The ingredients and microbiology studies of traditional eye medicine in a teaching hospital in Southwest Uganda

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ABSTRACT

Objective: The aim of this study was to investigate the usage, ingredients, and microbiological profile of Traditional Eye Medicine (TEM) at a teaching hospital in southwest Uganda.
Methods: This was a single-center prospective pilot study that included 11 individuals who used TEM before presenting to a tertiary eye center of the Mbarara University of Science and Technology (MUST) between February 15th, 2017, and February 24th, 2017. We noted the patients' demographics, chief complaints, reasons for using TEM, and duration of treatment. We obtained the 19 samples of TEM and reviewed botanical contents and the microbiologic profile via gram staining, KOH staining, and cultures on blood-heart infusion agar, blood agar, chocolate agar, and potato dextrose agar.
Results: The most common reason for using TEM was cultural belief, followed by the cost of western medications and distance to the eye clinic. Cataracts and allergic conjunctivitis were the most common diagnoses made. The major contents were botanical sources. Sixteen out of 19 samples (84%) showed positive microbial culture; 6 samples were polymicrobial, and 10 were monomicrobial. *Klebsiella* species was the most common microorganism, being isolated from 13 samples. Other bacterial organisms included *Staphylococcus aureus* and *Bacillus* species. Fungal species such as *candida* and *aspergillus* species were isolated as well.
Conclusion: Most of our patients used TEM due to cultural beliefs. Eighty-five percent of the TEM samples showed positive microbiology culture, predominantly with *Klebsiella* species. Further microbiologic studies are warranted to identify the correlation between the use of TEM, corneal contamination, and corneal ulcers.

Key words: Traditional Eye Medicine (TEM), Uganda, Bacterial keratitis, Fungal keratitis

INTRODUCTION

According to the World Health Organization, about 90% of the world's visually impaired people live in low-income countries[1]. The prevalence of blindness is approximately 1% in sub-Saharan Africa (SSA), and the important causes of blindness include cataracts, trachoma, and glaucoma[2]. The estimated population of Uganda is over 33 million, with a prevalence of visual loss of 3.9%[2]. In the paediatric population, visual loss due to corneal ulceration is the second leading cause of subnormal vision in Uganda[3].

Access to eye care is limited in rural areas of Uganda, as there are only about 40 ophthalmologists and 200 ophthalmic clinical officers in the entire country, and most of them practice near the capital, Kampala[3]. Ophthalmic clinical officers, who are nurses or medical personnel with one year of training in ophthalmology, refer patients to ophthalmologists or optometrists, offer surgical assistance, and provide eye care in rural areas. Due to the lack of access to appropriate eye care in the rural areas, Traditional Eye Medicines (TEM) are commonly used in Uganda and other African countries[4-8].

TEM are raw or partially processed materials that are applied to the eye for therapeutic effect[9]. Patients acquire TEM by manufacturing their own or purchasing from traditional healers, who are prescribers of TEM[9]. Although most traditional healers have limited knowledge and training regarding the detrimental properties of TEM, TEM are still widely used due to strong cultural and religious beliefs in Africa[10,11]. A study from Malawi reported that 72% of their patient group used TEM as methods of self-treatment for eye diseases[4]. Known complications from TEM include corneal opacities, staphyloma, corneal ulcers, panophthalmitis, endophthalmitis, uveitis, cataract, bullous keratopathy, and blindness[8,12]. A study from Nigeria reported that 16.7% of childhood blindness was associated with TEM[12].

Although TEM are frequently used and their harmful effects have been described, there are limited data regarding the microbiological investigation of the TEM. The objective of this study was to review the ingredients and microbiological profile of TEM at a teaching hospital in southwest Uganda.

MATERIALS AND METHODS

This was a single-center prospective study that included individuals who used TEM before presenting to a tertiary eye center of the Mbarara University of Science and Technology (MUST) between February 15, 2017, and February 24, 2017. The number of patients seen at MUST is approximately 10,000 annually, and the evaluations and treatments are offered for free. The study received institutional review board approval by the Ethics Committee of MUST, and voluntary informed consent was obtained from every participant. All procedures performed in studies involving human participants were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Interview questionnaires were specifically designed for TEM study and were used during patient interviews. All new patients in the eye clinic were asked about their use of TEM, and those who acknowledge the use of TEM prior to this visit were eligible for this study. These patients underwent full ophthalmologic evaluation by the in-house ophthalmologist, who then diagnosed and provided necessary treatment according to the hospital protocol.

Patients' demographic data included age, gender, and the distance between home and the eye clinic of MUST. We inquired about the ingredients used for TEM, the source, preparation methods, the duration and frequency of use, the cost, any subjective benefits and complications, and specific symptoms triggering the use of TEM. When the patients brought the samples of their TEM on their next visit, those were studied by the microbiology department of MUST. The microbiological studies for TEM involved gram staining, KOH staining, and cultures on blood-heart infusion agar, blood agar, chocolate agar, and potato dextrose agar.

RESULTS

The study included 11 subjects (72% females) who had used TEM prior to their visit at MUST eye clinic during the study period (Table 1). The median age of our patient group was 33 years [range: 5 to 85 years] at the time of their visit. The median distance from their residence and the MUST eye clinic was 30 miles [range: 10 to 100 miles]. The median duration of TEM use was 21 days [range: 1 day to 40 years]. The chief complaints that triggered TEM use in our group included eye pain (4), foreign body sensation (4), decreased vision (2), and itching (1). Ten out of 11 patients used TEM due to their cultural beliefs, which was the most common reason for using TEM. This was followed by the cost of western medications and travel distances to the eye clinic. The primary diagnoses made by the staff ophthalmologist were cataract (3), allergic conjunctivitis (3), trichiasis (1), dry eyes (1), conjunctival concretion (1), pingueculum (1), and squamous cell carcinoma of the eyelid (1). The cost of TEM ranged from 6,000 to 100,000 Ugandan shillings (approximately US$ 1.7 to US$27). Nine reported that TEM helped alleviate the initial symptoms. The original symptom worsened with TEM in one patient, who stopped TEM immediately. Five patients developed new complications, such as eye pain, after TEM use; in fact, 4 out of these 5 patients stopped using TEM due to these complications. One patient continued to use TEM even after noticing eye pain.

Table 1: Patients' demographics and their TEM usage pattern

Patient	Age (years)	Gender	Distance from home (miles)	Chief complaint	Diagnosis	Reason for using TEM	Duration of TEM use
1	78	F	25	Decreased vision	Cataract	Cultural beliefs	40 years
2	28	F	12	Eye pain	Squamous cell carcinoma	Cultural beliefs	3 days
3	85	M	10	Foreign body sensation	Cataract	Cultural beliefs	3 days
4	33	F	100	Eye pain	Allergic conjunctivitis	Cultural beliefs	1 day
5	27	F	16	Eye pain	Pingueculum	Cultural beliefs	4 days
6	27	F	100	Itching	Conjunctival concretion	Cultural beliefs	3 days
7	76	M	32	Eye pain	Cataract	Cultural beliefs	4 years
8	72	F	30	Eye pain	Dry eyes	Cultural beliefs	21 days
9	13	F	54	Foreign body sensation	Allergic conjunctivitis	Distance and cost of western medicine	60 days
10	5	M	84	Eye pain	Allergic conjunctivitis	Cultural beliefs	1 year
11	58	F	30	Eye pain	Trichiasis	Cultural beliefs, cost of western medicine	21 days

Eye pain and foreign body sensations were the most common chief complaint in our study group. Ten out of 11 patients used TEM due to their cultural belief. TEM: Traditional Eye Medicine.

Ten patients out of 11 returned to the clinic with 19 TEM samples. One patient purchased the TEM from a traditional healer, and another individual bought it from the family members. The rest of the patients manufactured the TEM by themselves. The major contents were botanical sources, which were prepared by either squeezing fresh leaves or boiling the leaves. One sample was made with rotten food. Ingredients for TEM included *omuribata* (crepis species), *obugando* (*senegalia senegal*), *omuhire, omutengye* (rotten food), *agashongwire, enyabarashana* (black jack plant), *rokaka* (aloe), *Butabuta* (goat weed), tea leaves, *akihabukuriu* (*oxalis corniculata*), *omujaja* (*ocimum gratissimum*), *akaihabukuru* (*macrotyloma axillare*), *nyakabatura* (*emilia coccinea*), *akacumucumu akakye* (*plectransthus amboinicus*), *egunga***.** A taxonomist at MUST was consulted to identify the local names of the botanical sources, yet we were unable to identify names of two plants as the names differ depending on the villages.

Sixteen out of 19 samples (84%) showed positive results on microbiology culture (Table 2). Six samples showed polymicrobial results, while 10 samples were monomicrobial. *Klebsiella* species was the most common microorganism, which was present on 13 samples. Gram positive species, such as *Staphylococcus aureus* and *Bacillus* species, were shown on five samples. Fungal species, including *candida* (3) and *aspergillus* species (2), were present on 5 samples. Fortunately, none of the patients had concurrent corneal infections.

Table 2: The ingredients and microbiological culture results of TEM

TEM sample	Ingredients in local name	Microbiology culture results	Species
1	Omuribata (Crepis species)	Monomicrobial	*Klebsiella* sp.
2	Obugando (Senegalia senegal)	No growth	No growth
3	Omuhire	Monomicrobial	*Klebsiella* sp.
4	Omutengye (Rotten food)	Monomicrobial	*Bacillus subtilis*
5	Agashongwire	Monomicrobial	*Klebsiella* sp.
6	Enyabarashana (Black jack plant)	Monomicrobial	*Klebsiella* sp.
7	Rokaka (Aloe)	Polymicrobial	*Staphylococcus aureus* and *Aspergillus niger*
8	Goat weed	Monomicrobial	*Klebsiella* sp.
9	Tea leaves	No growth	No growth
10	Akihabukuriu (*Oxalis corniculata*)	Polymicrobial	*Staphylococcus aureus*, *Klebsiella* sp., *Candida* sp.
11	Egunga	Polymicrobial	*Staphylococcus aureus*, *Klebsiella* sp.
12	Enyabarashana (*Black jack plant*)	Polymicrobial	*Klebsiella* sp. and *Candida* sp.
13	Omujaja (*Ocimum gratissimum*)	Polymicrobial	*Klebsiella* sp. and *Candida* sp.
14	Omujaja (*Ocimum gratissimum*)	Polymicrobial	*Staphylococcus aureus and Aspergillus flavus*
15	Akaihabukuru (*Macrotyloma axillare*), Enyabarashana (*black jack plant*), Emilia coccinea (*Nyakabatura*)	Monomicrobial	*Klebsiella* sp.
16	Omuribata	Monomicrobial	*Klebsiella* sp.
17	Akacumucumu Akakye (*Plectranthus amboinicus*)	Monomicrobial	*Klebsiella* sp.
18	Enyabarashana (*Black jack plant*)	Monomicrobial	*Klebsiella* sp.
19	Omujaja (*Ocimum gratissimum*)	No growth	No growth

Sixteen out of 19 samples showed positive results on microbiology culture. *Klebsiella* species was the most common microorganism detected. TEM: Traditional Eye Medicine.

DISCUSSION

We observed a wide range of ages in our study population, which included 11 patients from the age of 5 to 85 years. The median distance from their home to the clinic was 30 miles, and eight patients had to travel more than or equal to 25 miles to be seen. Interestingly, one patient used TEM for 40 years mostly for decreased vision from his cataract. Eye pain and foreign body sensation were the most common symptoms that triggered the use of TEM in our patient group. The most common diagnoses associated with TEM use were cataract and allergic conjunctivitis. Aghaji *et al*[13] reported that cataract and glaucoma were the most common conditions treated by traditional healers in Nigeria.

The majority of our patients used TEM based on cultural beliefs. Eight out of these nine patients believed that TEM helped alleviate their initial symptoms, even though five of them reported developing eye pain from using TEM. Surprisingly, only two patients used TEM due to the high cost associated with western medications, even when the cost of TEM could be as high as 100,000 Ugandan Shillings (approximately 27 USD) when bought from a traditional healer. The cost of TEM from our study was comparable to the cost of treatment offered by traditional healers in Nigeria (a mean cost of 19.4 USD) and South Africa (a mean cost of 20 USD)[13,14]. The majority of individuals manufactured their own or acquired TEM from family members. Only one individual purchased it from a traditional healer. This may be due to the high cost associated with TEM and the convenience of creating their own TEM.

Only one patient reported that the distance was the primary reason for using TEM. These responses were conflicting to a study done in Ivory Coast by Lasker[15] who noted that accessibility was an important factor in choosing the course of therapy. Our results reflect that most patients had faith or belief in TEM, which encouraged the use of TEM as the first-line therapy prior to presenting to the eye clinic. This was contrary to previous studies that reported the cost and affordability were the main reasons for using TEM in Nigeria[16,17]. However, Kayoma *et al*[17] also noted that the majority of their patients still considered using TEM even without the cost aspect because of fewer side effects.

The ingredients for the collected TEM samples mostly consisted of botanical sources, although one sample was made with rotten food. Previous studies reported potential contents for TEM, and examples included soap, alcohol, ground cowries, donkey and cow dung, human sputum, bird and lizard droppings, and urine[7,13,18]. Maregesi *et al*[7] identified preliminary microbes in the sample TEM made with lizard droppings, and its culture demonstrated polymicrobial results including *Streptococcus* species, *Bacillus* species, *Staphylococcus aureus, E. coli, Candida albicans,* and *Aspergillus* species[7]. Our TEM samples predominantly showed *Klebsiella* species, a gram-negative species, which was present in 81% of our samples that were culture-positive. *Klebsiella* species has been associated with corneal ulcer and endophthalmitis[19,20]. *Klebsiella*-specific polysaccharide capsules enable it to resist phagocytosis by the neutrophils, allowing it to invade the eyes more easily, especially in diabetic patients[21]. Additionally, we observed polymicrobial culture results with *Staphylococcus aureus*, *Bacillus subtilis, candida,* and *aspergillus* species. Our data suggest that *Klebsiella* species and fungal organisms be considered as potential causative agents when treating corneal ulcers in Uganda, especially when cultures are unavailable.

A study published by Courtright *et al*[22] suggested that collaborative training programs for traditional healers in Malawi could be associated with positive results, such as lower rates of blindness and bilateral corneal disease from TEM. Our hope is that initiative for training traditional healers in African countries is stimulated by our demonstrating evidence of microbiological contamination of TEM regardless of the method of preparation.

In conclusion, this was a single-center pilot study to understand the pattern of TEM use and the ingredients and microbiologic contents of TEM. The majority of our patients chose to use TEM based on their cultural belief that TEM could treat their eye condition. The longest duration of TEM use was 40 years. Eighty-five percent of the samples collected showed positive growth in microbiology culture, predominantly with *Klebsiella* species. Further microbiologic studies comparing culture results of TEM to corneal samples will be necessary to reveal the association between the use of TEM, corneal contamination, and ulcers. Our findings suggest that there should be larger evidence-based studies to support public health interventions to minimize the use and side effects of TEM.

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