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Indigenous knowledge of communities around Lake Victoria Basin regarding treatment and management of tuberculosis using medicinal plants

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This survey was aimed to determine the indigenous knowledge of communities around Lake Victoria Region regarding the treatment and management of Tuberculosis. Opinion leaders suggested the names and locations of known Traditional Medical Practitioners (TMPs) in the study locale. A sample of 102 TMPS from Kenya, Uganda and Tanzania residing around Lake Victoria Basis in East Africa participated in the study. Snow ball sampling technique was used to draw 22 TB patients claimed to have been treated by TMPs. It was established that local people have remarkable detailed knowledge of species identity, characteristics and their uses in the treatment and management of Tuberculosis. The main parts of the plants used include the root, bark, leaves and seeds in various combinations. It is concluded that local people have vast knowledge regarding the treatment of tuberculosis which is largely confined to the elderly, exploit the medicinal plants non-sustainably and use crude plant extracts as concoctions for treating and/or managing TB. It is recommended that traditional knowledge should be documented and top priority be given to the conservation of the habitat by launching special programs for raising people's awareness about sustainable utilization of medicinal plant species and conservation.

Key words: Indigenous knowledge, medicinal plants, rural community, treatment of tuberculosis, sustainable use, conservation.

INTRODUCTION

There is abundant literature which indicates that rural communities across the world and especially Lake Victoria Region depend heavily on plant diversity and have traditionally made judicious selection of these plants for various purposes including control of various ailments affecting human and their domestic animals (Heinrich,2000; Mahmood et al., 2011a; Joshi et al., 2010). Traditional medicines have been defined as a sum of knowledge, skills and practices based on theories, beliefs and experiences indigenous to different cultures in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical or mental illness (Mahmood et al. 2011b). In many developing countries, a large part of the population, especially in rural areas depends mainly in traditional medicines for their primary health care (Mahmood et al., 2011d). In fact, a global review of phytomedicine in relation to ethnology reveals that the science of plants in the early days was based on the utilitarian approach (Wallis, 2005).

This is evident because there are several records of

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highly priced plant species which have been mentioned several times in literature (Joshi et al., 2010). These communities collect useful plant resources from various habitats and utilize them using indigenous knowledge and practices.

The global development of the art of making judicial selection of plants that can be used for curative purposes are found in Indus civilization dating back to 900 BC and the second Millennium BC (Ali, 2008). There is also a lot of evidence contained in hymns found in the Rigvenda as well as the Athervenda which contains the records of useful plants (Rajan et al., 2005). In other studies, a total of 341 different plants species are documented in the Charaka Samhita (900 BC), as useful in the management of human health (Ali, 2005). In the Susrita Samhita, there are a total of 395 plant species listed for the same purpose (Majumdar, 1971). It is evident that other scholars, from the East Asian Region in this field, have over 70 species of plants with the list currently being approximated at 600 plants that are used in Ayuverdic (Namjoshi, 1979). Such a culture depending on Mother Nature has been practiced for over 2000 years (Namjoshi, 1979).

In the African context, the literature pertaining to the use of plants as food and curative purposes dates back to about 1600 BC among ancient Egyptian culture (Diop, 1989). An Egyptian medical treatise (papyrus), drawn up in the Thebes, during the aforementioned period, contains an inventory of 700 plants used in medicine (Pelt, 1979; Diop, 1989). In West Africa in comparatively more recent times, amongst most communities, for example the Yoruba prior to the European civilization, it was mandatory that a young boy before initiation into adulthood had to learn the names of all the useful plants in relation to future uses by the pupil in life (Rodley, 1971).

Most indigenous and local communities are situated in areas where the vast majority of plant species are readily available either for free or at minimal cost which majority of rural poor communities in the developing and the developed world can afford (Samie et al., 2005). Of the entire world flora, 250,000 species have been identified and used for curative purposes (Patwadharn et al., 2005). This number represents only 15% of those species that have been effectively investigated and found to be useful (Okeke, 2005). Consequently, there are a whopping 85% of potentially useful plants that could be used for curative purposes which are yet to be investigated.

In addition, there is evidence that the search for plants with therapeutic activities has been a continuous process in the world over (Dimayuga and Garcia, 1991). For example, in Mexico, several field surveys have been carried out to isolate and elucidate active compounds in plants. Laboratory tests of the mentioned plants against Gram-positive bacteria have revealed high anti-bacterial activities. There is also evidence that most of the plant preparations are known to treat chronic diseases that are caused by non-bacterial pathogens (Patwadharn et al., 2005).

Tuberculosis (TB), which is a chronic condition requiring prolonged treatment, is an old human disease whose infection rate has often been dreaded in the human population, is increasingly becoming a world-wide problem because of the emergence of multi-drug-resistance (MDR) TB, for which treatment is beyond the reach of most African countries (Anyangwe et al., 2006; Kamuolratanakul et al., 1999). Estimates indicate that about one third of the world's population is exposed to TB and is responsible for approximately three million deaths each year (Anyangwe et al., 2006). It is also estimated that eighty one million new cases of TB occur each year and Africa has the highest incidence rate (WHO, 2002). Sub-Saharan Africa has a much higher rate than other African states (WHO, 2012). At the regional podium, Uganda has a prevalence rate of 65%, with Kenya and Tanzania around 57% (Bercion and Kuaban, 1999). There is a little contest that these figures portray the Lake Victoria region a tuberculosis endemic zone.

Furthermore, recent statistics indicate that women are more affected by TB than men. The disease kills more than 2,700 women each day (Anyangwe et al., 2006). This translates to over one million women killed each year. Moreover, the women are killed in their most productive years because of hormonal changes, nutritional deficiency and stress during pregnancy. The situation has been aggravated by the recently reported extensively drug resistant TB (XDR TB), which is resistant to both the first and second-line drugs, and is hence threatening to make TB impossible to treat especially in cases of co-infection with HIV/AIDS (Bloom, 2006; Thorn, 2006; Wright et al., 2006; WHO, 2012; CDC report, 2005).

Against this background, the research questions that constitute the problem addressed in this paper were: What is the range of indigenous knowledge regarding the treatment and management of Tuberculosis among the rural communities and how did they acquired such knowledge? Specifically, how did indigenous peoples know what plants to use and combine in their traditional treatment, especially when so many are poisonous or have no effect when ingested?

The purpose of this paper was to investigate the indigenous knowledge of communities around Lake Victoria Region regarding the treatment and management of Tuberculosis using medicinal plants. The study specifically sought to: (1) find out the extent to which local people know the symptoms and causes of TB; (2) determine the type of plant species used by the sampled TMPs to treat and manage TB; (3) determine the parts of plant species commonly used. The study also traced the TB patients who had ever visited TMPs to find out the extent they considered the treatment effective and the cost effective.

MATERIALS AND METHODS

The methodology used was a cross-sectional survey that employed mixed methods that incorporated qualitative and quantitative

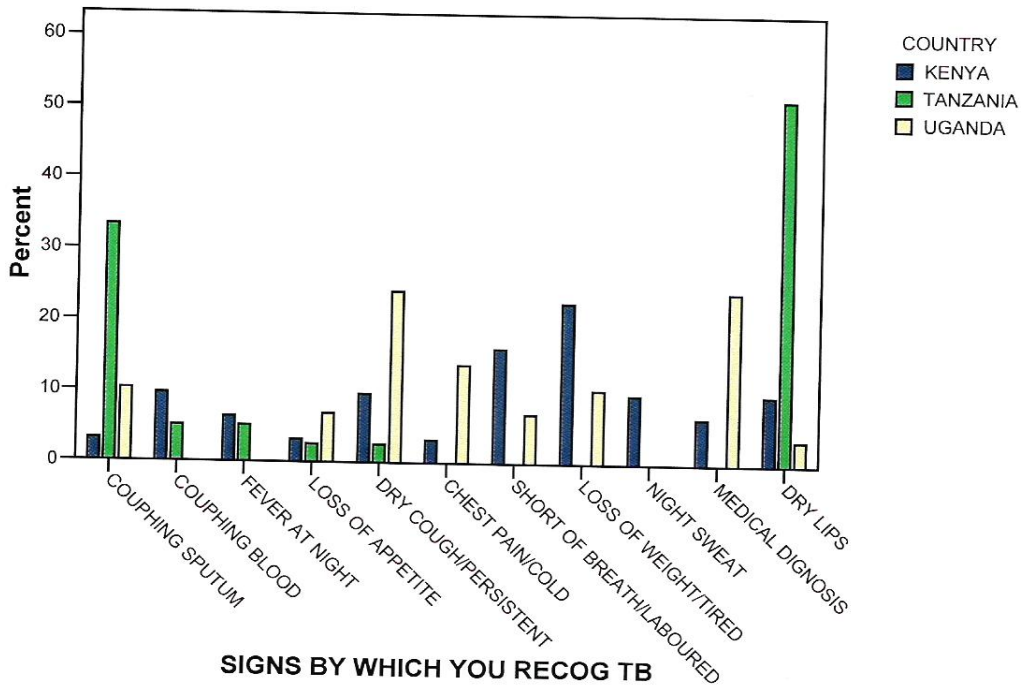

Figure 1. Knowledge of signs of Tuberculosis by country of TMPs MP.

approaches. The study which commenced in March 2007 covered three purposively selected districts from each of the three East African countries of Kenya, Uganda and Tanzania. In Kenya, the study sites were: Teso, Siaya and Kisii Counties. In Uganda the districts covered were Mukono, Mayuge and Mbarara. In Tanzania, the districts covered were Musoma, Magu, and Sangerema. The study locales were purposively sampled using the criteria of high prevalence rate of TB infections, ethnic diversity of residents and known Traditional Medical Practitioners (TMPs) in the area. The study used a combination of snowball/network sampling technique to reach 32 TMPs in Kenya, 31 TMPs in Uganda and 39 TMPs in Tanzania, making a sample of 99 TMPs. In addition, the study reached 3 TB patients in Kenya, 3 in Tanzania and 16 in Uganda, making an overall sample size of 122.

The qualitative approach involved the use of interview guides and ethnographic and case studies for specialists in Traditional Medicine and questionnaires for consumers of the traditional medicines. In this study, observations were made of the behavior of TMPs during their treatment exercises as well as appropriateness of their working environment and TB diagnostic techniques. Samples of mentioned and identified plants by the Traditional Medical Practitioners (TMPs) were collected from the study area and taken to the Department of Plant and Microbial Sciences, Kenyatta University in Kenya were identified by the university taxonomist.

The main dependent variables for the study were: Level of knowledge of plant species used to treat tuberculosis (measured in terms of ability identify the medicinal plant species by local names and the type of concoctions made); Knowledge of the major symptoms or signs of TB. These were compared with clinically known clinical signs; Parts of plants used and Medicinal preparation (juice, ash). The independent variables were country of residence age, sex and educational level.

The data obtained was edited and analyzed using Statistical Package for Social Sciences (SPSS) version 20. The relationship between age, level of education, sex, country of origin and knowledge of signs of tuberculosis and medicinal plants used to treat tuberculosis were assessed using Pearson correlation coefficient and the Chi-Square statistical technique.

RESULTS AND DISCUSSIONS

The 99 TMPs who participated in the study demonstrated a good understanding of the symptoms of tuberculosis which they claimed to treat and manage using medicinal plant species. Figure 1 indicates the most frequently mentioned signs of TB by the TMPs. The signs that were used to diagnose TB were; labored breathing, loss of weight and tiredness, dry persistent cough, dry lips and coughing blood, amongst others.

The following are the most frequently mentioned signs of TB across the region:

1) Dry lips, 24.2% (Kenya 3.0%, Tanzania 20.2% and Uganda 1.0%).
2) Coughing sputum, 17.2% (Kenya 1.0%, Tanzania 13.1% and Uganda 3.0%).
3) Dry persistent cough, 11.1% (Kenya 3.0%, Tanzania 1.0% and Uganda 7.1%).
4) Loss of body weight and tiredness, 70.1% (Kenya 7.1%, Uganda 3.0%).
5) Medical diagnosis, 9.1% (Kenya 2.0%, Uganda 7.1%).
6) Labored breathing/shortness of breath, 7.1% (Kenya 5.1%, Uganda 2.0%).
7) Coughing blood, 5.1% (Kenya 3.0%, Tanzania 2.0%).

Table 1. Medicinal plants used to treat Tuberculosis.

Medicinal plant	Location
Entada abyssinica	Kenya and Tanzania
Albizia coriaria	Uganda
Warbugia ugandensis	Uganda, Kenya and Tanzania
Rubia cordifolia	Uganda and parts of Kenya
Mangifera indica	Uganda
Zanthoxylum chatybeum	Uganda and Kenya
Eucalyptus spp.	Uganda, Kenya and Tanzania
Entada abbysinica	Kenya and Tanzania
Acasia hoki	Uganda
Gurcinia spp.	Uganda and parts of Kenya

8) Night fevers and loss of appetite
9) Chest pains
10) Night sweats, about 4.0%.

The information carried in Figure 1 indicates that the level of knowledge of TMP regarding the signs of tuberculosis is fairly well distributed across the Lake Victoria Basin. The TMPs in the region concurred that the common signs of tuberculosis are coughing sputum, dry persistent cough, loss of appetite and dry lips. The signs which were predominantly mentioned by TMPs in Kenya and Tanzania were coughing blood and fever at night. The signs mentioned by TMPs in Uganda and Kenya alone were chest pains, labored breath/shortness of breath, loss of weight, night sweats and medical diagnosis.

The sex breakdown of TMPs and their level of knowledge regarding the common signs of tuberculosis were also computed. The symptoms of tuberculosis frequently mentioned by the TMPs by sex in decreasing order of mention were: dry lips; coughing sputum, persistent dry cough, chest pain, loss of weight, fever at night and coughing blood. It was established that there was a slight positive and non-significant difference between the knowledge levels of TMPs by sex. The only notable difference was that night sweat was mentioned exclusively by females while the medical history and loss of appetite was only mentioned by males. Thus, there was no significant difference between the frequency of mention of the signs of tuberculosis and sex (x^2 = 20.455, df = 10, P = 0.321).

The overall impression is that the symptoms of TB according to the traditional health care practitioners who participated in the study were nearly similar to the general clinical allopathic symptoms though disparities existed across the study locales. In some cases there was mixing up as most respiratory diseases initially express themselves alike. Some TMPs mentioned loss of body weight and coughing blood as the common symptoms of TB, while the common symptoms of respiratory tuberculosis according to published literature includes malaise, weight loss, fever and night sweats, over three weeks cough, breathless chest pain (Schreider, 2006).

It was established that the people residing along the Lake Victoria Region have a good knowledge of useful plant species especially the knowledge on medicinal plant species. Table 1 summarizes the wide spectra of plant species (initially given in local names but later given scientific names) reported as being used by TMPs across the Lake Victoria Basin.

The information in Table 1 indicates that TMPs across the entire Lake Victoria Region have a wide knowledge of medicinal plant species used for the treatment and management of Tuberculosis. In terms of ethnic distribution of these plants in Kenya, Warbugia ugadensis was widely used among the Kisii, in Kisii District; Luo in Siaya/Bondo District and Ateso in Teso Districts. In Uganda, the ethnic distribution spread among the communities living in Mayuge and Mbarara. In Tanzania, the TMPs were located in Geita Districts.

Entada abbyisinnica was also used in Kenya among the Kisii, Siaya and Teso communities, Tanzania within Musoma and Bunda Districts and rarely used among the communities in Uganda. Instead, the most commonly used plant species to treat TB in Uganda are Rubia cordifolia and Psidium guajava in Mayuge District and Albizia coriara; Acacia hokii; Garcinia species in Mbarara Districts. This finding is consistent with those of Kunjani et al., (2011), Mahmood et al., (2011c) and Martin, (1995) who concur that local communities have rich indigenous knowledge which needs to be saved in black and white.

It was further established that a large proportion of TMPs did not cultivate any of these medicinal plant species due to cultural considerations, misconceptions regarding the role of herbal treatment. Some of these misconceptions included the perception that people who planted these medicinal plants in their homesteads were practicing witchcraft. It was therefore evident that traditional beliefs and practices are also deeply rooted in their culture in such a way that they attribute most of the complicated ailments and other misfortunes to supernatural origin due to soul loss, spells or curses casts by evil spirits by their displeasure. The local people use the medicinal plant species and their parts for the treatment of ailments following the traditional practices.

There was no statistically significant correlation between the level of knowledge of the plant species used to treat tuberculosis and the age of the TMPs. The implication is that most of this useful knowledge has been passed over to the younger generation. However, it was found that there was a significant difference between the level of knowledge of plant species used to treat TB and the sex of the TMPs (x^2 = 46.6, df = 35, P≤0.001). It was evident that female TMPs had better knowledge than the male counterparts. Further, the TMPs whose main occupation was practicing treatment using medicinal plants and/or farming and nursing had better knowledge regarding the medicinal plants used to treat TB, than those with other occupations or businesses.

There was a moderately weak correlation between the TMPs level of knowledge about the signs of TB and the media through which they learned how to treat TB. A majority of TMPs acquired their knowledge on how to treat TB from their parents, relatives and other healers. A large proportion of TMPs reported that they acquired their skills through a combination of parental and other healers' knowledge. A minority reported that they acquired the skills through books belonging to healers associations. In fact, the only TMPs who reported that they had acquired their skills through books and healers association were the more educated lot. These were largely concentrated in Kenya among the Kisii community and Uganda among the communities around Mukono and Mayuge Districts.

The different parts of the plant species used for making the herbal medicines are summarized in Table 2. It is noted that the most frequent part of plant species used to treat TB were: whole plant parts mentioned by 32 TMPs followed by roots/tubers and then leaves as well as seeds. The least frequently part of the plant species was the stem.

In terms of inter-country comparisons, TMPs in Kenya use more of whole plant followed by roots/tubers to treat TB. In Uganda, the most frequently used plant parts are roots/tubers followed by whole plant. In Tanzania, the most frequently plant parts are whole plant, followed by leaves and seeds. This finding confirms the observation made by Storr (1995) that roots are the most potent parts of some plants and uncontrolled root harvesting for medicine has severe effect to herbal plants especially when they are in low stock.

The most popular medicinal preparations across all the three countries are: decoction, paste, juice and ash from burnt plant parts. This finding is consistent with the observation made by Kunjani-Joshi et al., (2011) that popular preparations are infusion, decoction, paste or juices. The medicinal uses of the species vary from one district or village to the next district.

Figure 2 carries information on how the recovery rate of TB was known to the TMPs in various study locales. From the figure, it is evident that there are various ways of assessing whether or not their TB patient had recovered after undergoing treatment. About two-thirds of TMPs knew about the recovery of their TB patients either through self-reporting or through other TB patients referred to the TMPs by those who had recovered. It was only in Siaya/Bondo and Teso in Kenya where the patients reported to TMPs that they had recovered as a result of the herbal treatment. Some patients who had recovered from TB were still undergoing treatment for other diseases unrelated to TB as at the time of the study. Most of the patients who knew their recovery status through laboratory testing were from Uganda. None of the Previous TB patients from Tanzania reported that they had undergone laboratory testing.

The TMPs were also unanimous that the recovery rate of patients seeking tuberculosis treatment depended on whether or not they had taken the prescribed dosage regularly and for the recommended duration (an average of about six months). A tracer of some of the previously treated patients who had recovered testified that they had recovered as a result of the herbal treatment. This confirms that most of the local herbalist had a good mastery of indigenous knowledge of the medicinal plants used to treat and/or manage tuberculosis in the Lake Victoria Region in East Africa.

Table 2. Most frequently used parts of plant species to treat TB in Lake Victoria Region.

Plant part	Kenya	Uganda	Tanzania	Total
Leaves and seeds	7	5	10	22
Stem	4	6	8	18
Roots/tubers	9	11	10	30
Whole plant	12	9	11	32
Total	32	31	39	102

There is little doubt that many traditional practitioners have good knowledge and extensively use medicinal plant species and use the plants and their parts to treat various diseases including TB. The commonly used plant parts to prepare decoctions, paste, juice, and powder for treatment were the bark, roots and whole plant which exposes these plant species to extinction. Because of the therapeutic and economic implications of herbal medicines, the plant species used are subjected to destructive harvesting by greedy traders. A negligible percentage of the TMPs made any effort to cultivate the medicinal plant species in their homesteads. Domestication of medicinal wild varieties is constrained by a number factor including misconceptions, attitudes and unawareness on the specific propagation conditions. For example, some assume that domestication either makes other villagers relate the practice to witchcraft or merely lessen medical potency of wild plants (Katende, 1995).

It is apparent that the plant species which were collected from the wild, especially from common areas might become locally extinct when their habitats are destroyed or modified. Of grave concern is the fact that most of the knowledge is concentrated among the older generation of the TMPs and that most of the plant species were not being harvested sustainably. This finding is consistent with Adhikari et al., (2010) who reports that uprooting of Aloe spp and Asparagus racemosus for medicine caused large scale soil erosion in Maradavally forests. They pointed out that unfortunately, localized threats to such simple species is hardly addressed on the grounds that the effect does not conform to UICN red list criteria for declaring an organism threatened species (IUCN, 2007). The critical point of concern here is that even if a species is not categorized a threaded species to IUCN scales, its scarcity to a particular community must have local impact

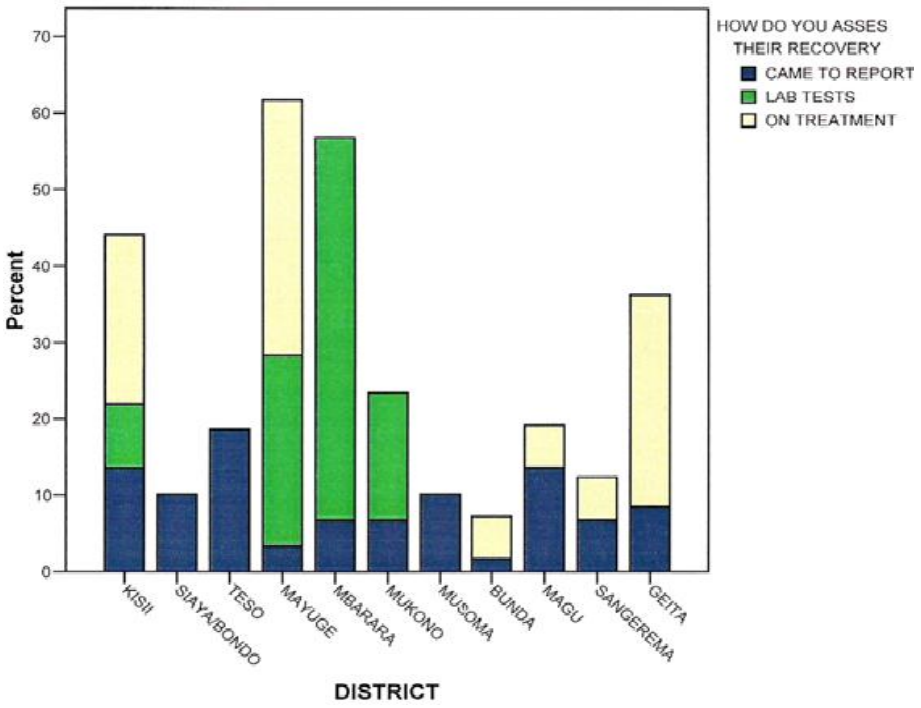

Figure 2. How recovery rate was determined.

that deserves to be addressed locally. Whenever a medicinal plant becomes unavailable, its use is overtaken by less important species, or else, complex concoctions of unpopular medicinal plants are formulated (Arjurn et al., 2009).

Furthermore, because a majority of the rural and urban poor have strong attachment to herbal medicine and also combine spiritual beliefs with therapeutic efficacy, there is need for value addition to ensure the toxicity and sustainability concerns are addressed through systematic research not only in the Lake Victoria Region but also in the Eastern African Region. This concern is also echoed by Kunjani et al., (2011) who observes though some initiatives have already been taken for the conservation and sustainable utilization of the useful species, less priority is given to conserve these resources in an integrated manner.

The causes of tuberculosis were also well known by the TMPs and were consistent with those medically established ones. These included known causes such as: smoking; overcrowding/contacts; bacterial diseases and inheritance (Anyangwe et al., 2006). The study also found that more than three quarters of the TMPs learned about the symptoms, causes and treatment of tuberculosis through parents/relatives of the older generation and dreams. A negligible percentage learned about the treatment of tuberculosis through modem print and electronic media and other sources such as journals/publications, internet or healers associations. The few TMPs who updated their knowledge regarding tuberculosis treatment were the most educated with at least tertiary level of formal schooling.

Among the sampled TMPS, 74% of the older people and 58% of the new or younger generation used medicinal plants and their products to cure various ailments including Tuberculosis. There was a moderately positive and significant relationship between the TMPs' levels of knowledge about the signs of TB and the age of TMPs (r-0.48, P≤ 0.05). The TMPs with more appropriate knowledge were in the advanced age groups of 50 years and above. This finding is consistent with the finding by (Schulters, 1986) who expresses fear that those who hold this useful information may be buried with the information.

CONCLUSION AND RECOMMENDATIONS

This study reveals that the study area is rich with medicinal plants and it is a common trend to use these plant species in local healthcare system especially in the treatment and management of Tuberculosis. A large proportion of TMPs have a rich wealth of diverse indigenous knowledge regarding the symptoms and causes of tuberculosis. Of graver concern is that the TMPs use plant parts such as stem and roots which not only expose these precious medicinal plant species to extinction but also lead to environmental degradation.

It is strongly recommended that major thrust should not only be directed towards documenting and conserving

traditional knowledge but also undertaking an intensive inventory and documentation of useful plant species, their chemical constituents, habitats and potential utilization as raw materials. The study indicates that there seem to be a good potential for their sustainable utilization.

Assessment of herbal or simple medicinal plant species with locally important medicinal value could be better achieved by considering local uses linked to these. This can be achieved by involving communities whose survival is affected by either a loss or abundance of individual plant species in their environments.

As most plants are extracted for their roots and or tubers, total uprooting of non-timber plants for medicine can be reduced significantly through chemical profiling of leaves for possible presence of same active chemotypes of the root. Harvesting of leaves for medicine can have less deteriorating effect due to fast proliferation cycles.

There is a need to establish a link between communities who are dependent on plan species for their primary healthcare and researchers on *ex-situ* conservation of locally important medicinal plants.

Medicinal plants with market value should be treated as important resources for sustainable development through commercial cultivation. Entada abbysinica, Eucalyptus spp and Warburgia ugadensis which were the most popular plant species among the sampled TMPs in the Lake Victoria Region of East Africa are proposed for commercial cultivation.

Finally, top priority should be given to the conservation of the habitat by launching special programs for raising people's awareness about sustainable utilization of medicinal plant species and environmental conservation. Therefore, emphasis should be given to implement some pilot programmes for plantation, domestication and cultivation of useful plant species not only found to treat TB, but also other diseases.

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