Plants used to manage type II diabetes mellitus in selected districts of central Uganda.

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Abstract

Background: Chronic diseases such as diabetes mellitus are increasing in incidence in sub-Saharan Africa. African traditional medicine is part and parcel of the health care system in Uganda. Majority of the indigenous population will have visited a traditional health care practioner or self-administered herbal medicines before seeking conventional health care. However, documentation of the various medicinal plants is still lacking, necessitating a well-organized information search for such knowledge through research. Such information can lay a firm and clear foundation for scientific investigation of the purported therapeutic benefits of the said plants. The objective of this study was to collect names of medicinal plants used to manage diabetes mellitus type II in selected districts of central Uganda.

Methods: In this ethnobotanical survey, names, of plants used to manage diabetes mellitus type II as well as the methods of preparation, routes of administration and the plant parts used in the districts of Mukono, Kampala, Wakiso and Masaka in the central region of Uganda were documented using a researcher administered questionnaire. Participants were recruited using a snow ball approach in which one individual directed us to another. Informant consensus was determined for each of the plants mentioned.

Results: A total of 18 names of medicinal plants were recorded of which Aloe vera var, Solanum indicum and Vernonia amygydalina were the most commonly mentioned plants and thus had the highest informant consensus. Leaves were the main parts that were used to prepare the herbal medicine while water as the solvent used in all the preparations. In all the cases, only the oral route was used for administration of the medicines.

Conclusion: Documentation of medicinal plants used to manage diabetes can further improve on the formalization process of the Ugandan traditional medicine system as well as lay a basis for further scientific investigation with emphasis on the plants whose informant consensus is high.

Key words: Medicinal Plants, diabetes mellitus, Uganda

DOI: http://dx.doi.org/10.4314/ahs.v15i2.24

Introduction

Traditional medicines play a pivotal role among rural communities of developing countries for the provision of health care[1]. Traditional health care is an important part of medical care in Uganda and throughout Africa, representing first line therapy for 70% of the population,[2]. The use of traditional herbal remedies as alternative medicine plays a significant role in Uganda, since it forms part of the culture and beliefs of the indigenous people and features significantly in primary health care[3].

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Unfortunately, clear documentation of these medicinal plants and traditional remedies is still lacking. In Asia, the practice of herbal medicine is extremely well established and documented thus, most of the medicinal plants that have international recognition come from this region especially from China and India. In Africa, attitudes towards traditional, herbal medicines vary strongly. One reason for this is the confusion between herbal medicine and witchcraft, inspite of this, there are millions of Africans who prefer traditional methods of treatment[4].

Non Communicable Diseases (NCDs) in sub-Saharan Africa are an emerging problem and these include diabetes, hypertension among others. The increase in NCDs is due to multiple factors e.g. Adoption of unhealthy lifestyles and the ageing population[5]. Diabetes mellitus is a heterogeneous group of disorders characterized by hyperglycemia (fasting plasma glucose > 7.0mmol/l), or a plasma glucose > 11.1mmol/l two hours after a meal) due to absolute or relative deficiency or diminished effectiveness of circulating insulin[6].

Worldwide, several plants used traditionally for the management of diabetes have been studied for their hypoglycemic activity with positive results further strengthening the argument that medicinal plants could play a role in discovery of novel compounds in the management of several disease including diabetes mellitus. A preparation of the whole plant of Phyllanthusamarus was found to have hypoglycemic effects in 9 human subjects, 4 of whom were diabetic[7]. In streptozotocin induced diabetic rats, phenolic constituents of the heartwood of Pterocarpus marsupium, marsupin and pterostilbene significantly lowered the blood glucose levels and the effects were comparable to metformin[8]. In addition, the hypoglycemic efficacy of Pterocarpus marsupium has been further evaluated in a multicentric (4 centres) flexible-dose open trial in newly-diagnosed patients of non-insulin-dependent diabetes mellitus. Control of blood glucose (both fasting and post-prandial levels) was attained in 67 of 97 patients (69%) studied in 12 weeks and the optimum dose was 2 g of the extract. HbA1c values also decreased significantly[9].

In another study, the chloroform eluted fraction of the petroleum ether extract of the root bark of Salacia oblonga Wall demonstrated hypoglycemic potency in rats when compared to tolbutamide[10]. The alcoholic extract of Inula racemosa lowered blood glucose and enhanced liver glycogen in rats. However, there was no increase in plasma insulin levels nor an increase in the degree of degranulation of beta cells of pancreas. Its action may be at the peripheral level by potentiating insulin sensitivity[11]. The hot water extract of Camellia sinensis significantly reduced the blood glucose level and was found to possess both preventive and curative effects in streptozotocin induced diabetic rats[12] while oral administration of the methanolic extract (but not the water extract) of aerial parts of Artemisia pallens led to significant blood glucose lowering in glucose fed hyperglycemic and alloxan induced diabetic rats[13].

Ocimum album (Holy basil) leaves significantly decreased the fasting and post-prandial blood glucose levels in patients with NIDDM in a randomized, placebo- controlled, crossover, single blind trial[14] and administration of Ocimum sanctum leaf powder to normal and diabetic rats for a period of one month resulted in a significant reduction in fasting blood sugar[15]. Chronic administration of Prunus amygdalus (Almond) seeds and its proportionate fractions viz. defatted seed and oil to rabbits demonstrated a definite hypoglycemic effect. The active factor seems to be non-oil fraction which is only partly soluble in ethyl ether[16] and Significant hypoglycemic effect was observed with 1500 mg/kg dose of juice of leaves of Lantana camara in rats[17]. These and more studies carried out in different parts of the world are clear evidence that clear documentation of medicinal plants can aid their investigation for potential therapeutic compounds.

Due to the expensive costs, unavailability and inaccessibility associated with allopathic treatment of hyperglycemia; there has been a growing interest in complementary and alternative medicine by patients, health care providers as well as researchers[18]. It is thus not surprising that approximately 60% of Uganda's population seeks care from Traditional and Complementary Health Practioners before visiting the formal sector[5].

Despite the high reliance on medicinal plants[4] for different therapeutic benefits, little has been done to document herbal medicines. There is consequently an urgent need to document such plants to provide reference materials for prospective researchers, traditional health practioners as well as the indigenous people, the global community with interest in herbal medicines and the generations to come. The objective of this descriptive study was to document the medicinal plants used in the management of diabetes mellitus type II through a cross sectional survey

Methods

Study areas

The survey was carried out in towns and trading centres: in Masaka (at Lukaya), in Kampala (Banda and Kibuye), in Wakiso (Bweyogerere and Kireka), and in Mukono (Seeta and Mukono town). The study areas where chosen because of their high population density and the high usage of medicinal plants in these areas. The study was carried out between April 2013 and May 2013.

Study method

The survey employed an ethnobotanical approach comprising of interviews using researcher administered questionnaires in four Ugandan districts, Kampala, Wakiso, Mukono and Masaka.

Individual interviews with informants were done to col-

lect ethnobotanical data on the medicinal plants, their means of preparation, routes of administration and the respective parts used to manage diabetes mellitus type II.

Informant consensus

Informant consensus for the different plants was determined by considering how many informants mentioned a specific plant as usable for the management of diabetes mellitus II. This was done after pooling all the data from the different districts. Informant consensus can play a predictive role of the potential therapeutic efficacy of a given medicinal plant[19].

Subject recruitment

Subjects were recruited using a snow ball approach where a subject would direct the researchers to another party with experience in using herbal medicines in management of diabetes mellitus type II. The index participant in each district was identified with the help of the locals. A total of 338 informants were recruited, 92 from Kampala, 90 from Wakiso, 86 from Mukono and 70 from Masaka.

Ethical considerations

Ethical approval of this study was obtained from Mbarara University of science and technology institutional review committee.

Before interviewing any respondent, the study team members explained the objectives of the study, methods and the plan to use the data that would be generated from the interviews would be used. All interviews proceeded only after informed consent was provided.

Data analysis

Each participant was asked about the different medicinal plants they were aware of as usable for the management of diabetes mellitus type two. This information was arranged in such a way that the number of informants who mentioned a given plant was recorded. In addition the plant parts used, routes of administration and the method of preparation for the different plants was also recorded. The data was then summarized in Table 1. Data was categorized by district where plant names were recorded under each district were they were collected to determine how many plants were mentioned in each district. The data was then merged and the overall informant consensus for each of the plants was determined by counting the number of times each plant was mentioned overall. Similarities or differences in the plant parts used, routes of administration and methods of preparation was determined from the data pool.

Results

Medicinal plants used to manage diabetes and their informant consensus

In our ethnobotanical survey, a total of 18 plants were recorded. The highest number of plants (18) were recorded from Masaka and the lowest (15) from Kampala. 17 plants were recorded from Wakiso and from Mukono . Aloe vera var. had the highest informant consensus as it was mentioned by 117 different informants. It was followed by Solanum indicum (92), Vernonia amygydalina (67), Cucurbita maxima (53), and Anona muricata (39). The rest of the plants had an informant consensus ranging from 29 and 5. The plant with the lowest informant consensus was Crassocephalum vitellinum which was exclusively mentioned in Masaka district. The rest of the documented medicinal plants were mentioned in all the four districts except in Kampala where Artocarpus heterophyllus and Leonatis mollisima were in addition not mentioned as some of the medicinal plants used to manage diabetes mellitus II.

Plant parts used, methods of preparation and routes of administration in the management of diabetes.

There was 100% informant consensus on the means of preparation, plant parts used and the routes of administration. Water was the only solvent used in the formulation of all the medicinal plants. In Kampala, 10 informants reported adding honey to Aloe vera formulation in order to improve on its palatability. Leaves were the most used plant parts and were used in 9 of the plants, they were followed by fruits (used in 7 of the plants) and then seeds used in 4 of the plants. Roots were the least used plant part as they were only used in Mondia whyte. In 3 plants (Syzygium cumini, Solanum melongena and Anona muricata) more than one plant part was used for medicinal purposes.

Fruits were used fresh except for Solanum indicum which could be used when dried as well. Leaves, roots and seeds would either be used fresh or dried. In the case where they were dried, they would be pounded and reduced to powder form and kept for reconstitution with water when needed.

Fruits of; Syzygium cumini , Solanum melongena and Solanum indicum could also be cooked and eaten thereafter as an alternative means of preparation. Informants also mentioned that the fruits of Solanum melongena and Solanum indicum were also used as routine vegetables that could be served alongside meals.

Table 1: Medicinal plants used to manage diabetes mellitus type II: parts used and informant consensus.

Sr.	Local name	English Name	Scientific Name	Informant Consensus	Plant part(s) used
1.	Ekigaji	Aloevera	*Aloe vera var.*	117	Leaves
2.	Katunkuma	Bitter Berries	*Solanum indicum*	92	Fruits
3.	Omululuza	Bitter leaf	*Vernonia amygydalina*	67	Leaves
4.	Ensujju	Pumpkin	*Cucurbita maxima*	53	Fruits
5.	Ekitafeli	Graviola	*Anonamuricata*	39	Fruits and leaves
6.	Amatungulu	Natal Plum	*Carissa macrocarpa*	29	Fruits
7.	Omugavu	Albizia tree	*Albiziachinensis*	28	Leaves
8.	Empirivuma	Wild Date Palm	*Phoenix reclinata*	26	Seeds
9.	Omulondo	White's Ginger	*Mondiawhytei*	22	Roots
10.	Bilinganya	Egg plant	*Solanum melongena*	21	Fruits and leaves
11.	Jambula	Java plum	*Syzygium cumini*	19	Seeds and fruits
12.	Akaddo Kanamirembe	Goats' Weed	*Ageratum conyzoides*	18	Leaves
13.	Akabamba	*Natal Indigo*	*Indigofera arrecta*	13	Leaves
14.	Ekifumufumu	Lion's ear	*Leonatis mollisima*	11	Leaves
15.	Entula	Garden egg	*Solanum gilo*	10	Fruits
16.	Ovakedo	Ovacado	*Persea Americana*	9	Seeds
17.	Ffene	Jack fruit	*Artocarpus heterophyllus*	6	Seeds
18.	Ekilalaakuba	-	*Crassocephalum vitellinum*	5	Leaves

Table 2: Medicinal plants used to manage diabetes mellitus type II: routes of administration and methods of preparation

Sr.	Local name	Scientific Name	Route of Administration	Method(s) of preparations
1.	Ekigaji	*Aloe vera var.*	Oral	• Leaves crashed, mixed with water and filtered. Honey may be added as a sweetener. • Leaves may be reduced in size, the jelly drained and left to dry under sun's heat. The dried material can be reconstituted with water
2.	Katunkuma	*Solanumindicum*	Oral	• Fruits can be crushed, mixed with water and filtered • Fruits can be dried, pounded into a powder and reconstituted with water and then filtered • Fruits can be cooked and eaten
3.	Omululuza	*Vernonia amygydalina*	Oral	• Fresh leaves can mixed with water and then squeeze to express the juice out. • Leaves may be shade dried, reduced into a powder and later reconstituted
4.	Ensujju	*Cucurbita maxima*	Oral	• Fruit is reduced in size and crushed. After water is added and the juice is filtered off.
5.	Ekitafeli	*Anonamuricata*	Oral	• Fruits are eaten when ripe or reduced, crushed and expressed to make juice • The leaves are reduced in size shade dried and reduced further to a powder that can be reconstituted with water. • Leaves may also be crashed fresh, mixed with water and then filtered to make a debris free solution
6.	Amatungulu	*Carissa macrocarpa*	Oral	• Fruits are eaten fresh or can be crashed, water added and the mixture is filtered to make a juice
7.	Omugavu	*Albiziachinensis*	Oral	• Leaves are crashed, water is added and the mixture is filtered • The leaves are reduced in size, shade dried and reduced further to a powder that can be reconstituted with water
8.	Empirivuma	*Phoenix reclinata*	Oral	• The seeds are dried, roasted and then crashed into powder. The powder can be reconstituted with water. Or the seeds may be crashed after drying without roasting them.
9.	Omulondo	*Mondiawhytei*	Oral	• The roots are crashed, water added and then filtered to make a clear solution • The roots may be chewed directly
10.	Bilinganya	*Solanum melongena*	Oral	• The fruits are reduced in size and cooked. The soup and the fruits are consumed. • The leaves are crashed, water is added and then the solution is filtered. • The leaves are reduced in size, shade dried and reduced further to a powder that can be reconstituted with water
11.	Jambula	*Syzygium cumini*	Oral	• Fruits are cooked and consumed, leaving the seeds behind • The seeds are dried and crashed into a paste. The paste is reconstituted with water and filtered to make a solution
12.	Akaddo Kanamirembe	*Ageratum conyzoides*	Oral	• The leaves are crashed, water is added and then the solution is filtered. • The leaves are reduced in size, shade dried and reduced further to a powder that can be reconstituted with water
13.	Akabamba maliba	*Indigofera arrecta*	Oral	• The leaves are crashed, water is added and then the solution is filtered. • The leaves are reduced in size, shade dried and reduced further to a powder that can be reconstituted with water
14.	Ekifumufumu	*Leonotis mollisima*	Oral	• The leaves are crashed, water is added and then the solution is filtered. • The leaves are reduced in size, shade dried and reduced further to a powder that can be reconstituted with water
15.	Entula	*Solanum gilo*	Oral	• The fruit is reduced in size and cooked. The soup and fruits are consumed
16.	Ovakedo	*Persea Americana*	Oral	• The seeds are dried and crashed into a powder. The powder is reconstituted with water
17.	Ffene	*Artocarpus heterophyllus*	Oral	• The seeds are dried and crashed into a powder. The powder is reconstituted with water
18.	Ekilalaakuba	*Crassocephalum vitellinum*	Oral	• The leaves are crashed, water is added and then the solution is filtered. • The leaves are reduced in size, shade dried and reduced further to a powder that can be reconstituted with water

Discussion and conclusion

The survey unveiled a wide range of plants used to manage diabetes mellitus type II. All the participants had used herbal medicines before but not necessarily for the management of diabetes. This finding could have been partly due to the snow ball approach employed. It is also consistent with WHO findings that point out a high dependence on medicinal plants and traditional health care methods for management of different ailments[20].

Aloe vera var was the most commonly used plant to manage diabetes mellitus and its hypoglycemic activity has been somewhat extensively studied[21,22]. Aloe vera was followed in frequency of use by Solanum indicum, Vernonia amygydalina , Cucurbita maxima, Anona muricata, Carissa macrocarpa, Albizia chinesis, Phoenix reclinata, Mondia whytei, Solanum melongena, Syzygium cumini, Solanum gilo, Persea Americana and Artocorpus hetephyllus in that order. However, plants like Lantana camara, Catharanthus roseus and Camellia sinensis though present in Uganda and in the study areas were not mentioned in the traditional management of diabetes though they are used in other parts of the world like India. This could imply the need to integrate information from elsewhere in the world in the assessment of potential medicinal plants but could also indicate variation in phytochemical composition due to geographical differences.

Informant consensus on the different plants used is important as it gives a guideline on which plants may actually possess therapeutic benefits. According to Trotter and Logan[19], this can aid prioritizing medicinal plants for further study. It was thus of importance to consider this parameter as it can further guide other researchers in choosing which plants to study for potential lead compounds in drug discovery.

The minimal use of roots as a medicinal plant part noted in this study, is considered a good indicator as this prevents the destruction of the plant hence facilitating conservation and future propagation[23,24]. The predominant use of leaves is inconsistent with Gidday and colleagues'[25] study in Ethiopia which documented roots as the most used plant part but consistent with Tabuti's study in Budiope county in Uganda[26]. The predominance of the oral route for administration is also consistent with several other studies like Tabuti's[26] and Gidday[25]. This predominance in the use of the oral route may be because the other routes may not be possible due to the complexities that may be involved in the formulations needed to use other routes and requirement for a higher degree of expertise.

Limitations

There is a possibility that many more plants could have been documented if the study had been done in a wider area for a longer time. Also the time spent with the informants was little (about 10 minutes) and this may not have allowed the informants to exhaust all the information they had. The study was limited by time constraints. In addition, the informant's knowledgeability and experience was not ascertainable thus leaving a possible gap of us being provide with inaccurate information. Some informants wanted motivation in the form of money. This could not be availed due to resource and financial constraints. This could have impact negative on the quality of information such applicants provided.

Conclusion

From this survey, medicinal plants used in the management of diabetes mellitus II in selected districts of Central Uganda were identified and recorded. This activity is crucial for formalization of the traditional medicine sector in Uganda. The identified plants especially those with a high informant consensus should further be evaluated scientifically to ascertain existence of therapeutic benefits for diabetic patients or the absence of such. In addition, similar studies should be carried out in other parts of Uganda to further enrich the information available on medicinal plants used to manage diabetes.

Acknowledgement

The project described was supported by the MESAU-MEPI Programmatic Award through Award Number 1R24TW008886 from the Fogarty International Center. The content is solely the responsibility of the authors and does not necessarily represent the official views of the Fogarty International Center or the National Institutes of Health.

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