



The use of traditional medicines among mycetoma patients

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Received 19 September 2020; revised 9 October 2020; editorial decision 12 October 2020; accepted 24 November 2020

Background: Mycetoma patients frequently present with advanced disease, the cause of which is multi-factorial, but the use of traditional medicine modalities has been shown to be an important one. Traditional medicine is an integral part of the Sudanese culture and many mycetoma patients revert to it because it is accessible, cheap and available.

Methods: To confirm this anecdotal observation, the pattern and characteristics of traditional medicine use among a group of mycetoma patients seen at the Mycetoma Research Center in Khartoum, Sudan, were studied.

Results: In this descriptive, cross-sectional, hospital-based study, 389 mycetoma-confirmed patients were included. All of them had used traditional medicine at some stage of their mycetoma treatment. Among them, 66% had first consulted traditional healers for mycetoma treatment. In this study, 58% had consulted religious healers known as fakis, while the majority (72%) of those who consulted specialist healers had consulted herbalists. The most frequent type of traditional medicine received by patients from religious healers was al-azima (31%) and the most common treatment given by the specialist healers was herbal medicine (46%).

Conclusion: Traditional medicine can lead to a delay in seeking medical care and serious complications. Collaboration with traditional healers, and training and educating them to refer mycetoma patients to specialised centres is vital to ensure that they receive proper treatment in a timely and efficient manner.

Keywords: healers, Khartoum, mycetoma, Mycetoma Research Center, Sudan, traditional medicine

Introduction

Mycetoma is a chronic granulomatous destructive inflammatory disease.¹ It is caused either by true fungi or bacteria of the actinomycetes class and thus it is classified as eumycetoma and actinomycetoma, respectively.^{2,3} Mycetoma is endemic in tropical and subtropical regions in what is known as the Mycetoma Belt. It extends from America (Mexico and Venezuela) to Africa (Senegal, Mauritania, Chad, Ethiopia, Sudan and Somalia) and Asia (Yemen, Iran and India).⁴ Sudan has the highest reported incidence.⁵

Mycetoma is characterised by a triad of a painless subcutaneous mass, multiple sinuses and purulent or sero-purulent discharge containing grains.⁶ The inflammatory subcutaneous mass often extends to affect the skin, the deep tissues and bone leading to deformity, disability and loss of function, and sometimes it can be fatal.⁷ It usually starts and progresses slowly and gradually and more frequently affects the lower limbs

and hands.⁷ Less often, it affects the head and neck, chest and abdominal walls, as well as the perineal, inguinal and gluteal regions.^{8–10} Most of the affected patients are young adults in the age group of 20–40 y and frequently they are farmers, students and labourers.¹¹ Out of 6792 confirmed mycetoma patients who presented to the Mycetoma Research Center (MRC) up to 2015, 5150 (76%) were males and 1642 (24%) were females and most (4353 [64%]) were aged <30 y at presentation.⁶

Mycetoma is a unique, neglected tropical disease; currently, there is a massive knowledge gap in its epidemiology, in particular its incidence, prevalence and entry route, as well as individual susceptibility and resistance mechanisms.^{7,8} The available diagnostic tools are invasive, expensive and of low sensitivity and specificity.^{9–11} There is a lack of international consensus on the best treatment regimens; there are few medicines available for mycetoma and these have many side effects and toxicity, and are either not available or are inaccessible in most mycetoma-endemic areas.^{12,13} The current treatment outcome

is suboptimal and disappointing, characterised by low cure rates and high recurrence and dropout rates.¹³

Currently, there is no control or prevention programme for mycetoma as its epidemiological characteristics are not sufficiently understood and hence early case detection and treatment are the only available tools with which to reduce its burden and complications.¹⁴

The majority of patients present late with advanced disease. This is attributed to the fact that the disease is usually painless, its slow and gradual onset and progression, patients' low level of health education and poor socioeconomic status, as well as the scarcity of medical and health facilities in endemic regions.^{1,2} Hence, many patients consult traditional healers for management of the condition.¹⁵

Traditional medicine (TM) is an integral part of every culture around the world. According to the WHO, TM is defined as 'the sum total of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness'.¹⁶ In general, it is noticed that where the number of healthcare professionals who practise modern medicine is not sufficient to meet the healthcare needs of the population, particularly in countries with limited resources, TM becomes an essential resource for people's health.¹⁷

In Sudan, many people use TM to cater for their primary healthcare needs as it is part of their culture and belief system and is accessible and affordable.¹⁸ The extensive use of TM in Sudan can also be attributed to the low level of health education and socioeconomic status among patients, meagre health infrastructure and lack of trained health professionals, particularly in rural areas. It is also worth mentioning that traditional healers are available in many towns and villages and are well respected within their communities.¹⁹

The traditional healer is defined as 'an educated or layperson who claims an ability or a healing power to cure ailments, or a particular skill to treat specific types of complaints or afflictions and who might have gained a reputation in his community or elsewhere. They may base their powers or practice on religion, the supernatural, experience, apprenticeship or family heritage'.¹⁹

El Safi categorised traditional healers into general practitioners and specialists. General practitioners include religious healers and 'magic-mongers', while specialists include herbalists, baseers (bonesetters), dayas (midwives) and shallaqs (eye surgeons).¹⁸ There are of two types of Muslim religious healers, fakis and faqirs. The faki is a peddler of religious recipes. Their healing abilities are not as broad as those of the faqir, but people genuinely fear them because they practise black magic. Faqirs are usually descendants of holy men, from whom they inherit baraka (blessing) and office.¹⁸ They have gained credibility among the masses because they are believed to commune with God. They perform general healing but mainly specialise in managing mental illness. The religious healers employ different religious techniques such as the spitting cure (al-azima), the incantations (al-ruqia), the erasure (al-mihaya) and ritual incensing (al-takhriga and al-bakhra).¹⁸

Al-azima is when the healer recites certain Quranic verses or litanies while laying his hand on the patient's head and spitting at the patient after each verse to transfer the blessing. The

al-ruqia is when the healer recites certain Quranic verses to cure the patient while putting his hand on the patient's head.

Al-mihaya is a drink prepared by healers by writing certain Quranic verses on a wooden tablet used to teach Quran. After this writing is washed off then the erased fluid is drunk by the patient.

Al bakhra is prepared by the healer by writing some astrological formulas, magical seals and numerical squares, with certain verses from the Quran. The paper is then folded and burnt in an incense burner and the fumes are inhaled by the patient. Al takhriga is also burnt and inhaled by the patient but it is different in that it is usually composed of an assortment of herbs and some minerals.¹⁸

El Safi also described other TM methods performed by healers and these include some minor surgery, poultices, cupping and cautery. Herbalists rely on the rich Sudanese materia medica, which contains a variety of recipes made of medicinal plants and used for therapeutic nutritive, health-promoting, preventative and cosmetic functions.¹⁸ He mentioned one poultice that is made of the powder of tartus (*Hydnora abyssinica*) to treat mycetoma. A religious healer, Shaikh Musa Al-Azab, was famous for treating mycetoma foot (nubut in Arabic) and people used to call him for help by saying 'ya rajl al-subut kharraj al-nubut' (the one who removes the mycetoma).¹⁸

Although widely used, herbal medicine in Sudan lacks clinical evidence to prove its efficacy and clinical trials are not considered necessary. According to El Safi, many influential and vocal people consider the 'test of time' as adequate proof for the efficacy of herbals in treating different conditions. Through the concept of test of time, herbalists have identified indications for the use of different herbals. Many herbals have been tested and proven to be effective and are widely used for different indications; some of those commonly used in Sudan are haraz (*Acacia albida*) for diarrhoea, harjal (*Solenostemma argel*) for headache, fever and common cold, hernab (*Carissa edulis*) as antifungal, hilba (funegreek) for epigastric pain, joint affliction and abdominal disorders, garad (*Acacia nilotica*) for fever and sore throat and simbil (*Andropogon nardus*) for fever as well as an anti-inflammatory and demulcent.¹⁸

To the authors' knowledge, the only study that has been conducted to investigate the use of TM in treating mycetoma was carried out in Sudan by Ezaldeen et al., and it only explored herbal treatment.²⁰ The late and advanced presentation of mycetoma can be attributed to many causes, but the use of TM is assumed to be the most frequent.²⁰ Therefore, this study was set up to investigate the patterns and determinants of the use of TM in mycetoma treatment, its prevalence and the most common modalities accessed. It was also designed to study the characteristics of those who access TM and the most common types of traditional healers who claim to treat mycetoma, as well as their opinions regarding medical treatment.

Materials and Methods

This was a descriptive, cross-sectional, facility-based study conducted at the MRC, Khartoum, Sudan. After providing informed consent, all patients seen at the centre who agreed to participate from June to December 2019 were included in the study.

A total of 400 mycetoma patients were interviewed but 11 questionnaires were excluded due to incomplete data.

The data were collected in a predesigned, pretested structured questionnaire. The questionnaire consisted of six sections and included patients' demographic characteristics, their self-reported health, general and mycetoma-related visits to traditional healers, the TM provided to them and the different TM modalities used for mycetoma.

The data were managed using a Microsoft Excel spreadsheet. Data were analysed using Epi-Info software version 3.5.1 (Centers for Disease Control and Prevention, Atlanta, GA, USA) to design a data-entry tool. Data were imported to STATA version 11.0 (STATA Corp. LP, College Station, TX, USA). The analysis was conducted via a one-way table to calculate distribution frequency, while inferential analysis was performed by χ^2 and logistic regression. Significant level was set at $p < 0.05$.

Results

The socioeconomic characteristics of interviewed patients

Two hundred and ninety-eight of the interviewed patients (78%) were males, 199 (51%) were adults in the age group 20–40 y and 216 patients (56%) were married. More than 50% were from urban settings (Table 1). Overall, there was a low level of educational attainment, with 18% being illiterate and only 29% receiving primary education.

A significant number of participants were unemployed (29.84%) while 20% were farmers. Most of the women studied (58%) were unemployed and the majority of them (76%) were illiterate or had only received khalwa (primary education) or less. In 104 participants (27%) disease duration was < 1 y; 255 participants (66%) had a disease duration of < 5 y, while 34% had a disease duration of > 5 y.

Health conditions and medical consultations

Three hundred and thirty-five participants (87%) stated that their general health was either 'very good' or 'good', 40 (10%) of them thought it was 'moderate' and only 11 (3%) felt their health was 'bad' or 'very bad'. Thirty-eight participants (10%) had concomitant medical problems, including diabetes (39%), hypertension (21%) or another (40%).

Of the traditional healers consulted, 33% were herbalists, 26% were fagirs, 24% were fakis and 16% were baseers. Most of the women (51%) had consulted a religious healer (either a faki or a fagir). Most of the respondents consulted traditional healers for leg or foot swelling treatment (69%), followed by hand swelling (7%) and the rest recorded diseases affecting the back, groin and other sites; 15% of respondents were aware they had a diagnosis of mycetoma when they consulted a healer.

When asking the respondents about why they had recourse to traditional healers rather than formal (allopathic) healthcare providers and hospitals, 155 of participants (47%) believed that TM was beneficial and 141 (42%) said that they had used it because it was available to them. Only 23 patients (7%) preferred TM over modern medicine because it was cheaper, but 12 (4%) stated that modern medicine was not available to them.

Table 1. The sociodemographic characteristics of study populations

Sociodemographic characteristic	No.	%
Gender		
Male	298	77.7
Female	86	22.3
Age, y		
< 20	52	13.37
20–39	199	51.16
40–59	105	26.99
≥ 60	33	8.48
Marital status		
Single	172	44.33
Married	216	55.67
Highest educational level obtained		
Illiterate	67	17.31
Khalwa	49	12.66
Primary education or less	111	28.68
Intermediate school	54	13.95
Secondary education	69	17.83
Higher education and more	37	9.56
Occupation		
Farmer	77	20.16
Shepherd	19	4.97
Worker	42	10.99
Student	28	7.33
Government employee	14	3.66
Unemployed	114	29.84
Other	88	23.04
Residence		
Rural	153	41
Urban	218	59

In the study, 204 respondents (53%) had consulted traditional healers for mycetoma treatment as their first choice, of whom 21% were women. Also, 181 respondents (47%) had consulted modern healthcare providers first. Urban residents were more likely to have consulted modern healthcare providers first than rural residents (OR: 2.06, $p < 0.05$).

One hundred and sixty-one respondents (43%) consulted a traditional healer based on a friend's advice, 143 (40%) through word of mouth (information passed from another unspecified person), 13% because of another patient's recommendation and very few (1%) through referral from a healthcare provider. Almost half of the respondents (49%) were brought to traditional healers by a family member, colleague or friend while 49% went on their own. One hundred and eighteen of those patients (32%) believed that the traditional healer could treat mycetoma before their visit to the MRC.

Most of the participants (207 [55%]) had consulted only one traditional healer for mycetoma treatment, but 21% had consulted two and 24% more than two. The duration of attendance at the healer ranged from 200 (56%) for ≥ 1 mo, 86 (24%) for > 1 y and 71 (20%) for several years.

Table 2. Unadjusted and adjusted logistic regression models of traditional healer advice to use modern drugs

Independent variable		(Unadjusted) bi-variate model		(Adjusted) multi-variate model	
		OR	p	OR	p
Gender	Female	1	Reference	1	Reference
	Male	1.45	0.464	1.31	0.797
Age, y	<20	1	Reference	1	Reference
	20–39	0.96	0.946	1.89	0.575
	40–60	0.47	0.249	0.52	0.674
	≥60	0.29	0.269		
Marital status	Single	1	Reference	1	Reference
	Married	1.35	0.455	0.79	0.786
Level of education	None	1	Reference	1	Reference
	Khalwa	2.25	0.385	0.97	0.987
	Primary	3.65	0.100	3.33	0.452
	Intermediate	2.63	0.277	10.61	0.616
	Secondary	4.01	0.091	7.74	0.225
	Higher	1.80	0.565	0.48	0.712
Occupation	Unemployed	1	Reference	1	Reference
	Farmer	1.52	0.382	1.95	0.510
	Shepherd	0.57	0.604	0.99	0.995
	Worker	1.08	0.904	1.39	0.757
	Student	0.75	0.716	0.47	0.509
	Government employee Other	0.24	0.070		
Residence	Rural	1	Reference	1	Reference
	Urban	2.45	0.045*	10.31	0.020*
Still visiting traditional healer	No	1	Reference	1	Reference
	Yes	3.68	0.007*	13.60	0.112
Still using traditional medicine	No	1	Reference	1	Reference
	Yes	2.26	0.127	2.08	0.677
Number of visits to traditional healer	1	1	Reference	1	Reference
	2	0.99	0.983	1.08	0.936
	>2	0.98	0.971	1.10	0.923
Type of traditional healer	Faki	1	Reference	1	Reference
	Fagir	1.35	0.555	1.62	0.601
	Baser	0.18	0.111	0.19	0.281
	Herbalist	0.60	0.351	0.58	0.546

*Statistically significant.

In general, during their lifetimes, participants had consulted traditional healers to a varying extent: 140 (38%) had only made 1 visit, 132 (35%) made 2–10 visits and 100 (27%) made >10 visits.

The data collected showed that during the previous year, 53% of the participants had consulted traditional healers at least once, 34% had 2–10 consultations and 13% had >10 consultations with traditional healers.

When investigating the type of traditional healers consulted for mycetoma, it was found that 199 participants (51%) had

consulted a religious healer, of whom 115 (58%) had consulted a faki and 81 (41%) a fagir. Most of the women in the study (52%) had consulted religious healers and 67% of them preferred the faki. The study showed that married participants had consulted a fagir more often than single participants (OR: 2.22, $p=0.007$) and that urban residents consulted a fagir more often than a faki compared with rural residents (OR: 2.9, $p=0.001$).

The study revealed that 276 participants (71%) had consulted specialist traditional healers while some had consulted both a specialist and a religious healer. Of those who consulted a

specialist, the majority (198 [72%]) consulted herbalists while 72 (26%) were treated by a baseer. Significantly more urban residents consulted a baseer compared with rural residents (OR: 0.042, $p=0.031$) (Table 2).

The study showed that 292 participants (77%) had consulted traditional healers prior to receiving medical treatment for mycetoma but that 86 participants (23%) consulted traditional healers even after they had started modern medical treatment. At the time of interview, only 41 respondents (12%) were still using TM and of them 34 (83%) continued using TM because they still believed that it was useful.

Thirty-five participants (10%) were still in regular consultation with traditional healers. Of this group, 45% said that they were discussing medical problems with healers, 10% their medical treatment, while 45% gave other reasons.

Traditional healers advised only 66 participants (18%) to consult medical doctors for mycetoma treatment, 29 (8%) to use modern medicines and 22 (6%) to obtain the medical tests to diagnosis mycetoma. Traditional healers advised urban residents to use modern drugs for mycetoma treatment significantly more often than rural residents (OR: 2.45, $p=0.02$). Mycetoma patients were more likely to continue consulting traditional healers if they had been advised by them to use modern mycetoma drugs (OR: 3.68, $p=0.007$).

TM treatment

In this study, 126 patients (33%) had been receiving mycetoma medical treatment for <1 y, 156 (41%) for 1–5 y, 55 (14%) had been on treatment for >5 y but <10 y, and 44 (12%) for ≥ 10 y. When the participants were asked if the traditional healers had ever advised them to stop using modern medicine, only 4% admitted to having received such advice. In this group of participants, those who continued their consultations with traditional healers were more likely to be advised to stop modern medicine than those who had stopped visiting traditional healers, which is statistically significant (OR: 4.21, $p=0.013$). Patients with more frequent visits to traditional healers were more likely to be advised by traditional healers to stop mycetoma medicines ($p=0.003$).

The participants used different types of traditional religious treatments. One hundred and twenty patients (31%) received al-azima (the spitting cure), 89 (23%) received al-ruqia (the incantations), 111 (29%) received al-mihaya (the erasure) and 104 (27%) received al-bakhra (the ritual incensing). Most participants received more than one traditional treatment modality.

For participants seen by traditional specialists (baseer or herbalist), different types of treatment modalities were used. One hundred and eighty-one patients (46%) received herbal treatment, 174 (44%) had poultices, 102 (26%) had cauterization (Figure 1), 27 (9%) had cupping (Figure 2) and 9 (2%) had local surgical excision (Table 3).

In a few patients (4%), other methods were used, including massaging and moving the leg and washing the wound regularly; in one patient, sulfuric acid was applied at the mycetoma site.

Although 38% of patients used traditional treatment for <6 mo, 12% continued traditional treatment for >10 y.

Thirty patients (8%) admitted receiving surgery from traditional healers. The patients described most of these surgical



Figure 1. Photograph showing a mycetoma patient with cauterization.



Figure 2. Photograph showing a cupping treatment on a mycetoma patient.

interventions (73%) as 'removing parts of the tumour'. One patient stated that a healer bit him to remove the grains of the mycetoma. Seven patients (23%) described the surgical intervention by traditional healers as amputation. The sites of those interventions primarily involved the feet (22 [73%]) and legs (7 [23%]).

The poultices used were mostly composed of *Ac. nilotica* (garad) (27%), *Trigonella foenum* (hilba) (17%), *N. sativa* (kammoon) (16%), *Calotropis procera* (ushar) (8%), *Citrullus colocynthis* (hanzal) (9%) and *Acacia oerfota* (laoat) (3%). One hundred and fifty-eight patients (40%) had tried a variety of other materials, including car battery liquid, car engine oil, tar, vinegar, ghee, bean oil, cactus, tea, salt, olives, eggs, ajeeen (fermented dough), the wax of goat and cows, and tamarind. The majority of poultice users (209 [97%]) applied them directly to the mycetoma site.

In this study, 102 respondents (28%) had cauterization performed by a traditional healer, either directly on the mycetoma site (84%) or around the mycetoma site (16%). Of the respondents, most were treated once (59%), while the rest (41%) were treated two or more times. Thirty-four patients (9%) received cupping;

Table 3. Traditional treatments used to treat mycetoma

Religious treatment (by faki or faqeer)	No.	%
Al-Azima (the spitting cure)	120	31
Al-Ruqia (the incantations)	89	23
Al-Mihaya (the erasure)	111	29
Al-Bakhra (the ritual incensing)	104	27
Other	7	2
Specialist treatment (by baseer or herbalist)	No.	%
Surgery	9	2
1 Amputation	3	10
2 Removing parts of the tumour	23	77
3 Other	4	13
Poultices	174	44
1 Garad (<i>Acacia nilotica</i>)	104	27
2 Hilba (<i>Trigonella foenum</i>)	66	17
3 Kammoon (<i>Nigella sativa</i>)	63	16
4 Ushar (<i>Calotropis procera</i>)	33	8
5 Hanzal (<i>Citrullus colocynthis</i>)	34	9
6 Laoat (<i>Acacia oerfota</i>)	12	3
7 Other	158	40
Cupping	34	9
Cautery	102	26
Herbal medicine	181	46
1 Garad (<i>Acacia nilotica</i>)	69	18
2 Hilba (<i>Trigonella foenum</i>)	36	9
3 Kammoon (<i>Nigella sativa</i>)	38	10
4 Ushar (<i>Calotropis procera</i>)	21	5
5 Hanzal (<i>Citrullus colocynthis</i>)	24	6
6 Laoat (<i>Acacia oerfota</i>)	12	3
7 Moringa Oleifera	8	2
8 Arabic gum (<i>Acacia nilotica</i>)	8	2
9 Other	123	31

for 85% it was performed on the mycetoma lesion; 69% had it performed once and 31% were treated two or more times.

The most commonly used herbal treatment was *Ac. nilotica* (garad) (18%), followed by *N. sativa* (kammoon) (10%) (Figure 3), *T. foenum* (hilba) (9%), *Ci. colocynthis* (hanzal) (6%), *Ca. procera* (ushar) (5%), *Ac. oerfota* (laoat) (3%), *Moringa oleifera* (2%) and *Ac. nilotica* (Arabic gum) (2%). One hundred and twenty-three patients (31%) used other materials for their herbal treatment, including sesame oil, honey, yoghurt, vinegar, garlic, pomegranate peel, dates and various roots. While 109 patients (61%) used one specific herb on its own, 69 (39%) used mixed herbs.

Eighty-eight patients (38%) used herbs as poultices, while 87 (37%) rubbed it on the mycetoma site, 25 (10%) used it in a drink and 21 (9%) washed the mycetoma site with it. While most participants (170 [76%]) used the herbal treatment for <1 y, 38 (17%) used it from 1 to <5 y and 9 (4%) used it for 5–10 y.

In terms of cost, 294 patients (81%) paid <1000 Sudanese Pound (15US\$) for a traditional healer visit; 254 patients (75%) spent the same amount to buy the TM, which is generally cheaper than modern medicine. However, 181 respondents

**Figure 3.** Photography showing a mycetoma patient using Kammoon (*Nigella sativa*).

(48%) believed TM treatment to be more expensive than modern medicine.

Patient satisfaction and complications

While most participants (282 [74%]) stated that they were not satisfied with the traditional treatments used for mycetoma, 284 (75%) were also dissatisfied with the traditional healers they themselves had consulted. The main reason cited for this dissatisfaction was the lack of clinical improvement (98%). Moreover, 270 patients (72%) described the TM they received as useless. The majority of female participants in the study (75%) reported that they were not satisfied with the traditional treatment and, while 238 (64%) showed no change in their condition after using TM, 87 (23%) admitted noticing some improvement with its use.

In the study, 59 patients (18%) reported complications with TM use that included cellulitis, sepsis, fever, allergic reaction, itching and others (Figures 4, 5). Complications were more common among males compared with females (OR: 3, $p=0.024$). Patients in the age group of 20–40 y had more complications than patients aged <20 y ($p=0.046$).

When patients who had complications were asked if they would tell their doctor about these complications, 44% said they would volunteer the information spontaneously, but 51% said they would only tell their doctor if they were asked and 5% said they would never tell them.

Discussion

Regardless of the negative consequences of mycetoma on the lives of patients, families and the community and the heavy burden on the health system in endemic areas, it remains a neglected disease worldwide. The fact that mycetoma treatments are known for being given for long periods and producing low cure rates has resulted in patient dissatisfaction and led to many patients using different traditional treatment modalities. This was established in this study by the fact that a majority of patients had consulted traditional healers for treatment of their disease at some stage.

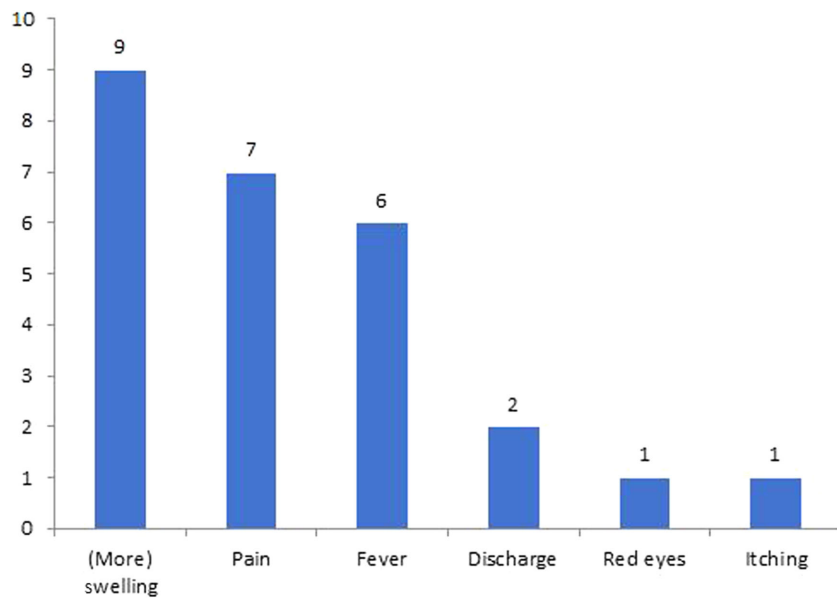


Figure 4. Complications associated with the use of traditional medicine.



Figure 5. Photography showing a mycetoma patient with complications due to cauterization treatment.

The study showed that most of the traditional treatment users were adult males, probably because mycetoma is most often seen in males in this age group 20–40 years.^{1,21–26} The response can also be influenced by the fact that men are more mobile and have both more time and resources with which to reach the MRC than females. Furthermore, women in mycetoma-endemic areas are frequently dependent on their families economically and socially and cannot attend central medical facilities on their own.

Most of the study participants (59%) were illiterate or had received khalwa (Quranic school) or primary education. This is also comparable with the work reported by Satti et al., who reported that 87% of mothers who used TM to treat their children were illiterate.²¹ Ahmed et al. reported that 72% of patients from central Sudan who used TM had only primary education or less.¹⁹ The WHO-SAGE study on the use of TM in middle-income countries reported that TM use was more common among poor, rural and less educated people.²³ Those with low educational achievements have less exposure to knowledge of modern medicine than those who are better educated. Many literate adult males in their 20s access knowledge on mycetoma via social media or the internet. Moreover, education sometimes challenges belief in TM. Illiterate women have a stronger belief in TM compared with men and they resort to healers more frequently for health and social issues. This is also influenced by the fact that these healers are often more available to them as they are based in the same village or nearby villages.

But it is interesting to note that the majority of participants (59%) in this study who used TM came from urban settings. This may be due to widespread cultural beliefs related to the efficacy of TM throughout the whole of Sudan and the recent migration of rural populations, who come with their cultures and beliefs to urban areas. This trend is further influenced by the high cost of modern medicines. As a result, TM has become a resort even for educated people. Women are known to be strong believers and frequent users of TM and are likely to influence other family members in the use of such treatment. More significantly, there are identifiable herbalists and baseers in most urban areas.

In this study, most of the participants attributed using TM rather than modern medicine to the fact that the former is either beneficial (47%) or readily available (42%). Abdelmagid in 2018 in Sudan showed that 76% of participants preferred TM as it is accessible.²⁴ Likewise, the weak health infrastructure,

particularly in rural areas, makes TM the only available modality for most of the affected population.

Only a minority of patients had received advice from their traditional healers to stop medical treatment, probably because those healers are earning a living from their treatments. This is in line with the report by Mohammed and Babikir, who showed that only 2.4% of respondents were advised to stop medical treatment.²⁵

In our study, 32% of patients were advised by their traditional healers to consult a medical doctor, use modern medicine or to get a medical test for their condition. This was significantly more common among urban residents, most probably due to the availability and accessibility of modern health facilities in urban settings. Moreover, some of the traditional healers, specifically in urban areas, who inherited the profession from their families, are both educated and also aware of the limits of TM.

It is reported that some baseers request their patients to bring x-ray images with them to consultations, some fagirs mix mehaya (holy water) with phenobarbitone to calm agitated patients, while some traditional healers request patients to undergo certain laboratory tests.¹⁸ This indicates that healers are becoming more aware of the importance of medical treatment.

In this study, there was a significant association between the urban setting and initial consultation for modern medical treatment rather than TM. This can be explained by better access to health facilities and the health education level in urban settings compared with rural areas.

Almost half of the patients (49%) were brought to a traditional healer by family members, colleagues or friends. This is in line with observations made by Ahmed et al. regarding this behaviour.¹⁹ The tight extended family system in Sudan may explain this practice, as it has a resilient and robust influence on the Sudanese people, who usually rely on the support of their families and friends when they face social, economic or health problems.

Most of the patients in the study (71%) had consulted traditional specialist healers rather than religious practitioners (51%). This is probably because patients preferred to see some physical change or improvement in their mycetoma lesions. Also, specialist healers (baseers and herbalists) usually handle physical ailments while religious practitioners (fakis and fagirs) deal with ailments that may be attributed to spiritual factors such as psychosis.

Among the religious healers consulted, the fagirs were the most popular. This was seen more often among married urban patients and among better educated patients than rural populations. Fakis commonly use black magic and tend to reside and practise in rural areas among poorer and less educated communities where laws against such practices are lax. Most of the women (51%) consulted a religious healer (either a faki or a fagir). This is a frequent practice among many women in Sudan as they go to them not only for health issues but also to ask for blessings on different issues in their lives.

In our study, the religious traditional treatments used were al-azima (the spitting cure) (30%), al-mihaya (the erasure) (29%), al-bakhra (the ritual incensing) (27%) and al-ruqia (the incantations) (23%). This is similar to the distribution of religious methods used by traditional healers to treat epileptic patients, as reported by Mohammed and Babikir,²⁵ where 46% of patients

received al-ruqia, 37% al-azima, 36% al-bakhra and 31% al-mihaya. This highlights that the selection of religious treatment methods has not changed substantially over time.

There was a significant association between urban residents and the type of specialist healer they consulted. Most tend to visit the baseer rather than a herbalist and this can be attributed to the fact that baseers usually practise from their homes or at fixed sites, both of which provide privacy for patients. Herbalists primarily move from place to place carrying their merchandise, which results in less privacy.

It is interesting to note that most patients (77%) started medical treatment after they changed from traditional treatment and had consulted traditional healers before using modern medicine. Some (23%) were still consulting traditional healers even after they started medical treatment and 12% were still using TM because they believed it was useful. This may be because of patients' dissatisfaction with medical treatment, particularly when the results are suboptimal, there are side effects and it is expensive.² Our results are in accordance with a report from Sudan on the use of traditional and spiritual treatment among Sudanese children with epilepsy by Mohammed and Babikir, which showed that 45% of patients used traditional and religious treatment after starting medical treatment and 13% used both modalities at the same time.²⁵

The fact that some of the study population (23%) have been alternating between modern medicine and TM can be attributed to the fact that in most regions in Sudan, and among most cultural groups, illness is seen not only to be a physical issue, but also has supernatural causes that must be addressed. In addition, the belief in herbal treatment is very strong and the use of herbs for sickness is a common everyday practice among most people across different cultures, genders, ages and educational backgrounds. Maintaining visits to traditional healers, while also being seen at the MRC, indicates that those patients do not see a contradiction between the medical and traditional treatment systems and, indeed, consider them as complementary to one another.

The study showed that 27% of patients consulted traditional healers >10 times. This is likely to be because these patients are desperate to be cured. This view is supported by Ezaldeen et al., who reported that 42.4% of mycetoma patients used herbal treatments at some stage in their treatment of disease.²⁰ However, the use of traditional treatment can lead to a delay in receiving appropriate medical care and hence the late presentation of mycetoma with serious complications leading to more local tissue damage, deformity and disability. Ezaldeen et al. reported that 29.3% of patients had such complications while receiving herbal treatment.²⁰

Similarly, Satti et al. studied the pattern and determinants of the use of traditional treatments in children attending a specialised children's hospital in Sudan and reported that 70% of children received traditional treatments prior to attending hospital. This resulted in a delay for 24% of symptomatic children in receiving medical treatment on time.²¹

Most patients who consulted traditional specialist healers received herbal medicine and poultices; *Ac. nilotica* (garad) was the most commonly used herb, both as a poultice ingredient and as herbal medicine. *Ac. nilotica* has been an important element of Sudan's materia medica for generations. Issa et al. reported that

Ac. nilotica was used in western Sudan to treat rheumatic pain, stomach ache, malaria and wounds as well as colds and flu.²⁶

Ezaldeen et al. reported that 10% of mycetoma patients studied used *Ac. nilotica* and 19% used *M. oleifera* as herbs.²⁰ The high incidence of the use of the latter was due to the fact there was a strong belief among the Sudanese population that *M. oleifera* possessed mystical effects in treating many ailments, unlike *Ac. nilotica*. This belief has decreased over the years, hence only 8% of our herbal medicine users had used *M. oleifera*. There is a need to explore the efficacy of *Ac. nilotica* pharmacologically as it has been the number one herbal medicine for Sudanese people for the treatment of many diseases for decades.

Cautery is also a prevalent form of TM performed in Sudan for treating many diseases, such as epilepsy, rheumatic pain and backache; 26% of our patients had cautery performed by traditional specialist healers, although this is less than that reported by Satti et al. (40%) for epileptic patients.²¹

In our study, 18% of patients had TM complications, which is lower than that reported by Ezaldeen et al. in 2013 (29.3%).²⁰ The cause is unclear but could possibly be increased awareness about TM as a probable cause of such complications.

The complications included increase in mycetoma lesion size, pain, fever, discharge and, to a lesser extent, red eye and itching. These complications were significantly frequent among male patients in the 20–40 y age group. The explanation is unclear but is likely to be due to the fact that this is the age group commonly affected by mycetoma.

Ezaldeen et al. reported that 6.4% of patients who developed herbal treatment complications would only inform their treating doctor about them if they were asked, while 1.6% stated that they would deny having complications even if they were asked.²⁰ In our study, 51% of patients stated that they would only tell their doctor if they asked compared with 44% who would tell their doctor of their own accord, while 5% said they would never tell their doctor. This change over time may underlie a significant improvement in patients' perception and knowledge of the importance of medical treatment.

Despite the strong reliance on their use, most of the patients studied (75%) were dissatisfied with TM and traditional healers, mainly because they experienced no improvement in their condition. In 1999, Ahmed et al. reported that 50% of patients were not satisfied with traditional healers.¹⁹ Among epileptic patients treated by traditional healers, Mohammed and Babikir reported that 47.2% of their patients experienced no improvement, while 10% experienced worsening health outcomes.²⁵ The high dissatisfaction encountered among mycetoma patients may be attributable to the inadequate response to TM and also to its complications. Moreover, the religious methods used have psychological effects but no physical impact on disease. These herbs have not been pharmaceutically tested and there is no medical evidence of their efficacy.

The cost of mycetoma traditional treatment, as documented in this study, was high, 15US\$ per visit, which is higher than a general practitioner's visit in Sudan. Half of the patients (48%) believed traditional treatment to be more expensive compared with modern medicine, perhaps because the studied population were patients seen at the MRC where they receive medical treatment for free.

Although the majority of patients confirmed their dissatisfaction with TM, many had continued visiting traditional healers. This may be attributed to the belief element related to TM and also to the delayed results associated with modern medicine.

In conclusion, this study clearly shows that most mycetoma patients had used TM as a treatment modality because of its availability, accessibility, affordability and the scarcity of modern medicine, particularly in mycetoma-endemic areas. However, the use of TM can lead to delays in seeking medical advice and hence the late presentation of mycetoma cases, which can cause serious complications.

The study of the characteristics of TM used for mycetoma and the reasons for its use is important for assessing its effects, potential risks, advantages and disadvantages over modern allopathic treatments. It will also facilitate developing policies and regulations for TM to fulfil the WHO's 2014–2023 Traditional Medicine strategy, as, according to the WHO, Sudan has yet to develop a national policy regarding TM.²⁷

It is essential to collaborate with traditional healers and to educate them regarding their limitations in the effective treatment of mycetoma patients. But with training, healers can be involved in early case detection, reduction of stigma and referral of patients to specialised mycetoma centres for diagnosis and treatment, all of which will prevent further harm to patients. Furthermore, they can be of great help in health education initiatives as they are widely accepted and respected by their communities. Health workers can make use of them as a referral source for patients who require medical treatment. In 1978, the WHO recommended the integration of modern medicine and TM. In its 2014–2023 Traditional Medicine strategy, the WHO recommended that member states harness the potential contribution of traditional and complementary medicine to health, as one of two key goals.²⁸ There is also potential for traditional healers to be trained as village nurses to benefit from their availability as part of the workforce, and their respect and acceptance among their communities. In Sudan, it was reported that traditional birth attendants were highly successful in increasing utilisation of the family planning programme from 10% to 26%, improving feeding practices and the use of oral rehydration therapy among mothers after they had received essential training from the Ministry of Health.²⁹

The presence of an organising body for traditional healers will be helpful in the effort to educate them. Although there is not a formal body for all Sudanese traditional healers that we know of, the herbalists in Sudan have a form of organisation by the name of the Sudanese Herbalists Union. Moreover, a group of researchers from the University of Khartoum and Kamamoto University in Japan have started an initiative to bring together different traditional healers in Sudan and start a project to scientifically verify herbal therapies currently being used for different indications. In February 2020, a large group of traditional healers attended a workshop held to discuss this matter. This is an important step forward in the effort of scientists to collaborate with traditional healers and verify their methods of healing. It can also help traditional healers to organise themselves into one association or group.

Health education programmes and campaigns on mycetoma are needed because it is a painless disease with a slow onset, and, because in Sudanese culture medical treatment is only

accessed when pain escalates and becomes intolerable, the assimilation of traditional healers to help with early identification of cases is a potentially beneficial strategy.

Authors' contributions: AF and EK conceived and designed the questionnaires. EK conducted data collection. AF and EK analysed the data. AF and TY contributed materials and analysis tools. EK and AF wrote the paper.

Acknowledgements: This work was supported by the Program for Nurturing Global Leaders in Tropical and Emerging Communicable Diseases, Graduate School of Biomedical Sciences, Nagasaki University and the Mycetoma Research Center, Khartoum, Sudan. We thank Dr. Ahmed Elamin for conducting the data analysis. Special thanks and gratitude to Dr. Samia Elnagar from the Ahfad University for Women for her valuable comments on the manuscript.

Funding: Not applicable.

Competing interests: None declared.

Ethical approval: The study obtained ethical clearance from Soba University Hospital Ethical Committee (No: 20 190 613).

Data availability: Data available on request.

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