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Conservation Strategies for Medicinal Plants in Ethiopia: A Comprehensive Review.

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ABSTRACT

This review provides an in-depth analysis of the policies, challenges, and conservation measures related to medicinal plants in Ethiopia. The country has implemented various policies to support sustainable development and utilization of plant resources, spanning environmental protection, natural resource development, and diversification of domestic commodities. However, indigenous knowledge of medicinal plants is at risk due to factors such as environmental degradation, deforestation, and the passing of traditional practitioners. Efforts to document this knowledge and establish herbaria are crucial for the conservation of declining medicinal plants.

The study emphasizes the importance of raising awareness, especially among the youth, about the contribution of traditional medicine to primary healthcare needs. It highlights the challenge of passing down this knowledge, with younger generations showing less interest in traditional practices. Incorporating traditional medicine into school curricula is suggested to bridge this gap.

Furthermore, the review addresses sustainability and continuity issues faced by traditional medicine in Ethiopia, including loss of medicinal plant taxa and habitats. Preserving diverse cultures with indigenous medicinal knowledge is essential for valuing biodiversity and ensuring resource availability for future generations. In-situ and ex-situ conservation methods are recommended to conserve valuable plant biodiversity and combat threats like habitat loss, environmental degradation, and overharvesting. In particular, in-situ conservation is crucial for plants difficult to domesticate, as well as those unable to produce desired active principles outside their natural habitats.

This comprehensive review underscores the urgency of coordinated efforts to transition from unsustainable practices to ecologically sound, socially acceptable, and economically equitable production and utilization systems for medicinal plants. It advocates for the implementation of conservation strategies tailored to Ethiopia's unique biodiversity challenges, safeguarding the valuable medicinal plants that are integral to the nation's cultural heritage and healthcare traditions.

Keywords: Ethnobotany, Medicinal Plant, Conservation, Natural habitat, in-situ conservation

Introduction

Historical Development of Ethnobotanical Study

Ethnobotany is the comprehensive study of the mutual relationship between plants and traditional peoples. The term was coined by the botanist John W. Harshberger in 1895 (Balick and Cox, 1996). It has evolved from a simple listing of plants into a new scientific field with appropriate methodologies for documenting and studying the accumulated indigenous knowledge on plants, emphasizing quantitative methods over mere listings.

Ethiopia boasts a rich history of utilizing traditional medicinal plants to combat various diseases. The widespread use and interest in these plants stem from their socio-cultural acceptability, accessibility, affordability, and the bio-medicinal benefits they offer (Dawit Abebe, 2001). According to some sources, worldwide, it is estimated that between 2000 to 65000 species of higher plants have been used in traditional medicine. In Ethiopia, more than 800 plant species are currently employed in traditional healthcare systems, treating nearly 3000 health conditions, including both mental and physical disorders (Tesema Tanto *et al*., 2002). Plants have long served as indispensable sources for both preventive and curative traditional preparations for humans and livestock.

The scope of Ethnobotany has expanded to encompass studies of modern cultures, and more recently, there has been a greater focus on its application, conservation, and sustainable development.

Indigenous Knowledge

Indigenous knowledge encompasses a wealth of accumulated knowledge, rules, standards, skills, and mental frameworks possessed by local communities in specific areas (Balcha, 2014). The direct and close reliance of these communities on natural resources has led to the development of indigenous knowledge, which aids in their adaptation to and survival in their environments. This unique knowledge is specific to each culture or society, forming the foundation for agriculture, healthcare, food preparation, education, environmental conservation, and a range of other activities. The intricate set of beliefs, practices, and knowledge known collectively as indigenous knowledge evolves over time and space. This knowledge, including time-tested

practices developed through generations of interaction with the environment, is cumulative and dynamic (Alcorn, 1984).

Indigenous peoples around the world possess unique knowledge of plant resources, which they rely on for sustenance, medicine, and various other uses, showcasing remarkable botanical expertise (Martin, 1995). Over centuries, different indigenous communities have developed their own specific knowledge regarding the use, management, and conservation of plant resources (Cotton, 1996). The systematic application of indigenous knowledge is crucial for the sustainable use of resources and sustainable development (Thomas, 1995). These communities have a longstanding tradition of using plants for medicinal purposes. This knowledge is the result of generations of careful observation, experimentation, and trial and error, leading to a deep understanding of the therapeutic properties of plants for disease prevention and treatment (Sofowora, 1982; Martin, 1995). Therefore, the knowledge and application of traditional medicine represent one of the most widely utilized indigenous knowledge systems, highlighting the deep interdependence between humans and plants, a subject of study in ethnobotany. This ethnomedicinal knowledge involves traditional diagnosis, the collection of raw materials, the preparation of remedies, and their prescription to patients.

The documentation of traditional knowledge, especially regarding the medicinal uses of plants, has yielded many important drugs used in modern medicine (Balick and Cox, 1996). Indigenous knowledge of remedies is often passed down through generations orally, often in strict confidence. However, this oral transmission is vulnerable to distortion, and in many cases, some of this invaluable lore is lost with each transfer. Hence, there is a pressing need for the systematic documentation of such valuable knowledge through ethnobotanical research. According to Getachew Berhan and Shiferaw Dessie (2002), knowledge of medicinal plants is commonly transmitted from generation to generation. In this process, valuable information can be lost whenever a medicinal plant is lost or when a traditional medicinal practitioner passes away without passing on their indigenous knowledge to others (Yibrah Tekele, 2014).

Indigenous knowledge is now recognized as encompassing the broader cultural knowledge of a given society, including all

its social, political, economic, and spiritual aspects. Sustainable development researchers have identified specific categories of indigenous knowledge that are particularly valuable, including knowledge related to resource management, pastoralism, agriculture, agroforestry, water management, wild food gathering, classification systems for plants, animals, soils, water, and weather, empirical knowledge about flora, fauna, and inanimate resources and their practical uses, as well as the worldview or how the local group perceives its relationship with the natural world (Emery, 1996).

Indigenous knowledge serves as an essential foundation for development projects, fostering innovation, enhancing technology adaptation, contributing to scientific knowledge, fostering understanding between researchers and local communities, strengthening local capacity for experimentation and innovation, and empowering local communities (Warburton and Martin, 1999). It is also crucial for conservation and sustainable development due to its locally appropriate, diversified production systems, respect for nature, flexibility, and social responsibility (Dewalt, 1994).

According to Stephan and Justin (2003), indigenous knowledge is the unique local knowledge that forms the basis for agriculture, healthcare, food preparation, education, environmental conservation, and a variety of other activities within a given culture or society. It is a systematic body of knowledge accumulated by a group of people over generations, shaped by their close interaction with nature. This knowledge is both cumulative and dynamic. One notable aspect of indigenous knowledge systems is their adaptive nature, acquired informally through interaction with the natural environment (Zemede Asfaw and Tigist Wondimu, 2007). Indigenous knowledge systems also encompass sets of concepts, beliefs, and perceptions that constitute the body of knowledge, as well as the processes by which it is acquired, stored, and transmitted. One of the most widely used indigenous knowledge systems in many countries is the knowledge and application of traditional medicine. This knowledge, known as ethnomedicinal knowledge, encompasses traditional diagnosis, the collection of raw materials, the preparation of remedies, and their prescription to patients (Farnsworth, 1994). The direct and intimate dependence of indigenous peoples on local resources has

led to the accumulation of indigenous knowledge, which has enabled these communities to adapt to and thrive in their environments (Martin, 1995). Indigenous knowledge regarding remedies is passed down orally in many countries, including Ethiopia, often with great secrecy (Jansen, 1981). This oral and informal transmission makes indigenous knowledge or ethnomedicinal knowledge susceptible to distortion, and in many cases, some of this lore is lost with each transfer (Amare Getahun, 1976). Thus, there is an urgent need for the systematic documentation and recording of such valuable knowledge through ethnobotanical research, as well as the use of indigenous knowledge to raise community awareness about its value, and the provision of resources such as computers, video equipment, etc. to help communities record and document their local practices and make indigenous knowledge available through newsletters, videos, books, and other media.

Traditional Medicinal Plants

The World Health Organization (WHO) defined traditional medicine as the comprehensive body of knowledge and practices that can be formally explained or employed in the prevention and alleviation of physical, mental, or social imbalances. It relies exclusively on practical experience and observation passed down from generation to generation, whether orally or in writing (Yilma Desta *et al*., 1996; cited in Fassil Kibebew, 2001).

According to Fassil Kibebew (2001), approximately 75-90% of the rural population worldwide (excluding Western countries) depend on traditional medicines as their primary healthcare system. This reliance is not solely due to poverty, where individuals cannot afford expensive modern drugs, but also because traditional systems are culturally accepted and address physiological needs in ways modern medicine may not. WHO (2001) emphasizes that consulting medicinal practitioners is instrumental in the development and incorporation of effective approaches in planning and budgeting for healthcare provisions in most developing nations and indigenous communities in Africa. Traditional medicine plays a central role in meeting the healthcare needs of rural populations and urban poor. As long as modern medicine continues to struggle in effectively meeting the healthcare needs of the continent's people (Jansen, 1981), the value and role of this healthcare system will

remain vital and its affordability and cultural relevance will persist, while modern healthcare services are often limited and costly (WHO, 1998).

Indigenous traditional medicinal practices primarily operated through private agreements between consenting parties, with knowledge transmitted orally through folk traditions (Asfaw Debela *et al*., 1999). The secrecy maintained by traditional healers makes the information less susceptible to distortion but less accessible to the public (Dawit Abebe, 1986). However, this knowledge is dynamic, as practitioners make concerted efforts to expand their expertise through reciprocal exchanges of limited information with one another (Dawit Abebe, 1986; Abbink, 1993).

According to the World Health Organization, over 3. 5 billion people in the developing world rely on medicinal plants for their healthcare (Balick and Cox, 1996). Additionally, approximately 60-85% of the population in every developing country relies on traditional medicine (Sofowora, 1982). The practice of traditional medicine is prevalent in countries like China, India, Japan, Pakistan, Sri Lanka, and Thailand. In Africa, traditional medicine is deeply embedded in the culture, even though it may not be as organized as in countries like India and China. Practitioners include herbalists, bonesetters, village midwives or traditional birth attendants, traditional psychiatrists, herb sellers, and other specialists (Sofowora, 1996).

Traditional medicinal plants play a significant role in the lives of many people in terms of supporting health, providing financial income, and ensuring livelihood security (Hamilton, 2003, 2004; Abdulhamid Bedri *et al*., 2004). Plants, especially medicinal ones, are invaluable and fundamental to nearly all life on Earth, offering essential benefits in the realm of health. However, traditional medicine also has its drawbacks, as various authors have noted (Amare Getahun, 1976; Sofowora, 1982; Dawit Abebe, 1986). One limitation lies in the lack of precision and standardization, hindering the recognition of the traditional healthcare system. Another drawback is the absence of precise dosages, which may lead to toxicity (Dawit Abebe, 1986). The measurements used for dosages are not standardized and depend on factors like the patient's age, physical appearance, socio-cultural interpretation of the illness, diagnosis, and the experience of individual

herbalists (Dawit Abebe and Ahadu Ayehu, 1993; Pankhurst, 1995).

Sources of Medicinal Plants

According to Frankel *et al.* (1995) medicinal plants species are grown in the natural ecosystem. Similarly, the work of Tesfaye Awas and sebsebe Demissew (2009) indicated that most of the medicinal plants in Ethiopia are collected from the wild, some are cultivated and some others are grown in home gardens either purposely for medicinal use or non-medicinal purpose (Zemede Asfaw and Ayele Nigatu, 1995). According to Zemede Asfaw (1997), plant species cultivated in Ethiopia home gardens for the purpose of medicine is about 6%. That a large of medicinal plant species that are used by the herbalists are collected from the natural vegetation. Local forests are sources of plant processes in to therapies used in traditional medicinal system (Balick and cox, 1996). The natural ecosystems of the forests, grass lands, wood lands, wetlands, field margins, contain a significant number of medicinal plants species. These are places where traditional healers and other members of the community collect medicinal plant species and use it (Endashaw Bekele, 2007).

Plants in Ethnoveterinary Medicine

Ethnoveterinary medicine refers to traditional animal healthcare knowledge and practices encompassing traditional surgical and manipulative techniques, traditional immunization, magical and religious practices, beliefs, management practices, and the use of herbal remedies to prevent and treat a range of disease problems encountered by livestock holders (Tafese Mesfine and Mekonnen Lemma, 2001). Ethnoveterinary medicine offers traditional medicines that are locally available and usually more cost-effective than conventional treatments. Livestock holders can prepare and use homemade remedies at minimal expense. This is particularly valuable in rural areas with relatively few veterinarians and limited access to other facilities (Mccorkle, 1995).

In Ethiopia, as in other developing countries, livestock production plays a pivotal role in the livelihood and economy of the majority of the population. Crop production heavily relies on animal traction. Livestock, especially in challenging environments, are vital for survival and are a driving force for food security and sustainable development. Despite the direct link between livestock health and productivity, the veterinary

medicine system in Ethiopia remains relatively small. Nonetheless, some widely known techniques for treating common livestock ailments are part of the common knowledge of livestock holders (IIRR, 1996). However, other practices are known only to a few indigenous professional healers who have learned them over the years. Stock raisers, including farmers and herders, have developed their unique methods for maintaining the health and productivity of their animals (Mccorkle and Mathias, 1996). They treat and prevent livestock diseases using age-old homemade remedies, surgical and manipulative techniques. Together, these indigenous local animal healthcare beliefs and practices constitute ethnoveterinary medicine. Like other forms of local technical knowledge, ethnoveterinary practices and skills evolve through empirical observation, primarily through trial and error, and sometimes through deliberate or even desperate experimentation and innovation (McCorkle and Mathias, 1996).

Ethnoveterinary medicine can be a crucial option when livestock raisers have no other animal healthcare choices, whether in rural or peri-urban areas. Despite its paramount importance as a livestock healthcare system, many traditional veterinary practices have remained undocumented in Africa and Ethiopia (Dawit Abebe and Ahadu Ayehu, 1993). Therefore, raising awareness about ethnoveterinary medicine, with a focus on useful plants for livestock treatment, is of paramount importance for livestock management. Additionally, proper documentation and understanding of farmers' knowledge, attitudes, and practices related to the occurrence, causes, treatment, prevention, and control of various ailments are crucial for designing and implementing successful livestock production (Tafese Mesfine and Mekonen Lemma, 2001).

Animal health care provided by owners, traditional healers, and veterinary professionals was revealed in a study conducted by (Wirtu *et al*., 1997). Moreover, due to the often expensive nature of modern drugs, which are not affordable for many Ethiopian farmers and pastoralists, they rely on their traditional knowledge practices and locally available materials, primarily plants, to control diseases in their domestic animals (Mirutse Giday and Gobena Ameni, 2003).

Despite its enduring importance as a livestock healthcare system, many traditional veterinary practices have

remained undocumented in Africa and Ethiopia (Dawit Abebe and Ahadu Ayehu, 1993). Therefore, creating awareness about ethnoveterinary medicine, emphasizing the use of beneficial plants for livestock treatment, is of paramount importance for livestock management. Furthermore, the proper documentation and understanding of farmers' knowledge, attitudes, and practices related to the occurrence, causes, treatment, prevention, and control of various ailments are crucial for the design and implementation of successful livestock production (Tafese Mesfine and Mekonen Lemma, 2001).

Threats to Medicinal Plants

While plants play a vital role in treating various human and livestock ailments, they are currently facing significant pressure. Indigenous knowledge on the usage of medicinal plants as folk remedies is diminishing for various reasons. According to Ensermu Kelbessa *et al*. (1992), habitats and species are rapidly disappearing due to environmental degradation, agricultural expansion, deforestation, and urban development.

Medicinal plants, as noted by Zemede Asfaw (2001), are considered to be at risk of conservation due to overuse and destructive harvesting. Collection of roots and bark, for instance, may lead to the death of the plant upon harvest (Dawit Abebe and Ahadu Ayehu, 1993). In a study conducted by Kebu Balemic *et al*. (2004), the most significant threats to medicinal plants in the Fentalle area were the harvesting of medicinal plants for firewood, charcoal, drought, agriculture, household use, and trade.

The decline in the knowledge and utilization of medicinal plants among the Zay people can be attributed to environmental degradation and intense deforestation (Mirutse Giday, 2001). Debela Hunde *et al*. (2004) also assert that modern education has had an impact on knowledge of medicinal plants. They point out that students who attend modern schools show an unwillingness to learn from their parents, providing evidence of the gradual disappearance of traditional knowledge.

A study conducted by Tesfaye Haile Mariam *et al*. (2009) revealed that elders aged 41-50 years old hold the majority of knowledge on herbal remedies. This highlights the concentration of ethnomedicinal knowledge among the elderly members of the community and the relative difficulty in transferring it to the younger generation.

Acculturation of the younger generation, as noted by Mirutse Giday *et al*. (2009), poses a major threat to the continuation of traditional medicinal knowledge and practice. Ethnomedicinal knowledge diminishes with the passing of knowledgeable elderly members of society, as only a few young people are willing to acquire this knowledge. Additionally, the invasion of alien weeds like Parthenium and the effects of climate change, such as increasing temperatures and severe droughts, may make it difficult for water-consuming medicinal plants to survive in the future (Muthuswamy and Solomon, 2009). Therefore, ethnobotanical studies are essential in documenting, analyzing, and disseminating knowledge on the relationship between medicinal plants and human society.

Conservation of Traditional Medicinal Plants

Ethiopia has established policies and strategies that promote the sustainable development and utilization of plant resources. These policies are evident across various sectors, including environmental protection, natural resource development, and diversification of domestic commodities (Endashaw Bekele, 2007).

According to Getachew Berhan and Shiferaw Dessie (2002), knowledge of medicinal plants is typically passed down orally from generation to generation in secret. This process can result in the loss of valuable information if a medicinal plant is lost or if a traditional medical practitioner passes away without sharing their indigenous knowledge. Therefore, it is recommended to document indigenous knowledge and establish herbaria for future use to aid in the conservation of declining medicinal plants (Muthuswamy and Solomon, 2009). Additionally, creating awareness about the contribution of traditional medical practices in meeting primary healthcare needs is crucial, especially among the youth (Mirutse Giday *et al*., 2009). It has been noted that the younger generation often lacks interest in learning about medicinal plants, and efforts should be made to incorporate traditional medicine into school curricula to foster greater appreciation for its usefulness (Mirutse Giday *et al*., 2009).

As Zemede Asfaw (2001) pointed out, in Ethiopia, as in other developing countries, traditional medicine faces challenges in sustainability and continuity, primarily due to the loss of medicinal plant taxa and their

habitats, as well as associated cultural knowledge. Preserving the diverse cultures with indigenous medicinal and other knowledge held by traditional communities significantly contributes to valuing biodiversity and maintaining resources for future generations (Medhin Zewdu, 2002). Therefore, both in-situ and ex-situ conservation methods can be employed for the conservation of plant biodiversity (Frankel *et al*., 1995). Recognizing the vital role of medicinal plants in addressing local and global healthcare needs presents an opportunity for collaboration between conservationists, traditional medicine practitioners, local communities, and others to develop mutually supportive solutions to issues related to forest loss and biodiversity decline. Current efforts are needed to transition from unsustainable practices of wild sourcing of medicinal plants to more ecologically sustainable, socially acceptable, and economically equitable production and utilization systems (Parrotta, 2002). Globally, various conservation measures have been implemented to protect threatened medicinal plant species from further depletion, including in-situ conservation in natural reserves and parks (e. g., homegardens) as well as ex-situ conservation in field gene banks, seed banks, and botanical gardens (Cunningham, 1993). In Ethiopia, a complementary implementation of in-situ and ex-situ conservation strategies is essential to conserve valuable plants, including medicinal plants, that are threatened by natural or human-induced factors (Abebe Demissie, 2001).

Conservation efforts employ both in-situ and ex-situ conservation methods. In-situ conservation involves the preservation of species in their natural habitats. Some traditional medicinal plants must be conserved in-situ due to challenges in domestication and management (Zemede Asfaw, 2001). Furthermore, certain plants may not yield the desired quantity and quality of active principles when cultivated outside their natural habitats. Medicinal plants can also be conserved by ensuring their growth in designated areas, as has been traditionally practiced (Zemede Asfaw, 2001).

Conclusions

The review has provided a thorough examination of the current state of medicinal plants in Ethiopia, highlighting their importance for the country's culture, health, and economy. It has also identified the main challenges and threats facing these plants, such as loss of indigenous knowledge, environmental degradation, and unsustainable harvesting. To address these issues, the review has suggested various policy recommendations and conservation measures, such as documenting traditional knowledge, raising awareness among the youth, incorporating traditional medicine into school curricula, and implementing in-situ and ex-situ conservation methods. These actions are vital for ensuring the survival and continuity of Ethiopia's rich and diverse medicinal plant heritage, which can benefit not only the local communities, but also the global scientific and medical community. The review calls for urgent and coordinated efforts from all stakeholders, including the government, researchers, practitioners, and the public, to protect and promote the sustainable use of medicinal plants in Ethiopia.

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