



The Practice and Modalities of African Traditional Medicine in Tuberculosis Treatment - A Traditional Medical Practitioners' Perspective

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Authors' contributions

This work was carried out in collaboration among all authors. Author WEC conceptualized the study, designed data collection questionnaires and wrote the first draft of the manuscript. Author TM was responsible for data collection and interviewing of all participants. Authors SM, RDM and TT were responsible for checking collated data and its analysis. Author JC directed the study and reviewed all study protocols. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study sought to explore the role of the traditional medical practitioner (TMP) and document the modalities of tuberculosis (TB) treatment in traditional medicine (TM) in Harare, Zimbabwe.

Study design: An ethnographic research survey of TMPs in Harare urban.

Place and Duration of Study: Harare's southern suburbs of Warren Park, Mufakose, Budiro, Belvedere, Mbare (Mupedzanhamo) and Harare central business district, between April and June 2021.

Methodology: Fourteen (14) experienced TB practitioners, registered with the Zimbabwe National Traditional Healers Association (ZINATHA) were recruited for the study. These included exclusive herbalists (36%), spiritualists (14%) and those who used a combination of spiritualism and herbalism (50%) in their practice. Data was collected through semi-structured in-person interviews. The practices and treatment modalities in the traditional treatment of TB were documented; and any linkages with the conventional medical system were identified.

Results: Forty-six (46) plant species from 28 families were prescribed in various polyherbal combinations for a maximum of 6 months in difficult cases. TMPs were found to be relevant and knowledgeable in the treatment of TB. In addition to offering alternative or complementary treatment options to patients, TMPs were also agents of health education promotion, and collaborated to some extent with allopathic healthcare providers across the service delivery system from diagnosis to treatment of patients.

Conclusion: If formalized, TMPs have the potential to make considerable contributions to TB treatment strategies and help improve treatment outcome in TB patients.

Keywords: Tuberculosis (TB); traditional medicine; traditional medical practitioner; treatment modalities; Zimbabwe.

1. INTRODUCTION

Tuberculosis (TB) is an ancient global public health threat that continues to ravage nations in modern times. Only recently surpassed by the coronavirus (Covid-19), TB is one of the leading causes of death, with an estimated 1.3 million fatalities recorded across the globe in 2022 alone [1,2]. Nationally, TB ranks third in mortality [3]. According to the World Health Organization (WHO) listings, Zimbabwe is one of the top 30 high TB/human immunodeficiency virus (HIV) and high multi-drug resistant (MDR)/rifampicin resistant (RR)-TB burden countries [2]. These high-burden countries account for an estimated 86-90% of the new cases of TB recorded worldwide each year. An upsurge in drug-resistant forms of TB has been observed, and 25% of the cases are from Africa [4-6]. Factors such as poor adherence, co-infection with HIV/AIDS, serious adverse effects of current medicines, inadequate treatment and limited options for anti-TB medicines have all contributed to the emergence of drug resistant strains; and the difficulty of eliminating TB [7-9].

Despite numerous interventions to combat the disease, TB remains a global health challenge. Even the newer anti-TB drug regimen containing

delamanid, bedaquiline, pretomanid and linezolid have been associated with side effects such as cardiotoxicity and QT prolongation, hepatotoxicity, arthralgia, headache, increased blood lipase/amylase, paresthesia, itchiness, and peripheral neuropathy [8,10-12]. This points out to the inherent limitations of recommended treatment strategies which are primarily based on conventional medicine (CM).

Ethnomedicine is an economical, readily available, efficacious and generally perceived to be a safe alternative, that makes up for the inadequacies of CM [13-15]; and could therefore expedite the attainment of universal health cover in TB. However, African traditional medicine (TM) is often missing from formal healthcare systems, and is therefore frequently underutilized as a tool for treating chronic illnesses, including tuberculosis [16]. This is regardless of the widespread reliance on TM either as a substitute, or a complement, to CM [13,17-20]. Traditional medical practitioners (TMPs) have prescribed an assortment of natural remedies in the treatment of TB; and alleviation of TB related symptoms, or side effects caused by conventional anti-TB medicines since time immemorial [17,21]. Plant phytochemicals have been shown to exhibit hepatoprotective,

antioxidant and immunomodulatory effects, in addition to their anti-mycobacterial action [22–25]. Moreover, about 75% of plant based moieties used in drug discovery originate from TM, and plant resources constitute the bulk of approved drugs to date [26,27]. It is therefore imperative for scientists to tap into this useful resource, and determine the extent to which TMPs can contribute towards the elimination of TB. This paper explores the practices and modalities of TM in TB treatment among TMPs in Harare urban, Zimbabwe. Comprehensive documentation of traditional medical knowledge will help in its preservation, formalization, and pave way for potential integration into the formal healthcare systems in the future.

2. METHODOLOGY

2.1 Study Participants

A survey of TMPs registered with the Zimbabwe National Traditional Healers Association (ZINATHA) was conducted from April to June 2021. The practitioners selected were certified TB practitioners, and were each attending to a minimum of ten patients suffering from TB per week at the time of data collection. Convenience sampling (non-random technique) of the TB practitioners in Harare's southern suburbs of Belvedere, Budiriro, Mufakose, Mbare (Mupedzanhamo), Warren Park and Harare-central business district was done. Sample size was determined by data saturation, that is, until no new plants were mentioned by two successive TMPs interviewed. TMPs who were not registered under ZINATHA, and/or had no known history of treating TB were excluded.

2.2 Data Collection

Information was collected from TMPs by means of semi-structured in-person interviews. The interviews were largely informal and comprised both short and open-ended questions in the vernacular language of Shona which all the participants were conversant with. The overall aim of the interviews with the TMPs was to have an enhanced understanding of the treatment modalities for TB using TM, and the role of the TMP. Some of the sub-themes considered included the following;

- a. TMPs understanding of the etiology of TB.
- b. Methods of TB diagnosis.

- c. TB treatment procedures.
- d. Details of the plant remedies used.
- e. Treatment costs.
- f. Any existing collaborations with CM.

3. RESULTS AND DISCUSSION

3.1 Demographic data of TMPs Interviewed

A total of 14 TMPs were recruited for the study as determined by data saturation, 50% of these were classified as both herbalists and spiritual healers. Spiritualism involves bone setting, deep trance, and use of “medical mirrors.” Practitioners were equally distributed between males and females (Table 1). This is in contrast to studies in other African countries where TMPs were mostly women [28,29]. TMPs were generally older, with at least half being over 60 years of age. The majority of the practitioners (71.4%) interviewed were well experienced, with at least 20 years of practice. A similar trend was observed by Lawal and colleagues in South Africa [30]. It appears that the mentorship of younger generations is lacking and there is a huge risk of losing valuable indigenous knowledge systems (IKS) with time [30].

3.2 The Role of the TMP in TB Treatment

3.2.1 Source of knowledge and/or healing power

At least 36% of TMPs came from families of healers who mentored and passed the knowledge to them through oral tradition (Fig. 1). This form of knowledge acquisition and training trend was observed in 100% of exclusive herbalists. Some knowledge is inevitably lost along the way [30] since IKS are not documented. African TMs can be better preserved and disseminated through traditional knowledge (TK) databases. India successfully developed a Traditional Knowledge Digital Library (TKDL) in a quest to preserve and protect its indigenous medicinal systems [31].

Another 36% of TMPs (spiritualists) relied on the guidance of their spiritual guide in the form of dreams, or deep trance in order to perform their role in diagnosis, selection of plants and administration of treatments. “*Mashave*,” more specifically the marine spirits (*shavi renjuzu*), and spirit mediums were also cited as sources of power.

Table 1. Demographic data of TMPs in Harare’s high-density suburbs

	Frequency	Percentage
Gender		
M	7	50.0
F	7	50.0
Age		
20-35	2	14.3
36-45	2	14.3
46-55	1	7.1
56-65	2	14.3
>65	7	50.0
Median age 66		
Mean age 60		
Type of Practice		
Spiritualism alone (incl. divination)	2	14.3
Herbalism alone	5	35.7
Both herbalism and spiritualism	7	50.0
Years of Practice		
0-5	1	7.1
6-10	1	7.1
11-15	2	14.3
16-20	0	0.0
>20	10	71.4

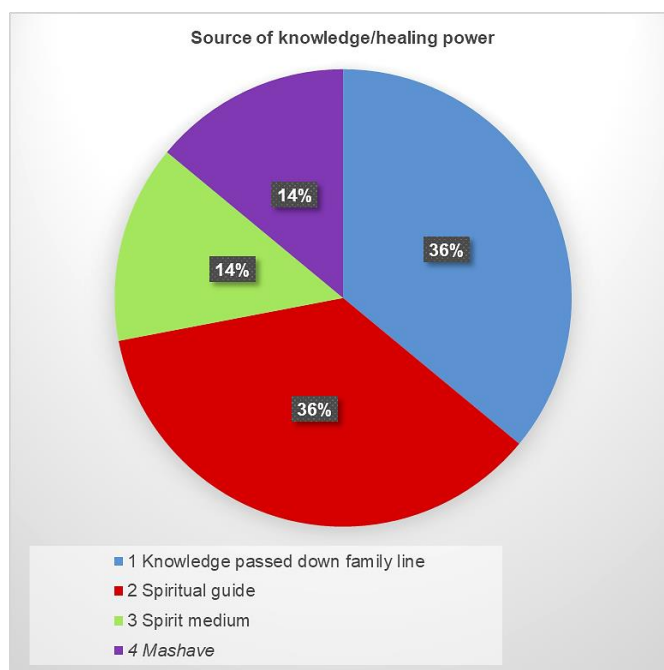


Fig. 1. Source of knowledge/healing powers

3.2.2 Assessment of practitioners’ knowledge on the etiology of TB

Most of the TMPs (64%) attributed TB to occupational and environmental exposure (e.g. dust, and poor air quality); whilst 21% associated TB with spiritual causes (Fig. 2). Bacteria was identified as causing TB in 14% of the

respondents, and these were all exclusive herbalists. All the TMPs appreciated that TB was a highly infectious disease, and some mentioned that they used personal protective equipment when they were treating TB patients. This demystifies the notion that TMPs are deemed ignorant and backward in some communities [32].

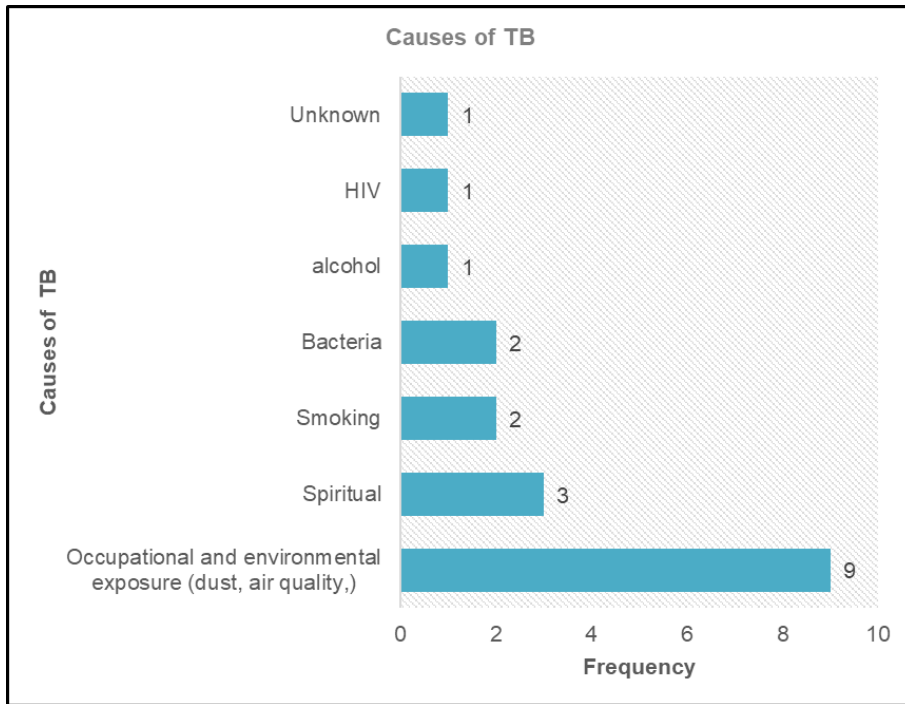


Fig. 2. Causes of TB according to the TMPs

3.2.3 Diagnosis of TB in TM

In our study, and other similar studies, practitioners were able to name the typical clinical manifestations of TB such as weight loss, body aches, fever, chronic cough and phlegm [33]. Divination was sometimes used to determine a patient's diagnosis. More than half of

the TMPs relied on the patient's clinical records for diagnosis of TB, in addition to the patient's history and the clinical symptoms at presentation (Fig. 3). Some herbalists strictly needed proof of the patient's TB test results before initiating therapy. We can therefore infer that there is some degree of collaboration with allopathic care.

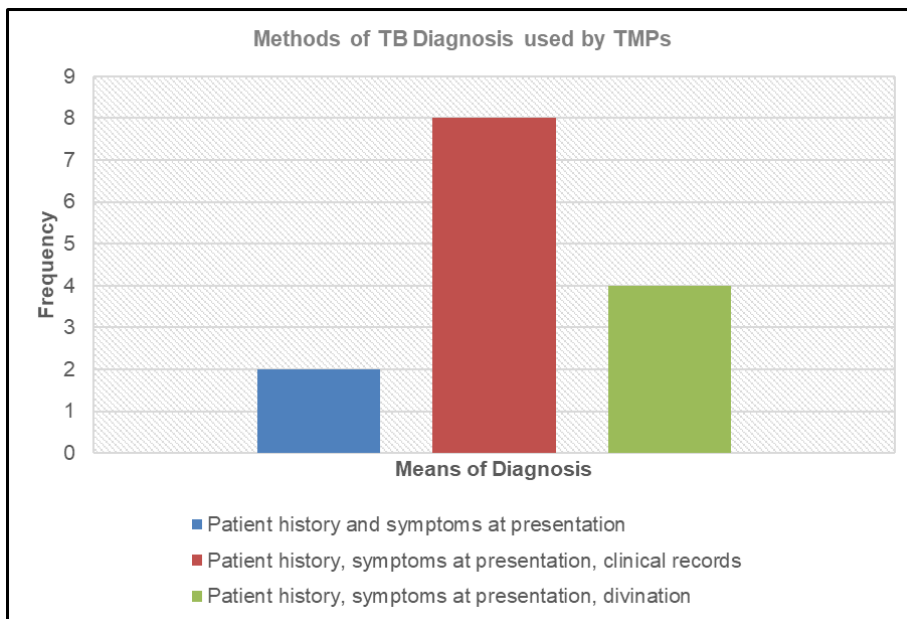


Fig. 3. Methods of Diagnosis used in the traditional treatment of TB

3.2.4 TMPs as healthcare providers in TB treatment

All the practitioners agreed that the likelihood of treatment success was almost always 100% when TB patients were treated with TM (Table 2). They reiterated that they hardly encountered patients who failed to recover from TB, or relapsed after completion of the prescribed course. The TMPs pointed out that it was only in a few instances (1 in 100 cases) that they encountered patients who were difficult to treat, or experienced side effects during treatment. Altering the treatment regimen increased the odds of successful treatment. The recovery of the patient along with the disappearance of clinical symptoms were considered as the primary indicators for successful treatment. However, there was no distinction made between treatment success rates for patients who were exclusively treated by TM, and those who used both TM and CM.

In some instances, TMPs referred the patient to the clinic for confirmatory laboratory diagnostic tests for the patient to be declared TB-free. Additionally, all TMPs reported that they often treated patients who had been informally referred to them from clinics (Table 2). These were usually patients who had responded poorly to drugs, or experienced adverse effects on administration of CM. CM and its practitioners have been shown to draw from TM in the management of many diseases including TB [34]. However, in this study, there was no formal reference system in place between the two healing systems. TMPs (64.3%) generally had no system for record-keeping, and did not usually follow-up on patients. It is therefore vital for practitioners to be trained in aspects of quality assurance and record keeping, in order to enhance their role as healthcare providers.

All the TMPs in the study reported that they encouraged their patients to continue taking anti-TB drugs if they were on the Directly Observed Treatment Short-course (DOTS). For patients not yet initiated on DOTS, spiritualists tended to give patients the option to exclusive TM, whereas herbalists were more pro-concomitant use of TM and anti-TB drugs. Future studies should validate the effectiveness of TMs, and determine potential pharmacokinetic interactions when TMs are taken alongside CMs [15]. Some common herbal medications such as garlic and ginger are known to interact with conventional treatments leading to reduced clearance and raised plasma concentrations [35,36]. Rifampicin is a known

inducer of CYP450 enzymes and p-glycoprotein, and hence the risk of adverse drug-herb interactions could potentially lead to serious toxicity in patients [37,38].

TMPs were seen to play a role in health education and promotion. This is an important aspect of TB care. They encouraged personal health awareness in patients; adherence to DOTS, hygienic practices, and healthy food choices. The inclusion of foods with nutraceutical potential in the formulation of herbal concoctions was notable, and these constituted nearly 40% of the plant species used by TMPs (Table 3). Indigenous vegetables, grains and fruits used included *Bidens pilosa*, *Vigna unguiculata*, *Amaranthus thunbergii*, *Cleome gynandra*, *Sorghum bicolor*, and *Garcinia b Buchananii* Baker. Pharma foods are the new pharmaceuticals, providing both nutritive and therapeutic value [39]; hence, this approach to treatment is highly commendable.

3.2.5 Pricing and affordability of traditional medicine

TMPs charged a consultation fee of between USD1-USD10. There was no standard cost for treatment, which varied from USD1-USD150 per course. The TMPs stated that this fee enabled them to collect and process the medicines. The plants were sourced from all around Zimbabwe including Harare, Bikita, Guruve, Vumba, Nyanga and Chimanimani. The general mode of operation however was that on successful recovery, patients brought a token of gratitude in the form of cash or kind. TM has long been recognized as an affordable and accessible form of treatment for low income populations [15,38].

3.3 Traditional Treatments for TB

TMPs prescribed a wide range of plants for the treatment of TB. Forty-six [46] plant species were mentioned in this survey (Table 3). These belong to 28 families (Table 4). Of these, nine families were mentioned by at least two practitioners in the survey; and these constituted 43% of plant species used for treatment. Previous surveys have similarly found vast differences in the species of medicinal plants used from one healer to another [27]. There are variations in species distribution across the ecological regions of Zimbabwe [14]. Although it was not investigated in this study, it is possible that the TMPs choice of medicinal plants was influenced to some extent by the TMPs place of origin. They exhibited remarkable knowledge of medicinal

plant use, which plant parts to use, some indications and contraindications in their use.

The bark, root and stem were the plant parts used for the majority of the remedies. Dosages administered were somewhat uniform for dried herbs, with a level teaspoon per cup (roughly 250mL) of water taken as a standard measure. These were administered over a variable treatment duration, with 6 months being the longest treatment period taken to eliminate all symptoms, and for patients to show full recovery. The choice of remedies and duration of treatment were informed by the patient's clinical presentation, their response to treatment and medicinal plants available. The role of the particular herb in the treatment regimen was also a factor. For instance, *S. singuenna* was administered only at the beginning of treatment for elimination of phlegm. Plants were also administered as an adjunct therapy for patients on DOTS thereby preventing and reducing the hepatotoxicity brought on by anti-TB medications. This is possibly achieved via the restoration of antioxidant enzymes, which results in a drop in the levels of liver enzymes [39]. In a similar study in Nigeria, the treatment duration did not exceed 12 weeks [39]. This is significantly lower than the 6-12 months usually required in CM. Previous scholars have found high prevalence of concurrent use of TM and CM in some populations [13]. From the interviews with the TMPs in this study, it is possible that most patients seeking TM may have been taking herbal medicines concomitantly with anti-TB drugs, leading to shorter therapies of no longer than 6 months. Future studies will however be required to validate this assertion.

Two or more different plant extracts were combined to make polyherbal remedies taken orally either as a tea or in porridge. This is a common practice in TM in many countries [40,41]. Combining multiple plants potentially enhances synergistic therapeutic action of the various phytochemicals present, whilst

minimizing on toxicity [40,42,43]. Most of these plants are common medicinal plants endemic to sub-Saharan Africa [20]. Some of the plants prescribed such as *Kigelia africana*, *Annona senegalensis*, *Peltophorum africanum* and *Warburgia salutaris* were in agreement with earlier uses of medicinal plants in the treatment of TB, prolonged cough, chest pains, and related symptoms as reported by Gelfand and colleagues [17], and other scholars [13,44]. A significant proportion of the plants have been shown to demonstrate anti-microbial activity *in vitro*, including anti-tuberculosis effects [25,48]. In general, phytotherapy has a multi-dimensional treatment approach which involves symptomatic relief, immune boosting, anti-mycobacterial activity, nutrient supplementation and reduction of hepatotoxicity [45].

Regardless of the wide array of remedies offered, some plant families were somewhat more commonly cited (Table 4). Plant species belonging to the Fabaceae, Canellaceae, Bignoniaceae, Poaceae, Amaryllidaceae, Euphorbiaceae, Asteraceae, Musaceae and Celastraceae families were used for TB treatment by more than one practitioner. The medicinal plants *Xeroderris stuhlmannii*, *Elephantorrhiza elephantina* and *Cassia abbreviata Oliv. var. granitica* (Baker f.) from the Fabaceae family were the most common ingredients in the remedies administered. Fabaceae is one of the largest plant families. Plant species in this family have multiple therapeutic uses which make them relevant in TM [46]. These plants have been reported to contain secondary metabolites such as alkaloids, terpenoids, coumarins, and flavones, which have displayed anti-mycobacterial activity *in vitro* [15,28–30]. Fabaceae plants have also generally shown satisfactory safety profiles [31,47,48]. There is therefore some merit in using these plants in formulating anti-TB remedies, although their pharmacological role in humans still needs to be demonstrated.

Table 2. Record keeping in traditional medicine and linkages with allopathic medicine

Treatment practices	Response (%)	
	YES	NO
Patient record keeping system in place	35.7	64.3
Patient follow-ups	21.4	78.6
Use of referrals by TMPs		
Patients referred to clinics	100.0	0.0
Patients referred from clinics	100.0	0.0
Concomitant use of allopathic medicine		
Patients encouraged to take anti-TB drugs	100.0	0.0

Table 3. Plants used in the treatment of TB

Botanical name	Common/ Venacular (Shona) name	Part of plant used	Preparation of medicine	Duration of treatment
<i>Kigelia africana</i>	Sausage tree/ <i>Mumvee</i>	fruit	The pod is boiled, and the cooled extract is dispensed into a storage container. Two tablespoons of extract are taken 3 times a day for 1 month. OR Powder mixed with porridge and taken 2-3 times a day. OR Infusion is taken orally 2-3 times a day.	1 month
<i>Warburgia salutaris</i>	<i>Muranga</i>	bark	1 level teaspoon of dried powder is taken 2-3 times a day in porridge.	4-6 weeks
<i>Xeroderris stuhlmannii</i>	<i>Murumanyama</i>	root bark stem	One teaspoon powder is mixed with porridge; OR 3-4 tablespoons of dried powder is mixed with 2L water and 2-3 cups taken each day.	3 months
<i>Bidens pilosa</i>	Black jack/ <i>Mutsine</i>	leaf	Leaves are cooked and eaten as vegetables.	6 months
<i>Vigna unguiculata</i>	Cowpeas/ <i>Munyemba</i>	leaf	Leaves are cooked and eaten as vegetables.	6 months
<i>Amaranthus thunbergii</i>	Pigweed/ <i>Mowa</i>	leaf	Leaves are cooked and eaten as vegetables.	6 months
<i>Elephantorrhiza elephantina</i>	<i>Ndorani/ Chizezepasi</i>	root	One teaspoon powder is mixed with porridge on an empty stomach, and taken twice a day.	6 months
<i>Cassia abbreviata</i>	<i>Muvheneka/ Muremberembe</i>	root, bark	Half teaspoon powder is mixed with porridge and taken once daily.	7-21 days, up to 6 months
<i>Musa paradisiaca</i>	Banana	stem	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This is taken 2-3 times daily.	3 months
<i>Aristolochia heppii</i> <i>Merxm.</i>	<i>Chividze</i>	root	One teaspoon powder is added to hot water or porridge, and taken 2-3 times daily.	3 months
<i>Dicoma anomala</i>	<i>Chifumuro</i>	root	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This is taken 2-3 times daily.	3 months
*ND	<i>Mahapa</i>	whole plant	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This is taken 2-3 times daily.	3-6 months
<i>Sorghum bicolor</i>	<i>Mapfunde</i>	grain	Whole grains are mixed with other herbs and soaked in cold water. A cup of this water is used to cook thin porridge, or mixed with a cup of hot water and drunk as tea. The medicine is taken 2-3 times a day,	1 month, followed by review
<i>Ximenia caffra</i> Sond. <i>var. caffra</i>	<i>Munhengeni</i>	root	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This is taken 2-3 times daily.	3-6 months

Botanical name	Common/ Venacular (Shona) name	Part of plant used	Preparation of medicine	Duration of treatment
<i>Guazuma ulmifolia</i> Lam.	Mutamba	root	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This should be taken 2-3 times daily.	3-6 months
<i>Lippia javanica</i>	Zumbani	leaf	The leaves are boiled and drunk as tea.	3-6 months
<i>Cleome gynandra</i>	Munyevehe	leaf	Leaves are cooked and eaten as vegetables.	
<i>Solanum lycopersicum</i>	Mudomasi	leaf	Dried leaves are mixed with other herbs and soaked in cold water. A cup of this water is used to cook thin porridge, or mixed with a cup of hot water and drunk as tea. The medicine is taken 2-3 times a day.	3-6 months
<i>Eleusine coracana</i>	Finger millet/Zviyo	grain	Whole grains are mixed with other herbs and soaked in cold water. A cup of this water is used to cook thin porridge, or mixed with a cup of hot water and drunk as tea. The medicine is taken 2-3 times a day.	3-6 months
<i>Vitex payos</i>	Chocolate berry/ Mutsubvu	bark, root	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This is taken 2-3 times daily.	3-6 months
<i>Peltophorum africanum</i> Sond.	African wattle/ Muzeze		One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This is taken 2-3 times daily.	3-6 months
<i>Gomphocarpus glaucophyllus</i> Schltr.	Blue milkweed/ Gwendere	root	One teaspoon powder is mixed with porridge and taken 1-2 times a day.	7-21 days
<i>Zanthoxylum chalybeum</i> Engl. var. <i>chalybeum</i>	Knobweed/ Mukundanyoka	root	One teaspoon powder is mixed with porridge and taken 1-2 times a day.	Variable, from 7 days to 6 months maximum.
*ND	Kasakosako	whole plant	Honey is mixed with dried plant powder, and a ritual is performed. Concoction is then mixed with porridge, and taken twice a day.	15 days, then review
Honey	Honey/Huchi		Honey is mixed with other medicinal plants and ritual performed. Concoction is then mixed with porridge and taken twice a day. OR Honey is mixed with onion and garlic. One teaspoon of this preparation is taken once a day for up to 3 months for the cough.	15 days, then review, up to 3 months in some cases
<i>Gnidia kraussiana</i> Meisn. var. <i>kraussiana</i>	Manyesa/ Chitupatupa	tuber	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This is taken 2-3 times daily.	3 months
<i>Aloe greatheadii</i> Schönland	Gavakava	leaf	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This is taken 2-3 times daily.	3 months

Botanical name	Common/ Venacular (Shona) name	Part of plant used	Preparation of medicine	Duration of treatment
*ND	<i>Chidavanhu</i>	whole plant	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This is taken 2-3 times daily.	3 months
<i>Dalbergia nitidula</i> <i>Welw. ex Baker</i>	<i>Mudima</i>	root	The root is boiled in water and, the extract drunk as tea, OR 1 teaspoon of dried root powder is mixed with porridge to clear phlegm. This is taken 2-3 times daily for 2 days.	Cleansing for 2 days. Treatment depends on extent of infection.
<i>Allium cepa</i>	Onion	bulb	Honey is mixed with onion and garlic. One teaspoon of this preparation is taken once a day for up to 3 months.	Up to 3 months
<i>Allium sativum</i>	Garlic	clove	Honey is mixed with onion and garlic. One teaspoon of this preparation is taken once a day for up to 3 months	Up to 3 months
<i>Ricinus communis</i> L. <i>var. communis</i>	<i>Mupfuta</i>	root	5g of dried powder are taken in tea or porridge over 1 week.	3-6 months
<i>Senna singueana</i> <i>(Delile) Lock</i>	<i>Mudyamhungu</i>	root	Fresh root is boiled for 8-10 minutes, then the water drunk as tea. This induces vomiting of phlegm, and should be stopped as soon as phlegm is out.	At beginning of treatment only to clear phlegm.
<i>Ozoroa reticulata</i>	<i>Mugara gunguwo</i>	root	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This should be taken 2-3 times daily.	3-6 months
<i>Hypoxis</i> <i>hemerocallidea</i>	African potato	root	One teaspoon powder is taken as tea once a day for 6 weeks	3-6 months
<i>Pittosporum</i> <i>viridiflorum</i> Sims <i>var. viridiflorum</i>	<i>Muchemedza mbuya</i>	bark and leaf	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This should be taken 2-3 times daily.	3-6 months
<i>Securidaca</i> <i>longepedunculata</i> <i>Fresen.</i>	<i>Mufufu</i>	root	Soak root in water and mix until it froths. Taken after initial vomiting of phlegm. Usually taken together with <i>Ozoroa reticulata</i> .	3-6 months
<i>Annona senegalensis</i> <i>Pers.</i> <i>subsp. senegalensis</i>	<i>Muroro</i>	root	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This should be taken 2-3 times daily for chest pains.	3-6 months
<i>Gymnosporia</i> <i>senegalensis</i> (Lam.)	<i>Musosawafa/</i> <i>mugara njiva</i>	leaf, bark, root	One teaspoon powder is mixed with porridge and taken twice a day OR the leaves are chewed.	6 months

Botanical name	Common/ Venacular (Shona) name	Part of plant used	Preparation of medicine	Duration of treatment
<i>Loes.</i>				
<i>Flacourtia indica</i>	<i>Munhunguru</i>	leaf	Leaf is infused in hot water and taken as tea 2-3 times a day.	3-6 months
<i>Albizia antunesiana</i>	<i>Muriranyenze</i>	root	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This is taken 2-3 times daily.	6 weeks
<i>Lannea edulis</i>	<i>Mutsambatsi</i>	root	The root is boiled in water and taken as tea to alleviate chest pain.	6 weeks
<i>Garcinia buchananii</i>	<i>Mutunduru</i>	Bark, fruit	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This should be taken 2-3 times daily.	3-6 months
<i>Baker</i>				
<i>Acacia ataxacantha</i>	<i>Rukato</i>	root	One teaspoon powder is boiled in water to make tea.	3-6 months
<i>DC</i>				
*ND	<i>Gundamiti</i>	whole plant	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This should be taken 2-3 times daily.	6 weeks
*ND	<i>Mucherekese</i>	whole plant	One teaspoon powder is infused in hot water to make tea, or mixed with porridge. This should be taken 2-3 times daily.	3-6 months

*ND: No data. This could be because the plant could not be classified as the traditional healers gave a pseudonym, or gave the name of a polyherbal concoction, or the scientific names/families of the plants used could not be deciphered.

Table 4. The families of plants used in the traditional treatment of TB

Family	Number of plant species used in TB treatment	Number of times cited by TMPs in survey
Fabaceae	9	17
Canellaceae	1	3
Bignoniaceae	1	3
Poaceae	2	2
Musaceae	1	2
Euphorbiaceae	1	2
Celastraceae	1	2
Asteraceae	1	2
Amaryllidaceae	2	2
Verbenaceae	1	1
Thymelaeaceae	1	1
Sterculiaceae	1	1
Solanaceae	1	1
Salicaceae	1	1
Rutaceae	1	1
Polygalaceae	1	1
Pittosporaceae	1	1
Olacaceae	1	1
Lamiaceae	1	1
Hypoxidaceae	1	1
Clusiaceae	1	1
Cleomaceae	1	1
Asphodelaceae	1	1
Aristolochiaceae	1	1
Apocynaceae	1	1
Annonaceae	1	1
Anacardiaceae	2	1
Amaranthaceae	1	1
*ND	5	6

*ND: No data. This could be because the plant could not be classified as the traditional healers gave a pseudonym, or gave the name of a polyherbal concoction, or the scientific names/families of the plants used could not be deciphered.

The use of *D. nitidula* as an anti-TB remedy was also noted in this study (Table 3). Previous authors allude to its use as an expectorant, or for treatment of coughs [49], but not specifically for TB. Its more common uses are in the treatment of snakebites and malaria [49,50]. The anti-mycobacterial potential of this plant therefore calls for more laboratory investigation, which may lead to breakthrough findings in the search for newer drug candidates and adjunct treatments for TB.

The continued use of *Warbugia salutaris* bark was noted with concern, as this is an endangered species in sub-Saharan Africa, and was declared extinct in the Zimbabwean wild in 2008 [51]. Deforestation and climate change continue posing a threat to the availability of medicinal plants in coming years [52]. The practitioners who made use of *Warbugia* appreciated its rarity as they articulated how

difficult it was to obtain its bark for their preparations. There is therefore need to educate and train the TMPs on sustainable harvesting practices and cultivation of medicinal plants in order to protect plant species from depletion. There are currently some efforts to propagate and restore this tree into Zimbabwe's forests [51]. However efforts may be futile if the tree continues to be exploited without some control [51,53].

4. CONCLUSION

TMPs offered an affordable alternative or complementary treatment option for TB. They were found to be actively involved in the TB service delivery system from diagnosis, preparation and prescription of medicines. Practitioners were open to CM, often relying on para clinical testing for diagnosis and indication of treatment success. TMPs had a bi-directional

informal referral system with TB clinics. They were relatively informed about the etiology of TB disease, and had in depth knowledge of medicinal plants and their use. In addition to the treatment and management of TB patients. TMPs were also critical instruments of health education and promotion, fostering health awareness amongst patients.

TM is however still lagging in some aspects. There is need for training on safe harvesting practices and cultivation of medicinal plants to ensure sustainability of herbal medicines. TMPs also need to improve on record keeping and patient follow-ups. Standardization of herbal formulations, their dosages, as well as investigation of potential drug-herb interactions is also critical. Supporting studies on the efficacy, toxicity and related pharmacological activities of TM should be prioritized [32]. Regardless of these limitations, TMPs offer a multi-thronged approach to TB therapy and have the potential to make major contributions to Zimbabwe's TB treatment efforts.

The study was limited to only a few TMPs in Harare. A broader study involving a larger number of TB practitioners across Zimbabwe, and their patients would give a more informed position on TM practice in the country.

CONSENT

All participants gave informed verbal consent after the objectives of the study were clearly explained to them.

ETHICAL APPROVAL

The study was approved by the Joint Research Ethics Committee of the University of Zimbabwe and Parirenyatwa Hospital (JREC/04/2021). Permission was obtained from ZINATHA to conduct the study among its affiliated practitioners.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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