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Original Paper

Ethnobotanical Survey of Medical Plants Used in Treatment of Diabetes in Chipulukusu Compound, Ndola District, Zambia

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Abstract

Background: Almost 70% of the Zambian population depends on traditional medicine and traditional medicinal practices as a source of primary health care. However, there is little published information on local medicinal plants and their preparation in Zambia for the treatment of several ailments including diabetes. Thus, the current study aimed at documenting the local and botanical names of medicinal plants traditionally used in the treatment of Diabetes and their traditional methods of preparation in Chipulukusu compound, Ndola district, Copperbelt province, Zambia.
Methods: This was an Ethnobotanical survey that was conducted among the traditional healers of Chipulukusu compound in Ndola, Copperbelt Province, Zambia from October 2016 to April 2017. Twenty-seven traditional healers registered with THPAZ (Traditional Health and Practioners Association of Zambia) were interviewed. Data was collected using semi- structured interviewer administered questionnaire. Demographic data was analyzed using Microsoft excel by determine percentages and frequency. Plant diversity was analyzed by looking at the species and families of given plants; hence calculation of familiarity index (Fi) and the Relative frequency of citation (RFC).
Results: From a total of 27 traditional healers (THs) interviewed; 56% of them were female while 44% were male. A portion of *20%* of the THs acquired their knowledge on traditional medicine from members of the family mainly grandparents and parents; while *70%* through spirits and dreams and *10%* through an apprenticeship. A total of 26 plant species were collected, identified and classified into 20 families. The most frequently cited plants used to treat diabetes were *Erythrina abyssinica (0.4)*, *Kigelia africana (1)*, *Bidens pilosa (0.7)*, *Carica papaya (1)*, *Azaza garckeana* (0.78) and *Mangifera indica* (1).
Conclusion: The most commonly used plants in the treatment of diabetes were *Erythrina abyssinica,* Kigelia *africana, Bidens pilosa*, *Carica papaya*, *Azaza garckeana* and *Mangifera indica*. The plant parts most commonly used were roots (42%) and all the medicines were administered orally. Most plants were prepared through maceration (54%) of the crude drug.

Key words: Diabetes, ethnobotanical survey, medicinal plants, traditional healers, traditional medicine, traditional medicinal practices

1. Introduction

More than 80% of the population in sub-Saharan Africa depends on traditional medical practices as the primary source of health care [1,2], several factors have been discussed to justify this value In Zambia about 70% of the population depends on traditional medical practices for primary health care. Dispensers of this practice mainly known as traditional healers (THs) or doctors are supposed to belong to an association governing the Traditional doctors [3]. In Zambia this association is called THAPAZ. Despite the existence of this governing body, there has been little published information on local medicinal plants and their preparation in Zambia for the treatment of several ailments including diabetes [4,5,6]. Currently Zambia is experiencing a high

incidence rate of diabetes cases, about 190 per 1000 cases being reported [7]. Many of these patients are likely to use traditional medicine as a sole therapeutic method or as a complement to conventional medicines for so many reasons [8]. To encourage studies that prove efficacy, safety and chemistry of the traditional medicines, there is need for their documentation. Thus, the current study aimed at collecting and documenting the local and botanical names of medicinal plants traditionally used in the treatment of Diabetes and their traditional methods of preparation in Chipulukusu compound, Ndola, Copperbelt province, Zambia.

2. Methodology

Study Site and design

This was an Ethnobotanical survey that was conducted among the traditional healers of Chipulukusu community, an area with high incidences of diabetes [9] in Ndola district, Copper belt province, Zambia. The study was conducted between, October 2016 to April 2017.

Study population, sampling, inclusion and exclusion criteria

Using the Center for Diseases Control EPI stipulated calculator (CDC, 2012). The sample size was calculated to be 30 traditional healers. Considering a 95% confidence interval, a 5% Margin of error. The power of the study was approximated to be 90%. Although the study only accessed 27 traditional healers, representing 90% of the sample size, the study results could still be regarded as valid. Convenient sampling technique was used. In this study, only traditional healers registered with TAPAZ- Traditional Health Practitioners Association of Zambia were included.

Data collection, analysis and presentation

Data was collected using an interviewer administered semi-structured questionnaire. Plant names were given in vernacular by the traditional healers; where possible, plant samples were also collected from interviewees for botanical identification and classification by specialists at Mwekera Forestry College. Demographic data was analyzed using Microsoft excel by determine percentages and frequency. Plant diversity was analyzed by looking at the species and families of given plants; the frequency a given plant family is named, thus enabling the calculation of familiarity index (Fi) and the Relative frequency of citation (RFC). The familiarity index is the frequency a given plant species is mentioned as a medicine by a traditional healer divided by total number of traditional healers interviewed in the study. It is represented by the formula given below:

$$Fi = Na/Nb*100$$

Where *Na* is the number of informants that mention a species as medicine; *Nb* is the total number of respondents. The Relative Frequency of Citation is the number of times a plant species is mentioned by the interviewees. The value ranges between 0 and 1 and is calculated as shown below:

RFC= FC/Rt; where FC- frequency of citation and Rt is total number of respondents.

Data was also presented in forms of tables and graphs showing percentages and frequencies.

Ethical Clearance

During the study, all traditional healers interviewed remained anonymous, the interviewees did not receive any remuneration as participation was completely voluntary. The study was a low risk study since it did not involve any interventions on the respondents. Ethical clearance was obtained from ERES convergence ethics committee (REF No. 2017-MAR-019), following approval from relevant stake holders.

3. RESULTS

Socio-demographic information of the traditional healers: A total of 27 traditional healers of both sexes were interviewed. The tables 1-3 and graphs 1-3 highlight socio-demographic information of the THs.

Table 1- Distribution of traditional healers by sex

Row Labels	Frequency	Percentage
F	15	55.56%
M	12	44.44%
Grand Total	**27**	**100.00%**

Table 2- Level of education among traditional healers according to sex

Education level according to sex	Frequency	Percentage
Females		
Primary education	13	48%
Secondary education	2	8%
Female Total	**15**	**56%**
Males		
Primary education	3	11%
Secondary education	9	33%
Male Total	**12**	**44%**
Grand Total	**27**	**100%**

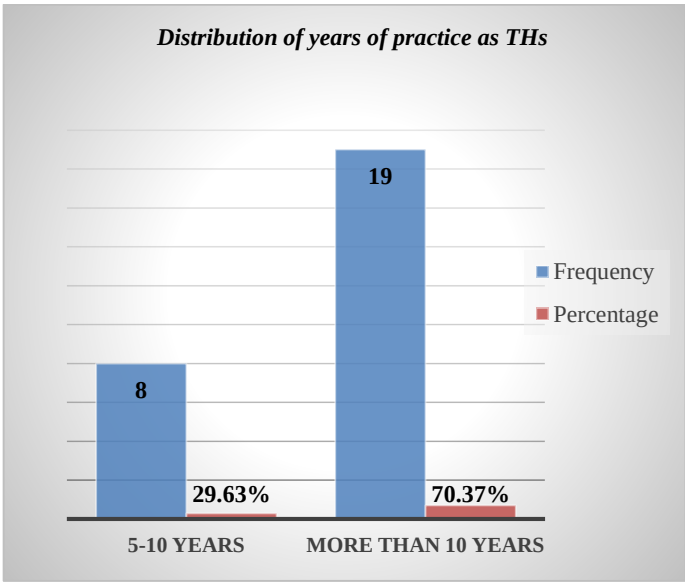

Figure 1- Distribution of years of practice as traditional healers

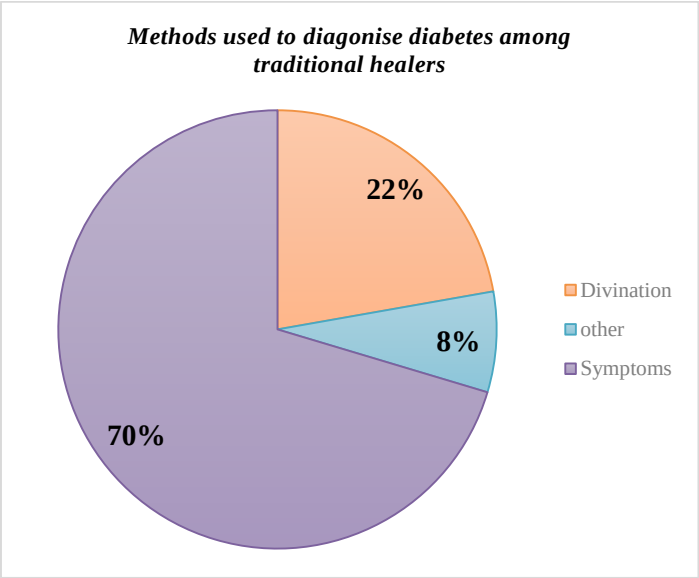

Figure 2- Methods traditional healers used to diagnose diabetes

Table 3- Percentage of traditional healers practicing traditional medicine as a primary occupation according to sex

Practice as a primary occupation	Frequency	Percentage
Females		
No	1	4%
Yes	14	52%
Females Total	**15**	**56%**
Males		
No	4	15%
Yes	8	30%
Males Total	**12**	**44%**
Grand Total	**27**	**100.00%**

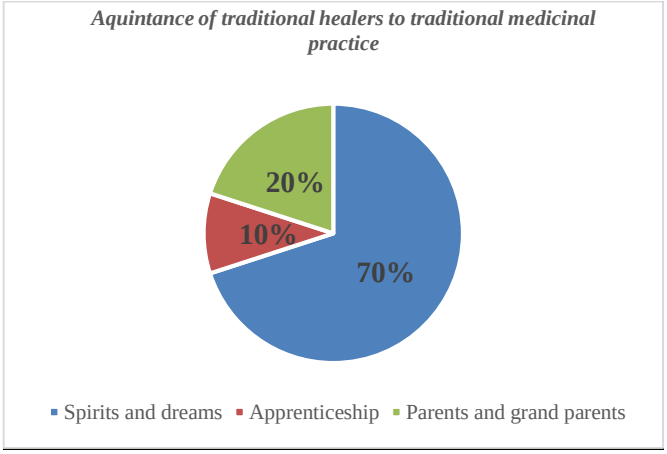

Figure 3- Acquaintance of traditional healers to traditional medicinal practice

Diversity of medicinal plants collected: A total of 26 plant species named by the traditional healers as used in treatment of diabetes was collected, identified and classified into 20 families. The plant parts used and roots of administration were noted. The familiarity index for the given plants was calculated. The tables 4, 5 and 6 given below, show this information in detail.

Table 4- Diversification of plants used in treatment of diabetes in Chipulukusu community

Botanical names	Family	Plant part Used	Method of Preparation	Route of Admin
Erythrina abyssinica	*Fabaceae*	Bark	Decoction	Oral
Saccharum officinarum	*Poaceae*	Outer part	Maceration	Oral
Abelmoschus esculentus	*Malvaceae*	Whole	Maceration	Oral
Moringa oleifera	*Moringaceae*	Leaves, seeds, Roots	Decoction	Oral
Carbonia benedicta	*N.O.compositae*	Leaves	Decoction	Oral
Musa acuminate	*Musaceae*	Whole	Cooked	Oral
Cactus	*Cactaceae*	Leaves	Maceration	Oral
Morus nigra	*Moraceae*	Whole	Eat as fresh fruit	Oral
Cucurbita pepo	*Cucurbitaceae*	Seeds	Roasted and pounded to make porridge	Oral
Kigelia africana	*Bignoniaceae*	Fruits	Maceration	Oral
Ziziphus abyssinica	*Rhamnaceae*	Roots	Macerate and take with milk	Oral
Hymenocardia acida	*Euphorbiaceae*	Roots	Maceration	Oral
Bidens pilosa	*Asteraceae*	Leaves	Maceration	Oral
Carica papaya	*Caricaceae*	Roots	Decoction	Oral
Citrus limonum	*Rutaceae*	Roots	Decoction	Oral
Azaza garckeana	*Malvaceae*	Roots and fruit	Eat fresh fruits Roots macerate	Oral
Cassia abbreviate	*Fabaceae*	Roots	Maceration	Oral
Solanum aculeastrum	*Solanaceae*	Roots	Maceration	Oral
Zanthoxylum chalybeum	*Rutaceae*	Roots	Maceration	Oral
Eleusine coracana	*Poaceae*	Whole	Make porridge	Oral
Aloe vera	*Asphodelaceae*	Whole	Maceration	Oral
Strychnos pungens	*Loganiaceae*	Roots	Decoction	Oral
Swartzia madagascariensis	*Fabaceae*	Roots	Decoction	Oral
Allium sativum	*Alliaceae*	Whole	maceration	Oral
Mangifera indica	*Anacardiaceae*	Leaves	Maceration	Oral

Table 5 - Distribution of families

Family	Frequency	Percentage
Alliaceae	1	4%
Anacardiaceae	1	4%
Asphodelaceae	1	4%
Asteraceae	1	4%
Bignoniaceae	1	4%
Cactaceae	1	4%
Caricaceae	1	4%
Cucurbitaceae	1	4%
Euphorbiaceae	1	4%
Fabaceae	3	12%
Loganiaceae	1	4%
Malvaceae	2	8%
Moraceae	1	4%
Moringaceae	1	4%
Musaceae	1	4%
Compositae	1	4%
Poaceae	2	8%
Rhamnaceae	1	4%
Rutaceae	2	8%
Solanaceae	1	4%
Grand Total	**25**	**100%**

Table 6- Most popular plants with their calculated familiarity index and Relative frequency of citation

Local name	Botanical name	Popularity	RFC	Fi
Umulunguti	*Erythrina abyssinica*	12	0.4	44.4
Umufungufungu	*Kigelia african*	27	1	100
Nakasokopyo	*Bidens pilosa*	19	0.7	70.4
Pawpaw	*Carica papaya*	27	1	100
Amakole	*Azaza garckeana*	21	0.78	78
Mango leaves	*Mangifera indica*	27	1	100

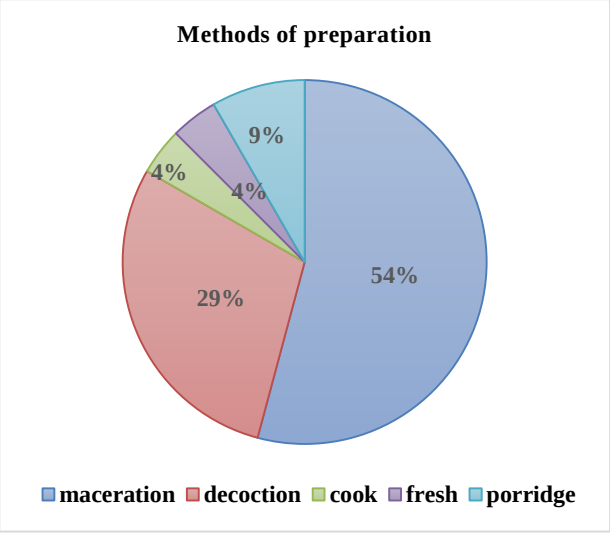

Figure 4- Methods used to prepare plant species

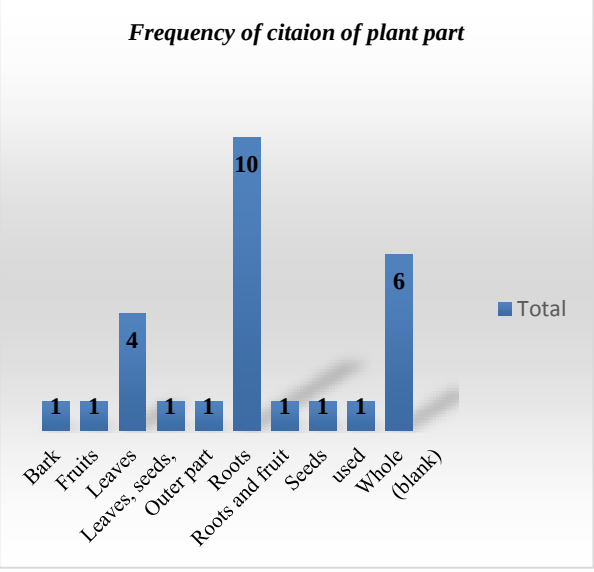

Figure 5- Frequency of citation for plant part utilized by the traditional healers

4. Discussion

It was observed that there were more female traditional healers 15 or (56%) than there were male traditional healers 12 or (44%). It was also observed that the educational status of both male and female interviewees was low, with only 11 (41%) possessing a secondary education background. The study also showed that 22 respondents (82%) depend on traditional medicinal practices as a main source of income and about 70% had been practicing for more than 10 years. These results are like those observed by Ndulo *et al.,* (2001) but differ with results reported by Agunu *et al.,* (2017) who reported more male practitioners with more than 30 years' experience [10,11]. Similar to Agunu and colleagues' stud, 70% of the respondents in this study possess knowledge of diabetes mellitus and based diagnosis on symptoms such as excessive thirst, frequent urination, sweating, tiredness, and heart palpitations which correspond to the clinical symptoms of diabetes [12].

This study documented and identified 25 species. However, 12 plant species that were documented in vernacular, could not be identified as there were no areal plant parts to help with identification. Of the 25-species identified, 6 species with the highest relative frequency of citation included*; Erythrina abyssinica, Bidens pilosa, Carica papaya*, *Azaza garckeana*, *Mangifera indica* refer to table 5. Some of the plant species mentioned in this study like *Mangifera indica, Bidens pilosa, Carica papaya, etc* have also been listed in other ethnobotanical surveys [2,14]. Further, plant species like *Cactus* [15], *Allium sativum* [19], *Cassia abbreviate* [20], and *Kigelia africana* [17], have been reported to give *in vivo* and *in vitro* activity.

The roots were the most frequently used (11 citations) followed by leaves and whole plant refer to fig 2. The extensive use of roots in indigenous recipe may be due to their enriched secondary metabolites [21] as well as, easy and an unlimited availability [22]. Dried plant parts are most commonly used and are mainly administered as a maceration (fig 4), suggesting that the active phyto-ingredients are polar in nature and heat liable thus, guiding future laboratory extractions of the given plant products. Similar to studies conducted in Ethiopia, Kenya, Sesheke and Uganda oral preparations were the most popular [1,2,13,21]. Infact, this study found that all preparations are given orally.

Conclusion

A Total number of 25 Medicinal plants belonging to 20 families were documented. The most frequently cited were *Erythrina abyssinica (0.4)*, *Kigelia africana (1)*, *Bidens pilosa (0.7)*, *Carica papaya (1)*, *Azaza garckeana* (0.78) and *Mangifera indica (1)*. Roots where the most frequently used parts. Maceration was the commonest method of preparation and drugs were administered orally. There is need to carry out similar studies in different parts of Zambia as the results of this study are not representative of the picture in other parts of Zambia. In a bid to provide, safe and efficacious medication to the community, there is need to conduct scientific investigations on the plants mentioned by the traditional

healers.

Declaration of interest

There are no interests to declare

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