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Ethnopharmacological study of anti-diabetic plants sold on the markets of Abidjan, Côte D'ivoire

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ABSTRACT

In the search for plants able to fight against diabetes, we have initiated an ethnopharmacological survey on the markets of the city of Abidjan in Côte d'Ivoire. The markets of three communes in the city were visited for this purpose: Yopougon, Abobo and Adjamé. In Yopougon, we visited Wassakara market. The large Abobo market and the Gouro market were respectively chosen for Abobo and Adjamé. This choice was justified by an impressive number of medicinal plants sellers in these markets. The survey interviewed 120 herbalists on the basis of a questionnaire sheet. These investigations revealed 27 species of plants used in traditional medicine, in the treatment of diabetes. These plant species belong to 20 botanical families with four strongly represented which are Asteraceae, Fabaceae, Euphorbiaceae and Rubiaceae. Three parts of plants are indicated by herbalists in the treatment of diabetes: leaves, twigs and whole plant. The preparation techniques are decoction and kneading. The preparations are used for drinking and purging by diabetic people. In relation to citation frequencies, two plants are regularly used. They are *Phyllantus amarus* (Fc = 9.86%) and *Nauclea latifolia* (Fc = 9.49%). These two plants were frequently encountered during our surveys. They are the most important species indicated against diabetes by Abidjan population. Both of these species of plant should be subject of other studies to prove the scientific basis of their empirical use in traditional medicine.

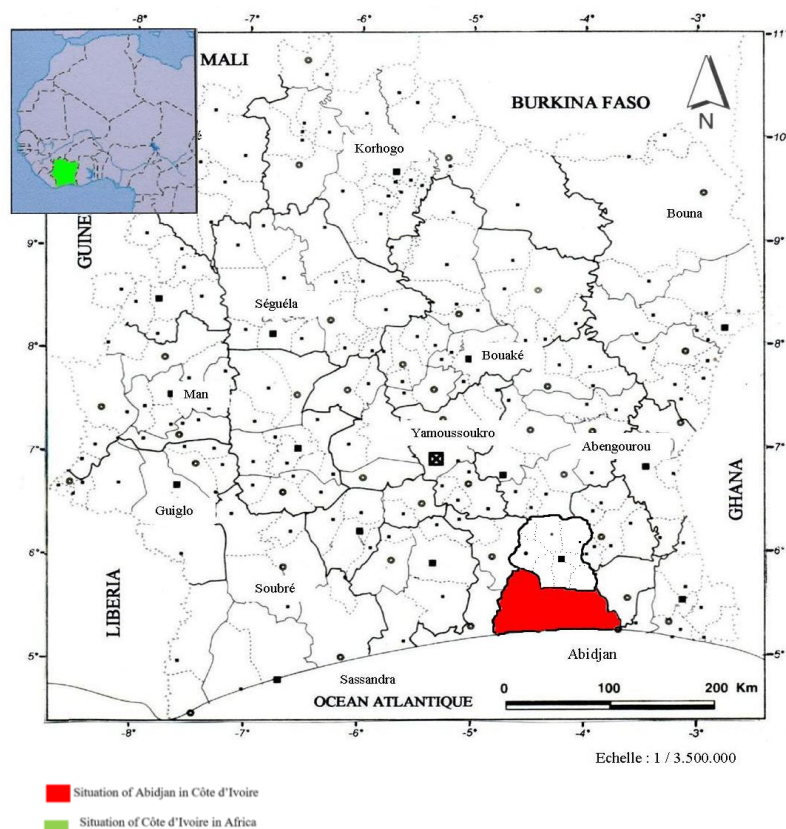**Keywords:** Ethnopharmacological, Diabetes, Plant, Côte d'Ivoire

INTRODUCTION

People have always resorted to plants since their exixtence (Ta Bi and N'Guessan, 2020) [14]. This need for health spawned the old medicine called traditional medicine, practiced all over the world. However, in developed countries, with the advent of synthetic molecules, modern or conventional medicine emerged and the public was convinced that plant medicine was out of fashion. Overwhelmed by chemistry, classical medicine has outclassed other therapeutic approaches, especially traditional medicine (Doh, 2015) [6]. Nevertheless, in recent decades, there has been a resurgence of interest in the use of medicinal plants, even in developed countries. The reason is that, in several localities of Africa such as Côte d'Ivoire, health centers are rare, even non-existent or sometimes very far from the populations who use medicinal plants. In addition, the the high cost of pharmaceutical products are other factors for populations, to choose traditional medicine (N' Guessan, 2008) [7]. Despite the progress made, modern medicine has not able to eradicate several diseases such as asthma, cancer, arterial hypertension and particularly diabetes, the subject of this study. Our planet had 120 to 140 million diabetics in 1998, 366 million in 2011 and will have 552 million cases in 2030 if there is no real fight (Ta Bi, 2013) [10]. In Africa, the number of diabetics, from 7 million in 2000 will increase to 18.2 million in 2030 (Beaglehole and Lefèbvre, 2004) [5]. In Côte d'Ivoire, the number of cases increases by 5 % each year (N'Guessan *et al*., 2009a) [9]. This high prevalence places diabetes as the most common endocrine disease (N'Guessan, 2008) [7]. It is a very important cause of disability and death in Côte d'Ivoire (N'Guessan *et al*., 2009b) [10]. Currently, diabetes therapy is based on the use of hypoglycemic agents (sulfonamides, biguanides, insulin), or on hygienic and dietary measures, physical exercise and requires so long treatment, what patients find hard to cope with. It is imperative to look for new solutions in order to fight against this "silent killer", (Aké-Assi, 2011) [3]. This is the motivation of this study. It is therefore a contribution to the search for plants with anti-diabetic potential.

MATERIAL AND METHODS

Presentation of the study environment

The study took place in the district of Abidjan in Côte d'Ivoire (Figure1).

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Figure 1: Situation of the District of Abidjan in Côte d'Ivoire, a country in West Africa

Material

The biological material concerns all plant species encountered during market surveys with their different parts (leaves, flowers, fruits, roots and stems). We used, during the investigations, classic material: a survey sheet comprising questionnaires aimed at collecting information. Sachets and newspapers were necessary to classify the samples of plants. A Nikon-type digital camera enabled shots. A computer was used for data entry and processing.

Method

Ethnopharmacological survey

The survey on anti-diabetic plants was carried out, from October 2018 to January 2019, with sellers of medicinal plants in the markets of Yopougon, Abobo and Adjamé (District of Abidjan, Côte d'Ivoire). In Yopougon, the Wassakara market was visited. The large abobo market and the gouro market were respectively chosen for the communes of Abobo and Adjamé. This choice was justified by an impressive number of sellers of medicinal plants in these markets. We visited herbalists at their work places using a survey sheet. They were therefore subjected to a questionnaire. The information covered plants used to treat diabetes, different parts used, preparation techniques and administration methods of remedies according to medicinal plant sellers. We also bought samples of each plant in order to identify them in laboratory.

Collection of botanical data

To identify the indicated plants in laboratory, we used collected samples, specimens from the herbarium of the National Center for Floristics in Félix Houphouët-Boigny University. The nomenclature of species follows the phylogenetic classification proposed by Angiosperms Phylogeny Group.

Citation frequencies of plants inventoried

The citation frequency (Fc) is the number of citations of a species out of the total number of citations of all species (Ta Bi *et al.*, 2016). It allows to know in this study the most encountered plant. It is calculated according to the following formula:

$$Fc = \frac{\text{Number of citations of the species (n)}}{\text{Total number of citations of all species (N)}} \times 100$$

Ta Bi (2017) [12]

Statistical analysis of Fc data

Citation frequencies were analyzed with SPSS 20 software. These values made it possible to carry out a Factorial Analysis of Correspondents (AFC) to form different classes through a dendrogram. To perform AFC, we followed the Bayer code to rename plant species (Aké, 2015) [5]. This code consists to designate a plant by initials of five letters. These five letters are the first three letters of the genus and the first two letters of the species. For example, a plant called *Nauclea latifolia* is referred to *Naula*.

RESULTS

List of inventoried plants

The ethnopharmacological investigations that we carried out in the markets of three communes of Abidjan, made it possible to meet 120 herbalists and to inventory 27 species of plants belonging to 20 botanical families. Four families are more represented: Asteraceae, Fabaceae, Euphorbiaceae and Rubiaceae. Three parts of plants are used in the treatment of diabetes: leaves, twigs and whole plant. The preparation techniques are decoction and kneading. The modes of administration are decocted to drink and pastes to purge. All these informations are recorded in table 1.

Table 1: List of inventoried plants and ethnopharmacological characteristics

Scientific names of plant species and families	Parts used in treatment	Preparation technique	Administration technique
Abrus precatorius (Fabaceae)	Branch	Decoction	Drink
Aframomum sceptrum (Zingiberaceae)	Leaf	Kneading	Purging dough
Alchornea cordifolia (Euphorbiaceae)	Leaf	Decoction	Drink
Annona senegalense (Annonaceae)	Leaf	Decoction	Drink
Azadirachta indica (Meliaceae)	Leaf	Decoction	Drink
Bambusa vulgaris (Poaceae)	Leaf	Decoction	Drink
Dissotis rotundifolia (Melastomataceae)	Leaf	Decoction	Drink
Ficus sur (Moraceae)	Leaf	Kneading	Purging dough
Hoslundia opposita (Lamiaceae)	Leaf	Decoction	Drink
Justicia flava (Acanthaceae)	Leaf	Decoction	Drink
Justicia secunda (Acanthaceae)	Leaf	Decoction	Drink
Microdesmis keayana (Pandaceae)	Leaf	Decoction	Drink
Mikania cordata (Asteraceae)	Branch	Decoction	Drink
Momordica charantia (Cucurbitaceae)	Branch	Decoction	Drink
Morinda lucida (Rubiaceae)	Leaf	Decoction	Drink
Nauclea latifolia (Rubiaceae)	Leaf	Decoction	Drink
Nephrolepis biserrata (Davalliaceae)	Leaf	Decoction	Drink
Nymphaea lotus (Nymphaeaceae)	Leaf	Decoction	Drink
Palisota hirsuta (Commelinaceae)	Leaf	Decoction	Drink
Parquetina nigrescens (Apocynaceae)	Leaf	Decoction	Drink
Persea americana (Lauraceae)	Leaf	Decoction	Drink
Phyllanthus amarus (Euphorbiaceae)	Whole plant	Decoction	Drink
Piliostigma thonningii (Fabaceae)	Leaf	Kneading	Purging dough
Tamarindus indica (Fabaceae)	Leaf	Decoction	Drink
Tectona grandis (Verbenaceae)	Leaf	Decoction	Drink
Tithonia diversifolia (Asteraceae)	Leaf	Decoction	Drink
Vernonia colorata (Asteraceae)	Leaf	Decoction	Drink

Citation frequency

Citation frequencies of the plants made it possible to establish an ascending hierarchical classification through a dendrogram (Figure 2). This dendrogram shows three groups of plants when cutting at the cluster distance of 3. The first group consists two plants which are strongly represented among the plants sold against diabetes in Abidjan. They are *Nauclea latifolia* (Figure 3) with an Fc of 9.49 % and *Phyllantus amarus* (Figure 4) for an Fc of 9.86 %. Nine other plants whose citation frequencies vary between 6.72% and 3.50% form the second group: *Justicia secunda, Microdesmis keayana, Tithonia diversifolia, Ficus sur, Hoslundia opposita, Bambusa vulgaris, Dissotis rotundifolia, Momordica charantia* and *Palisota hirsuta*. The other plants constituting the third group have a frequency of citation less than 3.50%. These are plants rarely encountered during surveys.
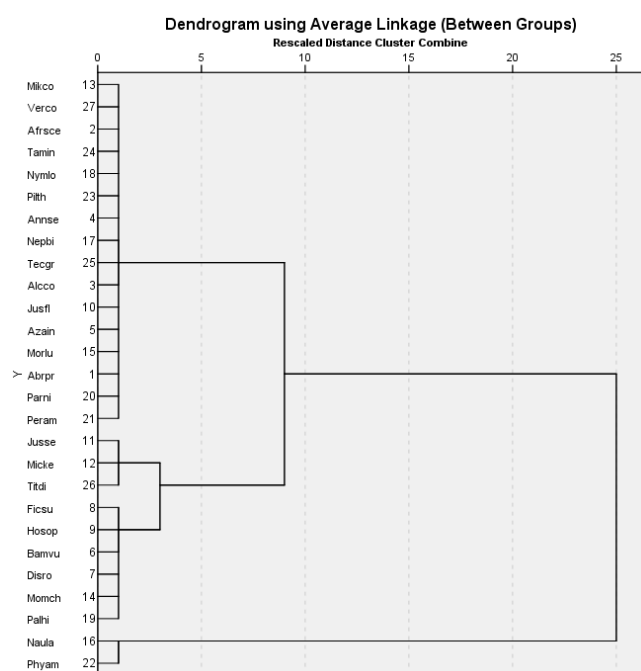
Figure 2: Dendrogram of the hierarchical classification of listed plants according to their citation frequencies (Fc)

Figure 3: *Nauclea latifolia* Sm. (Rubiaceae) Photo (N'Guessan, 2008)

Figure 4: *Phyllanthus amarus* Schum. and Thonn. (Euphorbiaceae) Photo (N'Guessan, 2008)

DISCUSSION

Ethnopharmacological investigations have made it possible to identify 27 plants belonging to 20 families. The most common families are Asteraceae, Fabaceae, Euphorbiaceae and Rubiaceae. These are the four important families of plants in ivorian Flora (Aké-Assi, 2001; 2002) [1, 2]. In addition, three parts of plants are used in the treatment of diabetes: leaves, twigs and whole plant. This result is confirmed by another study among Abbey and Krobou people of Agboville in Côte d'Ivoire which indicates the use of decocted, in 75% of cases, as medicinal form in the treatment of diabetes (N'Guessan *et al*., 2009a) [9]. In relation to the statistical analysis carried out, two plants stand out from the others. They are *Nauclea latifolia* and *Phyllantus amarus*. These two species should be the subject of other research in order to confirm their properties. The anti-diabetic effect of these two plants would be linked to the presence of alkaloid and flavonoid, chemical groups indicated in these plants (N'Guessan, 2008) [7]. In addition, the anti-diabetic effect of *Nauclea latifolia* was also mentioned in another study in Côte d'Ivoire (Aké-Assi, 2011) [3, 11]. These plants should attract the attention of scientific populations in the fight against diabetes.

CONCLUSION

Investigations relating to anti-diabetic plants in Abidjan city (Côte-d'Ivoire) took place in three communes: Yopougn, Abobo et Adjamé. These ethnopharmacological surveys made it possible to browse the markets of these municipalities. They resulted in inventorying 27 species of plants used in traditional medicine, in the treatment of diabetes. These plant species belong to 20 botanical families. Four families are more represented: Asteraceae, Fabaceae, Euphorbiaceae and Rubiaceae. Three parts of plants are used in the treatment of diabetes: leaves, twigs and whole plant. The preparation techniques are decoction and kneading. The modes of administration are decocted to drink and pastes to purge. According to the citation frequencies, two plants are regularly mentioned. They are *Phyllantus amarus* (Fc = 9.86%) and *Nauclea latifolia* (Fc = 9.49%). These two plants were encountered at all sellers of medicinal plants during the surveys. They are frequently used against diabetes in Abidjan. These two species should be the subject of other studies to verify their empirical properties in the fight against diabetes.

Conflict of interest

The authors declare no conflict of interests

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