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Ethno-botanical survey of medicinal plants traditionally used against Diabetes mellitus in the Eastern Kinshasa City, Democratic Republic of the Congo

[Enquête ethnobotanique sur les plantes médicinales utilises en Médecine Traditionnelle contre le diabète dans la partie Est de la ville de Kinshasa, République démocratique du Congo]

Koto-Te-Nyiwa Jean-Paul Ngbolua[1, *], Emmanuel Lengbiye Moke[1], Colette Masengo Ashande[1, 2], Monizi Mawunu[3], Clément Inkoto Liyongo[1], Félicien Mushagalusha Kasali[4], Robijaona Rahelivololoniaina Baholy[5], Dorothée Tshilanda Dinangayi[6], Damien Tshibangu Sha-Tshibey[6], Pius Mpiana Tshimankinda[6]

[1]*Département de Biologie, Faculté des Sciences & Technologies, Université de Kinshasa, B.P. 190 Kinshasa XI, République Démocratique du Congo*

[2]*Département de l'Environnement, Faculté des Sciences, Université de Gbado-Lite, B.P. 111 Gbado-Lite, République Démocratique du Congo*

[3]*Departamento de Agronomia & Jardim botânico do Instituto Politécnico da Universidade Kimpa Vita, CP. 77, Uíge, Angola*

[4]*Département de Pharmacie, Faculté des Sciences Pharmaceutiques et Santé Publique, Université Officielle de Bukavu, B.P. 570 Bukavu, République Démocratique du Congo*

[5]*Ecole Doctorale du Génie des Procédés et Systèmes Industriels Agricoles et Alimentaires, Université d'Antananarivo, Campus universitaire d'Ankatso, B.P. 566 Ambohitsaina, Antananarivo, Madagascar*

[6]*Département de Chimie & Industries, Faculté des Sciences & Technologies, Université de Kinshasa, B.P. 190 Kinshasa XI, République Démocratique du Congo*

Abstract

An ethnobotanical survey was conducted among traditional healers and herbalists in eastern Kinshasa (Democratic Republic of the Congo) to identify medicinal plant species traditionally used to treat diabetes mellitus. Fifty traditional healers and herbalists selected through the snowball sampling method were interviewed about plant species used in indigenous medicine to treat diabetes mellitus in Kinshasa city. Cited plant taxa were collected and identified at the Herbarium of the Faculty of Science & Technology, University of Kinshasa. Their ecological status was determined. Most respondents were male (58%), with a sex ratio 1.38. According to the marital status of respondents, single persons represent 42%, followed by married (32%), divorced (20%), and widowed (06%), respectively. Out of 50 persons interviewed, the most represented age group comprises individuals of >50 years. Most informants have a secondary school educational background (46%). In Kinshasa city, medicinal plants for treating diabetes mellitus are divided into 19 families, 25 genera, and 27 species. The culture/crop and forest plant species represent the most (37.04% each). The ecological and phytogeographical spectra revealed a predominance of trees (33.33%), microphanerophytes (48.15%), mesophytes (85.19%), sarcochores (66.67%), and pantropical species (40.74%). 68% of the population of Tshangu district in Kinshasa city uses Traditional Medicine, against 32% who are interested in modern medicine. 63% of them believe that medicinal plants can cure diabetes, 31.5% believe that plants improve their health, and 15% of the population surveyed believe that medicinal plants have side effects. The leaves are the most used part (40.74%), followed by the roots (25.93), fruits (18.52%), grains (7.41%), flowers, and stems (3.7% each). Promoting *ex-situ* conservation of some of these useful medicinal plants through *in vitro* cell culture will permit the preservation of these phyto-resources.

Keywords: Indigenous knowledge, medicinal plants, *ex-situ* conservation, metabolic diseases, diabetes mellitus.

*Auteur correspondant: Koto-Te-Nyiwa Jean-Paul Ngbolua (jpngbolua@unikin.ac.cd). Tél. : (+243) 816 879 527

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Résumé

Une enquête ethnobotanique a été menée auprès des guérisseurs traditionnels et des herboristes de la partie Est de la ville de Kinshasa (République Démocratique du Congo) afin d'identifier les espèces de plantes médicinales traditionnellement utilisées pour traiter le diabète sucré. Cinquante guérisseurs traditionnels et herboristes sélectionnés par la méthode d'échantillonnage en boule de neige ont été interrogés sur les espèces végétales utilisées en médecine indigène pour traiter le diabète sucré dans la ville de Kinshasa. Les taxons végétaux cités ont été collectés et identifiés à l'herbarium de la Faculté des Sciences & Techniques, Université de Kinshasa. Leur statut écologique a été déterminé. La majorité des enquêtés étaient des hommes (58%) avec un sex-ratio de 1,38. Selon l'état-civil des répondants, les célibataires représentent 42% suivis respectivement des mariés (32%), des divorcés (20%) et des veufs (06%). Sur 50 personnes interrogées, la tranche d'âges la plus représentée est constituée par les individus de >50 ans. La plupart des informateurs ont un diplôme d'études secondaires (46 %). Dans la ville de Kinshasa, des plantes médicinales utilisées pour le traitement du diabète sucré sont regroupées en 19 familles, 25 genres et 27 espèces végétales. Les espèces végétales de culture/culture et forestière sont les plus représentées (37,04% chacun. Les spectres écologique et phytogéographique ont révélé une prédominance des arbres (33,33%), des microphanérophytes (48,15%), mésophytes (85,19%), sarcochores (66,67%) et espèces pantropicales (40,74%). 68% de la population du district de Tshangu de la ville de Kinshasa utilisent la Médecine Traditionnelle contre 32% qui s'intéressent à la médecine moderne. 63% d'entre eux croient que les plantes médicinales peuvent soigner le diabète sucré, 31,5% appuient que les plantes améliorent leur état de santé, et 15% de la population interrogés pensent que les plantes médicinales ont des effets secondaires. Les feuilles sont la partie la plus utilisée (40,74%) suivies des racines (25,93), fruits (18,52 %), graines (7,41 %), fleurs et tige (3,7 % chacun). Promouvoir la conservation *ex-situ* de certaines de ces des plantes médicinales utiles par culture cellulaire *in vitro* permettront la conservation de ces phyto-ressources.

Mots clés : Savoir endogène, plantes médicinales, conservation *ex-situ*, maladies métaboliques, diabète sucré

1. Introduction

Diabetes is a severe chronic disease that occurs when the pancreas does not produce enough insulin or he body cannot use the insulin delivered effectively (WHO, 2016).

Diabetes mellitus is a metabolic disease responsible for erectile dysfunction in men (Maiorino et al., 2014) and constitutes a serious public health problem worldwide. It is a chronic condition that results in high blood sugar levels. According to the World Health Organization (WHO), diabetes mellitus is a chronic, metabolic disease characterized by elevated blood glucose level, which leads over time to damage to the heart, vasculature, eyes, kidneys, and nerves. Type 2 Diabetes mellitus is one of the most common metabolic disorders worldwide, and its development is primarily caused by a combination of two main factors: defective insulin secretion by pancreatic β-cells and the inability of insulin-sensitive tissues to respond to insulin (Roden and Shulman, 2019). Diabetes mellitus occurs when the sugar concentration is above 1.4 grams per liter. The chronic excess of sugar in the body is caused by a dysfunction of the pancreas, which no longer typically produces the insulin responsible for breaking down the glucose the diet provides. In addition, it can be promoted by disorders in the use of glycolysis in muscle tissue cells, hereditary and environmental factors, and other pathologies (Deteix, 2005).

Diabetes mellitus affects many people, especially in low-and middle-income countries. The number of deaths in 2021 is estimated at 6.7 million. In 2030 and 2040, the diabetic population is estimated to increase to 643 and 783 million, respectively (Kasali et al., 2022). Furthermore, its prevalence is expected to increase, reaching 578 million people by 2030 and 700 million by 2045 (Saeedi et al., 2019).

The impact of diabetes on the body manifests itself in the form of severe complications and other disorders (metabolic, degenerative, infectious, ketoacidosis, cardiovascular, and renal conditions). According to the WHO, there are an estimated 135 million diabetics worldwide, with a projected 300 million people likely to be affected by 2025 (WHO, 2016). According to the International Diabetes Federation (IDF), the estimation in an age-adjusted prevalence of diabetes is 6% for adults (20-79 years) in the Democratic Republic of the Congo (DRC) (Sagastume et al., 2022). In DRC, the prevalence of diabetes mellitus in Kinshasa was 7% among adults and 3.9 to 5.2% for gestational diabetes (Kasiam Lasi On'Kin et al., 2008, Kisindja et al., 2022; Lino et al., 2021).

However, many studies revealed that Traditional Medicine could be vital in managing diabetes (Inkoto, 2014).

So, people are turning to less expensive folk medicine, which they consider as effective as modern therapy.

To this end, WHO reports that in Africa, more than 80% of the population recourses traditional medicine for their primary health care (WHO-AFRO, 2010; WHO, 2013). DRC is a reservoir of plant biodiversity (Kikufi, 2000; Wetshondo, 2012; Gentilinin and Duflo, 1986; Kebrech, 2009; Kambu, 1990; Kantu, 2014; Ngbolua et al., 2011; Ngbolua et al., 2016; Inkoto et al., 2018; Ngbolua et al., 2018a; Ngbolua et al., 2018b). Its flora is rich in medicinal plants of biopharmaceutical interest and capable of providing anti-diabetic new lead compounds.

This survey aimed to conduct an ethnobotanical study of medicinal plants traditionally used to treat Diabetes mellitus in Eastern Kinshasa City, DRC, to identify and give their ecological characteristics (morphological types, biological types, phytogeographical distributions, and biotope) and to highlight their therapeutic virtues.

2. Matériel et méthodes

2.1. ***Study area***

The surveys were conducted in Eastern Kinshasa City (4°18 ' and 4°25 'S latitude and between 15°19' and 15°22'E longitude, the average altitude is 360 m above sea level) (Figure 1).

This city covers a surface of 9,965.2 square kilometers and is located in the low altitude climate, characterized by AW_4 climate type according to the classification of Köppen. This town is in the Guineo-congolian region and belongs to the Congolo-zambezean transition sector.

Figure 1. Localization of survey site and some samples of medicinal recipes

2.2. Ethical approval

The protocol of the present research was approved by the Ethics Committee of the Department of Biology of the University of Kinshasa under reference number CDB/DB-Sci-UNIKIN/PMM 016/2022. The research was carried out according to the principles of the Helsinki Declaration (rules of confidentiality and ethics) and the rules of access and benefit sharing (ABS) in compliance with the use of plant genetic resources and the code of ethics of the International Society of Ethno-biology were respected in this study.

2.3. Inclusion criteria

The recognized Traditional Healers and plant vendors, who were mentally stable, knew medicinal plants in general and Diabetes mellitus primarily, and practiced their activity in the market at the time of the survey were included.

2.4. Exclusion criteria

All unrecognized Traditional Healers and plant vendors with no patronage for the treatment of diabetes and not currently practicing their jobs at the time of the study were omitted.

2.5. Ethno-botanical survey

The present survey was conducted in the eastern part of Kinshasa city and covered one month. A total of 50 Traditional Healers and vendors of medicinal plants were interviewed (10 informants per market).

Informants were selected for their authentic knowledge on utilizing anti-diabetic natural resources using the snowball sampling method.

Ethno-medicinal information was obtained by interviewing Traditional Practitioners and plant vendors using a semi-structured questionnaire. The questionnaires were divided into three sections: (i) personal information such as name, age, sex, marital status, and educational level; (ii) traditional medicine practice, including knowledge of diabetes; (iii) vernacular herb names, plant part used, information on addressing of respondents to medicine and outcomes of the care.

The plants were identified by comparison using herbarium exsiccata at the Herbarium of the Laboratory of Systematic Botany and Plant Ecology, Department of Biology, University of Kinshasa.

This study identified plant species according to the third version of the botanical classification of angiosperms established by the Angiosperm Phylogeny Group (APG III) (2009). The ecological data have been described as follows: Morphological types: Tree (T), Shrub (Shr), Under shrub (U/shr), Perennial herb (Perh), Liana (Lia); Biological types: Climbing phanerophytes (Phgr), Rhizomatous geophyte (Grh), Rhizomatous geophyte (Grh), Mesophanerophytes (Msph), Microphanerophytes (Mcph), Lianous phanerophytes (Lph); Nanophanerophytes (Nph); Biotopes: Forest (F), Savanna (Sav), Ruderal (Rud), Culture/crop (Cult) and bush fallow (Buf); Phytogeographical distribution: Afro-tropical species (At), Pan-tropical species (Pan), Guineo-Congolese species (GC), Centro-Guinean Congolese species (CGC), Lower Guinea-Congolese species (BGC), Congolese and Zambezian species (GC-Z), Soudano-Zambezian species (SZ); Foliar type: Microphylls, Mesophylls, Megaphylls; Diaspora type: Sarcochorous (Sarco), Balochorous (Balo), Pogonochorous (Pogo), Sclerochorous (Scl).

The data collected in the field were analyzed using SPSS version 20.0 and Origin 8.5 Pro software's package.

3. Results and Discussion

3.1. Characteristics of the respondents

In this survey, 50 informants meeting the inclusion criteria were interviewed. The majority of the respondents were male (58%) and female (42%), while the sex ratio (M/F) was 1.38. According to the marital status of respondents, single persons represent 42%, followed by married (32%), divorced (20%), and widowed (06%), respectively. Out of 50 persons interviewed, the most represented age group comprises individuals of >50 years. Most of the informants have a secondary school educational background (46%), followed respectively by illiterate (30%), primary school level (20%), and postsecondary level (04%) as observed from the Socio-demographic information of respondents (Table 1).

Table 1. Socio-demographics data on informants

Variables	Frequency (%)
Gender	
Male	29 (58)
Female	21 (42)
Age (years)	
<18	0 (0)
18-50	10 (20)
>50	40 (80)
Marital status	
Single	21 (42)
Married	16 (32)
Divorced	10 (20)
Widowed	03(06)
Level of education	
Primary	10 (20)
Secondary	23 (46)
Post-secondary	02 (04)
Illiterate	15 (30)

3.2. Diversity of medicinal plants and Ecological characteristics

The ethnobotanical data and the ecological characteristics of inventoried medicinal plant species are presented in Table 2. 27 plant species belonging to 26 genera and 22 families have been recorded in the flora of the eastern part of Kinshasa city traditionally used for treating diabetes mellitus.

- ***Morphological types***

The results of the analysis of morphological types of the inventoried species are presented in Figure 2.

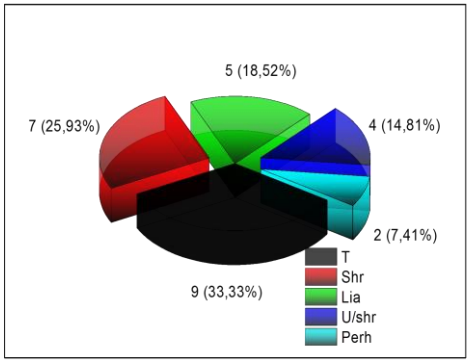

Figure 2. Morphological types of the inventoried plant species

The inventoried flora is made up of five primary life forms, which are trees (T), Liana (Lia), under-shrub (U/shr), and Perennial herbs (Perh) out of the 27 species inventoried. The analysis of Figure 2 shows that the plant species used in the treatment of diabetes by the inhabitants of the Tshangu district in Kinshasa city are composed more of trees and shrubs which represent 33.33% and 25.93%, respectively, followed by lianas (18.52%), under-shrubs (14.81%) and perennial herbs (7.41%). It is essential to know that woody species possess anatomical and histological structures that allow them to accumulate secondary metabolites responsible for their medicinal values (Bitsindou, 1996).

- ***Biological types***

The results of the biological type analysis of the inventoried plant species are presented in Figure 3.

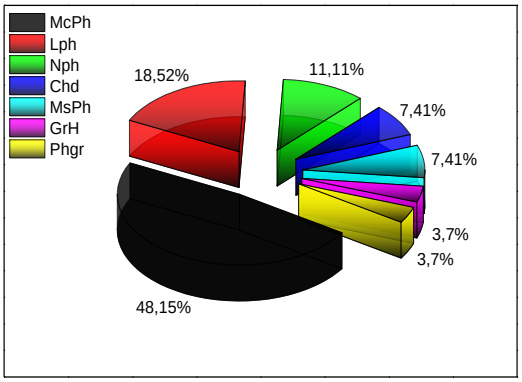

Figure 3. Biological types of the listed species

Figure 3 revealed that the inventoried species are dominated by the Microphanerophytes (McPh: 48.15%), followed respectively by Lianous phanerophytes (Lph: 18.52%), Nanophanerophytes (Nph: 11.11%), dressed chameophytes (Chd: 7.41%), Mesophanerophytes (MsPh: 7.41%), Rhizomatous geophyte (GrH: 3.7%) and Climbing phanerophytes (Phgr: 3.7%). The predominance of phanerophytes in inventoried medicinal plant species is the main characteristic of equatorial regions. Indeed, the Democratic Republic of the Congo is located in the heart of Africa, and 62% of its national territory is covered by forests (Debroux et al., 2007).

- ***Leaf types***

Data on the leaf types of the species found in the district are shown in Figure 4.

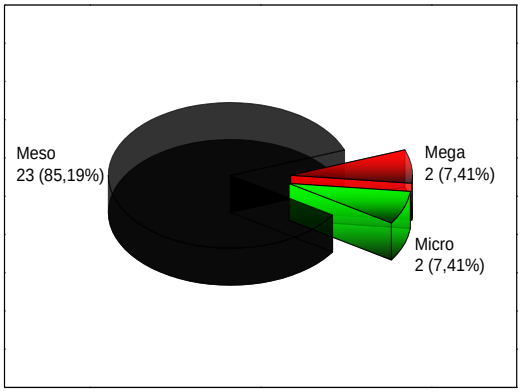

Figure 3. Biological types of the listed species

The results presented in Figure 4, show that Mesophyll foliar types (Meso) predominate with 85.19%, and this also shows that it is the most used by the population of this part of the city of Kinshasa followed by Megaphylls (Mega) and Microphylls (Micro) which represent 7.41% each.

- ***Type of diaspores***

Data on the diaspora types of the plant species surveyed are given in Figure 5.

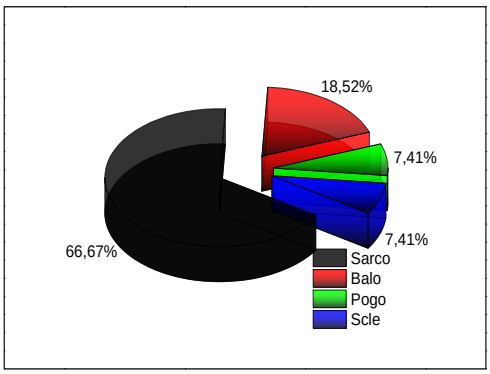

Figure 5. Diaspore types of the plant species surveyed

Figure 5 revealed that there are four kinds of diaspores had been inventoried in the district of Tshangu, namely the Sarcochores (66.67%), followed by the Ballochores which represent 18.52%, and Pogonochores and Sclerochores with 7.41% each.

- ***Habitat types***

Data on the habitat types of the plant species surveyed are given in Figure 6.

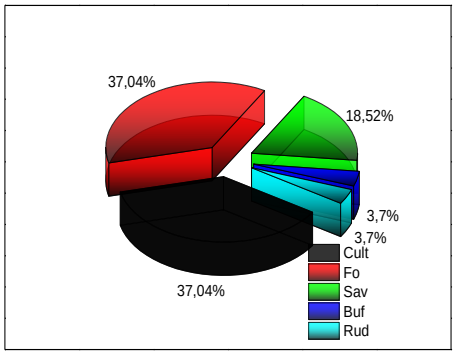

Figure 6. Habitat types of inventoried plant species

From habitat type of plant species used in folk medicine against diabetes in Kinshasa (Figure 5), the culture/crop (cult) and forest (Fo) plant species are the most represented (37.04% each) followed by the savanna species (Sav: 18.52%) and bush fallow (Buf) and ruderal (Rud) species (3.7% each). This result shows that cultured plant species predominate in anti-diabetic traditional recipes. It appears as a new approach in agroecology consisting of creating a productive ecosystem. The result also revealed the importance of forest plant species in conventional recipes compared to savanna, bush fallow, and ruderal plant species. This difference could be due to the high diversity of forest species.

In addition, traditional healers prefer to harvest wild plants because they have the advantage of having a relatively high content of active ingredients if the harvest is done in natural habitat (Bitsindou, 1996).

- ***Phytogeographical distribution***

Data on the types of phytogeographical distribution of the species surveyed are given in Figure 7.

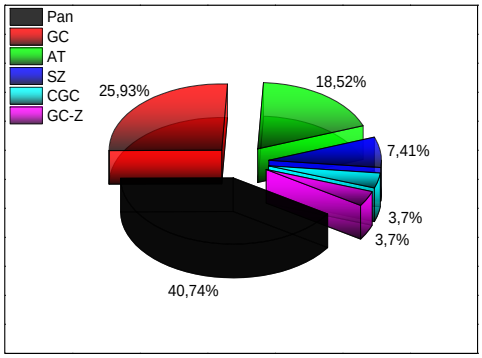

Figure 7. Phytogeographical distribution of the plant species surveyed

From the phytogeographical distribution of plant species traditionally used in folk medicine against diabetes in Kinshasa city (Figure 6), the Pan-tropical (Pan) species are the most represented (40.74%), followed by the Guineo-Congolese species (GC) species (25.93%), Afro-tropical species (AT: 18.52%), Soudano-Zambezian species (SZ: 7.41%). The Centro-Guinean Congolese species (CGC) and Congolese and Zambezian species (GC-Z) have the weakest abundance with 3.7% each. The present study observed that Pan-tropical anti-diabetic plant species predominate in Kinshasa City. In contrast, the predominance of the Guinean-Congolese plant species was observed in the anti-diabetic medicinal flora of Kisangani City (Katemo et al., 2012). Thus, in Africa and taking into account the phytogeographical distribution of plant species, the protection of the rainforest as a natural reservoir of medicinal plants should be a joint effort at provincial, national, sub-regional, and regional levels because of their large spectrum of distribution (Ngbolua et al., 2014).

3.3. Ethno-*medicinal uses*

Figure 8 gives the different parts used by the inhabitants of the Tshangu district in treating diabetes.

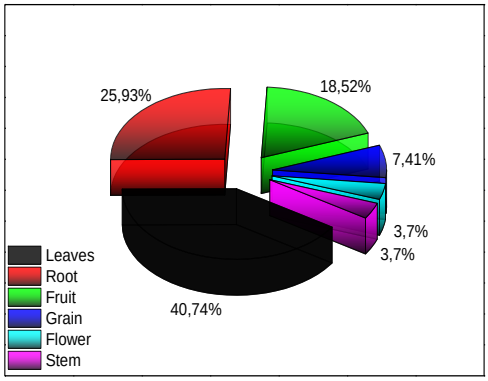

Figure 8: Plants used part in the treatment of diabetes in Kinshasa city

Figure 8 reveals that leaves are the most used part (40.74%), followed by the roots (25.93), fruits (18.52%), grains (7.41%), flowers, and stems (3.7% each). Using leaves as raw materials could prevent the destruction of overused medicinal plants and could be justified by the abundance of chemical groups they contain. The use of leaves in herbal medicine preparation is every day in other parts of the World, such as in Angola (Lautenschlager et al., 2018; Mawunu et al., 2022), Thailand (Tangjitman et al., 2015), and Bolivia (Thomas et al., 2009). Indeed, leaves are the leading synthesis site of plant-derived secondary metabolites (Dibong et al., 2011). Also, leaves are commonly used to prepare herbal medicines due to the likely presence of active compounds and comparative ease of phytochemical and pharmacological studies compared to other parts (Choudhury et al., 2015; Maduka et al., 2014).

Figure 9 gives data on the results of addressing respondents to medicine

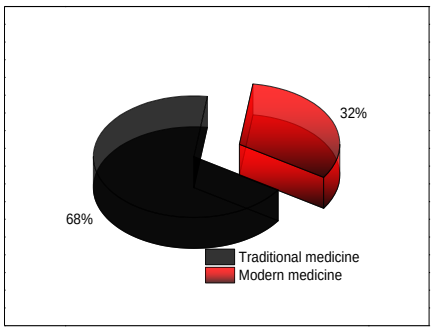

Figure 9: Information on addressing respondents to medicine

Figure 9 reveals that 68% of the population of Tshangu district in Kinshasa city uses Traditional Medicine, against 32% who are interested in modern medicine. These results are in perfect agreement with the estimation of the World Health Organization, according to which more than 80% of the population in Africa resort to Traditional Medicine to solve the primary health problem (WHO, 2002; 2013). The choice would sustain the use of medicinal plants for various health problems throughout the world, but also because of the growing poverty of the populations that do not have access to modern medicines because of their very costly costs (Mensah et al., 2019).

Figure 10 gives the outcome of diabetes treatment by Traditional Healers.

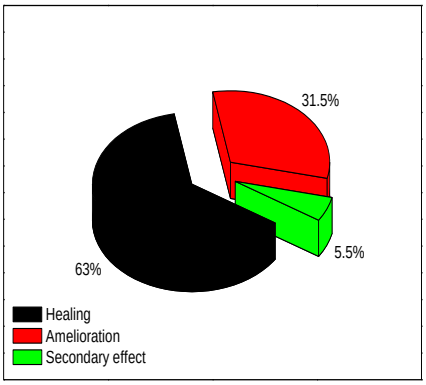

Figure 10. Outcomes of the care

The analysis of Figure 10 revealed that at least 63% of the people surveyed believe that medicinal plants can cure diabetes, 31.5% believe that plants improve their health, and 15% of the population surveyed believe that medicinal plants have side effects. Recent findings have shown that many plants used in Traditional Medicine are potentially toxic, mutagenic, and carcinogenic (Mensah et al., 2019). Artificial intelligence, notably computational chemistry and structural biology can help thus to screen virtually derived secondary metabolites from plants herein identified to establish anti-diabetic Phytocompounds libraries with interesting *in silico* pharmacokinetics and toxicological (ADMET/Tox) profiles to be tested on suitable models.

3.4. Similarities *of use*

Medicinal plant species contain bioactive compounds with a broad spectrum of activities. Phytocompounds like quinones, alkaloids, saponins, flavonoids, tannins, and terpenoids have been reported as having anti-diabetic activity both *in vitro* and *in in vivo* (Méril-Mamert et al., 2022). The plant kingdom constitutes an exciting source of new lead compounds. Indeed, several currently used drugs have been developed from medicinal plants, and some of these include quinine from the *Cinchona* tree (Rubiaceae) and artemisinin from *Artemisia annua* L. (Pousset, 2004; Chin et al., 2006; Gautam et al., 2007).

The conducted surveys revealed that 27 medicinal plant species are cited as anti-diabetic by 50 Congolese traditional practitioners.

Although, bibliographic research reveals that (1) five plant species identified in this study [*Ananas comosus* (L.) Merr. , *Catharanthus roseus* L., *Maprounea africana* Mull.Arg., *Persea americana* Mill., *Vitex madiensis* Oliv.] are also used against diabetes mellitus in Southern Katanga Area, DR Congo (Amuri et al., 2012); (2) Seven plant species identified in this study [*Catharanthus roseus* L., *Gnetum africanum* Welw., *Mangifera indica* L., *Morinda lucida* Benth., *Morinda morindoides* (Baker) Milne-Redh., *Persea americana* Mill., *Vernonia amygdalina* Delile Swere reported as anti-diabetic medicine in Kisangani city (Province of Tshopo, DRC) (Katemo et al., 2012); (3) 13 plant species identified in this study are also used in the provinces of in the Kwango, Kongo Central by traditional healers to treat diabetes mellitus (Tuwisana et al., 2019). These plants are *Catharanthus roseus* L., *Ficus benghalensis* L., *Gnetum africanum* Welw., *Lippia multiflora* Moldenke, *Mangifera indica* L., *Maprounea africana* Mull. Arg., *Morinda lucida* Benth., *Morinda morindoides* (Baker) Milne-Redh., *Moringa oleifera* L., *Persea americana* Mill., *Sarcocephalus latifolia* (Sm.)E.A.Bruce, *Vernonia amygdalina* Delile, and *Vitex madiensis* Oliv.

The convergence of the plant-derived-remedies use and the medicinal practices in different DRC provinces indicates the medicinal properties of the used plants. So if a plant is employed as a remedy in other regions where each people have specific restorative practices, there is strong evidence that the biological activity should be adequate. Traditional healers and Congolese herbalists acclaimed the plants derived-recipes reported in this work to be efficacious and have been used by locals for decades. Some medicinal plant species, like *Ananas comosus, Cocos nucifera, Gnetum africanum, Lippia multiflora, Vernonia amygdalina,* and *Vitex madiensis* are edibles. Thus, they may be recommended to patients to manage diabetes mellitus in current practice.

Concerning the wild plant species, which were identified in this survey, chromatographic fractionation is necessary to identify and characterize the safe, medically active secondary metabolites. It could lead to the standardization and quality control of the derived recipes and ensure their safety. After such scientific validation studies, they may be approved for use in primary health care. Some inventoried plant species have not been previously known as anti-diabetic elsewhere in DRC.

Among these plants are *Azadiracta indica* A., *Buchholzia coriacea* Engl., *Costus afer* Ker Gawl. *Gongrenema latifolium* Benth, *Raphia sese* De Wild., *Securidaca longipedunculata* Fresen., *Uvaria scabrida* Oliv. These results show that her Traditional Medicine characterizes every tribe of the DRC. Thus, because of social mobility, the different sociocultural groups are often crossed and can share knowledge, values, and traditional rituals concerning numerous social practices (Lougbegnon et al., 2015). It also shows that the cultural origin of the informants constitutes a vital parameter to consider in assessing Traditional Medicine knowledge.

5. Conclusion and Suggestions

In Kinshasa City, medicinal plants for treating diabetes mellitus are divided into 19 families, 25 genera, and 27 species. The ecological and phytogeographical spectra revealed a predominance of trees, microphanerophytes, mesophylls, sarcochores, and pantropical species.

The use of medicinal plant parts like roots and stem bark constitutes a potential threat to the disappearance of many plant species. It is therefore desirable that in-depth phytochemical and pharmacological studies be carried out on these listed species with a view to their scientific validation (conversion of traditional knowledge into scientific culture) on the one hand, but also to revalue them, conserving them and using them sustainably while respecting the convention on biological diversity on the other.

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Table 2: Ethno-botanical data and ecological characters of listed plants

N°	Species (family)	Local Names	Ecological characteristics						Used part	Doses
			MT	BT	FT	DT	PD	Habitat		
1	*Ananas comosus* (L.) Merr. (Bromeliaceae)	Difubu	Perh	Chd	Meso	Sarco	Pan	Cult	Fruit	-
2	*Annona reticulata* L. (Annonaceae)	Mfubutu	T	McPh	Meso	Sarco	Pan	Cult	Fruit	-
3	*Azadiracta indica* A. (Meliaceae)	Neem	T	McPh	Meso	Sarco	Pan	Cult	Root	1 glass/day
4	*Buchholzia coriacea* Engl. (Capparaceae)	Kamameso	Shr	McPh	Meso	Balo	GC	Fo	Flower	1 glass/day
5	*Catharanthus roseus* L. (Apocynaceae)	Pervenche	U/shr	Nph	Micro	Sarco	Pan	Cult	Leaves	1 glass/day
6	*Cocos nucifera* L. (Arecaceae)	Coco	A	McPh	Mega	Balo	Pan	Cult	Fruit	1 glass/day
7	*Costus afer* Ker Gawl. (Costaceae)	Minkeni	Perh	GrH	Meso	Sarco	GC	Fo	Grain	1spoon/day
8	*Cucurbita sp* (Cucurbitaceae)	Melon amer	Lia	Lph	Meso	Sarco	AT	Cult	Fruit	cook and eat
9	*Ficus benghalensis* L. (Moraceae)	Nsanda	T	McPh	Meso	Sarco	Pan	Cult	Leaves	1/2 glass/day
10	*Garcinia kola* Heckel. (Clusiaceae)	Ngadiadia	T	McPh	Meso	Sarco	AT	Fo	Root	1spoon/day
11	*Gnetum africanum* Welw. (Gnetaceae)	Mfumbwa	Lia	Lph	Meso	Sarco	CGC	Fo	Root	1 glass/day
12	*Gongrenema latifolium* Benth (Apocynaceae)	Lolanga	Lia	Phgr	Meso	Pogo	SZ	Fo	Leaves	1 glass/day
13	*Lippia multiflora* Moldenke (Verbenaceae)	Bulukutu	U/shr	Nph	Meso	Scle	GC	Sav	Leaves	1 glass/day
14	*Mangifera indica* L. (Anacardiaceae)	Mangue, manga	T	McPh	Meso	Sarco	Pan	Cult	Fruit	1 glass/day
15	*Maprounea africana* Mull.Arg. (Euphorbiaceae)	Kisele	Shr	MsPh	Meso	Balo	AT	Fo	Stem	1 glass/day
16	*Morinda lucida* Benth. (Rubiaceae)	Nsiki	Shr	McPh	Meso	Sarco	GC	Sav	Root	1 glass/day
17	*Morinda morindoides* (Baker) Milne-Redh. (Rubiaceae)	Kongo bololo	Lia	Lph	Meso	Sarco	GC	Fo	Leaves	1 glass/day
18	*Moringa oleifera* L. (Moringaceae)	Moringa	Shr	McPh	Meso	Balo	Pan	Cult	Leaves	1 spoon/day
19	*Persea americana* Mill. (Lauraceae)	Savoka	T	Lph	Meso	Sarco	Pan	Cult	Leaves	1 glass/day
20	*Quassia africana* (Baill) Baill. (Simaroubaceae)	Mupeshi peshi	Shr	McPh	Meso	Sarco	GC-Z	Fo	Grain	1 grain/day
21	*Raphia sese* De Wild. (Arecaceae)	Bakulu	T	McPh	Mega	Sarco	GC	Fo	Leaves	1glass/day
22	*Sarcocephalus latifolia* (Sm.) E.A.Bruce (Rubiaceae)	Kilolo kikwango	Shr	McPh	Meso	Sarco	AT	Sav	Root	1glass/day
23	*Securidaca longipedunculata* Fresen. (Polygalaceae)	Sunda	Shr	McPh	Micro	Sarco	Pan	Sav	Root	1glass/day
24	*Senna occidentalis* (L.) Link (Phyllanthaceae)	Herbe puante	U/shr	Nph	Meso	Balo	Pan	Rud	Leaves	1glass/day
25	*Uvaria scabrida* Oliv. (Annonaceae)	Kalombo	Lia	Lph	Meso	Sarco	GC	Fo	Root	1glass/day
26	*Vernonia amygdalina* Delile (Compositae)	Kasa bololo	U/shr	Chd	Meso	Pogo	SZ	Buf	Leaves	1 spoon/day
27	*Vitex madiensis* Oliv. (Lamiaceae)	Kifilu	T	MsPh	Meso	Scle	AT	Sav	Leaves	1/2 glass/day