have levels of antiplasmodial activity against laboratory strains of malaria parasites *in vitro* and murine *Plasmodia in vivo*. Plants like *Guiera senegalensis*, *Feretia apodanthera*, *Combretum micranthum*, *Securidaca longepedunculata* from Mali and *Pycnanthus angolensis* and *Morinda citrifolia* from Sao Tome are recommended by traditional practitioners in the management of malaria (Ancolio et al., 2002). Methanolic and chloroform extracts of these plants have been shown to possess better antiplasmodial activity against *P. falciparum* (Ancolio et al., 2002).

Burkina Faso has about 2 million cases of malaria per annum and at least ten medicinal plants being widely used by traditional healers in malaria management (Sanon et al., 2013). Crude aqueous, dichloromethane, methanol, water-methanol and alkaloid extracts of *Terminalia avicenoides*, *Combretum collinum*, *Ficus capraefolia*, *Anthocleista nobilis*, *Celtis integrifolia*, *Cordia myxa*, *Lophira lanceolata*, *Oppilia celtidifolia*, *Securinega virosa* and *Tapinanthus dodoneifolius* have shown to have good antimalarial effect against chloroquine resistant *P. falciparum* (Sanon et al., 2013). In addition, extracts from *T. avicenoides*, *C. collinum* and *F. capraefolia* have shown no cytotoxic effect but with a high selectivity index >10 (Sanon et al., 2013). In Nigeria, plants like *Momordica charantia*, *M. balsamina*, *Ageratum conyzoides*, *Diospyros monbuttensis* are used as antimalarial herbs (Awe and Makinde, 1997; Azas et al., 2002). A study by Olasehinde et al. (2014) showed that herbal extracts of *M. charantia*, *M. balsamina*, *A. conyzoides*, and *D. monbuttensis* have commendable levels of antiplasmodial activity with dose-dependent parasite growth inhibition. In addition, these plants are also used to cure yellow fever that is equally transmitted by the same mosquitoes as malaria (Awe and

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