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## **Phytochemical Analysis of Medicinal Plants Used to Support Infertility in Couples in Kananga (Democratic Republic of Congo)**

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### **Abstract**

This study aims to analyse current knowledge on medicinal plants used by healers to treat infertility in couples in Kananga, Democratic Republic of Congo, with a particular focus on their *phytochemical properties*.

Phytochemical analyses were conducted at the laboratory of the University of Notre Dame du Kasayi (UKA) and sociodemographic surveys were conducted among fifty healers, including 18 (36%) men and 32 (64%) women, and fifty infertile couples.

The study identified 18 plant species grouped into 18 genera and 14 families. The *Euphorbiaceae*, *Lamiaceae*, and *Rubiaceae* families are the most common, with two species (11.1%) each. Of the 11 orders listed, *Lamiales* and *Malpighias* ranked first with 3 (16.7%). Leaves, the most commonly prescribed organ, accounted for 66%. Infusions accounted for 44% of preparation methods, while oral administration was estimated at 70%.

Floristic analysis reveals: nine biological types, four phytogeographic types, four morphological types, and five types of diaspores.

Phytochemical analyses have shown: Flavonoids at 80%; Saponins at 74%; Polyphenols at 70%; Alkaloids at 67% and Tannins at 58%. This study highlights the importance of phytochemical analysis as an essential step towards the scientific validation, standardisation and safety of these traditional remedies.

**Keywords:** Phytochemical analysis, Medicinal plants, Couples' infertility, Kananga.

### **1. INTRODUCTION**

Couple infertility is defined as the absence of pregnancy in a couple of childbearing age after twelve months of regular sexual intercourse without contraception [1]. It is now a real public health problem. In Africa and developing countries, infertility affects 25 to 40% of the population [2]. In the past, women were considered solely responsible for infertility in

couples, but today we know that both sexes are affected, with men accounting for up to 30% of cases [3]. Many of the medicines currently in use are derived from plants. Modern medicine offers questionable results and sometimes has numerous side effects [4]. Urban populations are therefore turning to medicinal plants as a last resort to resolve the problem of infertility in couples [5].

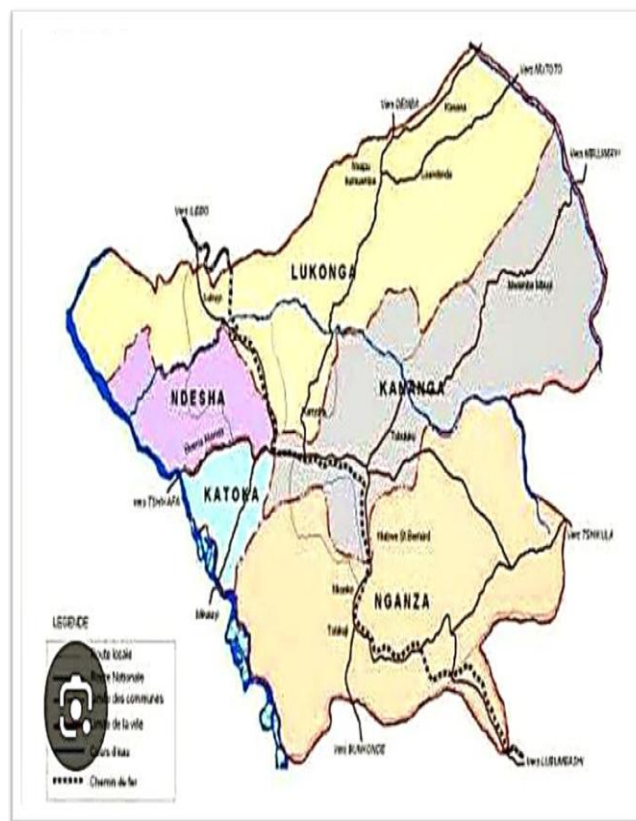
## 2. Materials and Methods

### 2.1 Materials

#### 2.1.1. Study area

The city of Kananga was created by the Governor General of the Colony following Order No. 12/357 of 6 September 1958 [6]. It was called Luluabourg from 1958 to 1972. Its name was changed by various texts. Since 1973, the most recent being Decree-Law No. 081 of 2 July 1998, it has been known by its current name, the city of Kananga, to this day [7]. In 2023, the population of the city of Kananga was 3,348,790 inhabitants; it is located in the centre of the Democratic Republic of Congo. Kananga is the capital of the Province of Kasai Central and the seat of the archbishopric. It is located between 5°23' and 25°25' south latitude and east longitude, covers an area of 743 km<sup>2</sup> and has a population density of 450 inhabitants/km<sup>2</sup>. Its climate is hot and humid, with an average annual temperature ranging between 25° and 28° C. Kananga has two seasons: a dry season between mid-May and mid-August; and a rainy season between September and mid-May [8]. Administratively, the city of Kananga is subdivided into five communes (*Figure 1*): Kananga, Lukonga, Ndesha, Katoka and Nganza.

The soil is mainly sandy-clayey, resting on a base of crystalline rock (granite), which influences the tree-covered savannah vegetation and local crops. The area is drained by the Lulua River and its tributaries, forming a hydrography typical of the Kasai Basin.



**Figure 1.** Map of the city of Kananga  
Source [9],

#### 2.1.2. Equipment

The biological material consists mainly of plant species recorded in the field. In addition to this material, a questionnaire, a field notebook and a pen were used.

### 2.2. Methods

The ethnobotanical study of medicinal plants used to treat infertility in couples in Kananga was carried out using a probabilistic sampling plan. It was conducted using an open-ended questionnaire for healers in order to obtain an overview of the plant species used to treat infertility in couples. The ethnobotanical field surveys were conducted from June to October 2025.

The ethnobotanical surveys were conducted among 50 healers, including 32 women and 18 men, based on their professionalism, at a rate of 10 healers per municipality. The interviews with these healers focused on identifying the plant species used to treat couples, the main plant organs used, the method of preparation, the method of administration and the habitats of the species (forest, savannah or cultivated). To facilitate understanding with the healers, the species were

identified in the local language (Tshiluba) and translated into French in order to identify each plant species used.

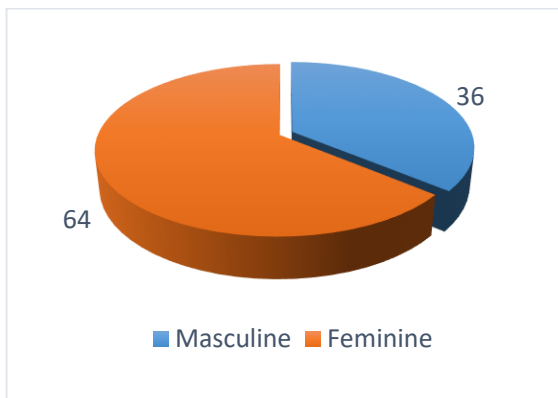
### 2.3. Data analysis and processing

The names of plant species, genera, families and orders were corrected using a combination of identification keys [10, 11, 14]. PlantNet software was used to certify certain specimens in person. The data collected on the survey forms were entered and statistically processed using IBM SPSS version 27.0 and Microsoft Office Excel 2013 software. Certain species that were considered doubtful or "ambiguous" were verified at the Agronomic and Environmental Sciences Laboratory of the University of Notre Dame of Kasayi (UKA).

## 3. Results

### 3.1. Sociodemographic data

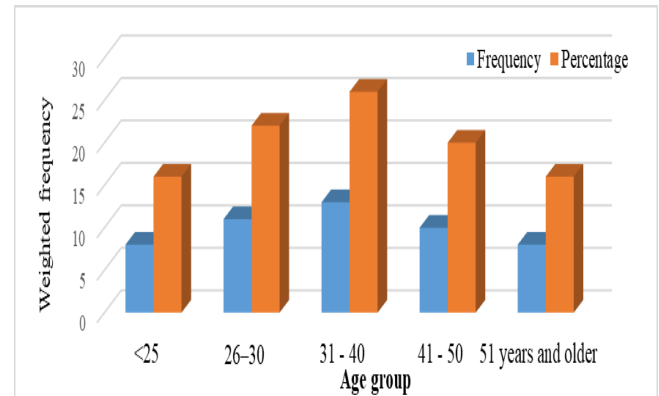
Figure 2 presents the results according to the gender of the healers.



**Figure 2:** Distribution of healers by gender

Figure 2 shows that of the 50 healers practising the profession of supporting couples affected by infertility surveyed in the city of Kananga, 36 (64%) are women and 14 (36%) are men.

Figure 3 below highlights the different age groups of healers.

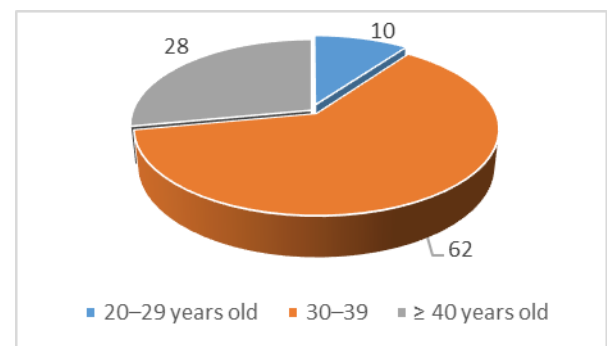


**Figure 3:** Age groups of healers

Figure 3 above shows that the respondents fall into five age groups as follows:

- 8 (16%) for healers under the age of 25;
- 11 (22%) for those aged 26-30;
- 13 (26%) for the 31-40 age group;
- 10 (20%) for the 41-50 age group; 1 ; and
- 8 (16%) for the age group of healers aged 51 and over.

Figure 4 shows the different age groups of infertile couples.

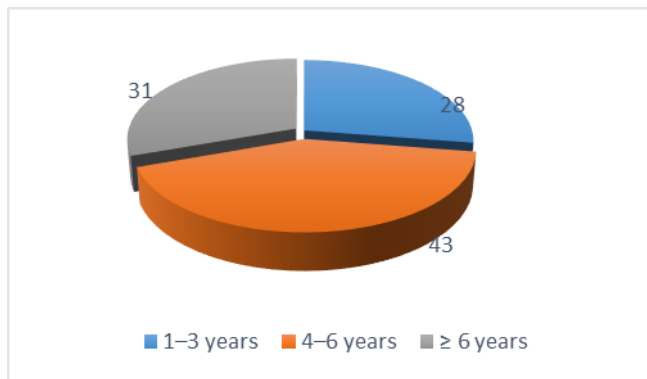


**Figure 4:** Age group of healers

Figure 4 above shows that there are three age groups of couples, as follows:

- 62% are in the 30-39 age group;
- 28% fall into the 20-29 age group;
- 26% are in the ≥ 40 age group;

Figure 5 below shows the duration of infertility among couples.

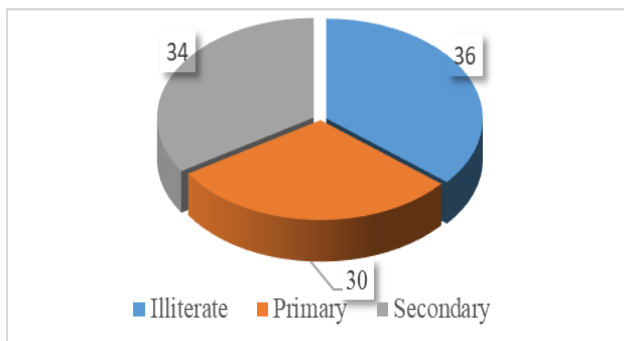


**Figure 5:** Duration of infertility among couples

Figure 5 above highlights three key moments that marked the duration of infertility among couples, as follows:

- 43% are in the 4-6 age group;
- 31% are aged 1-3;
- 28% are aged  $\geq 6$  years.

Figure 6 below shows the educational level of healers

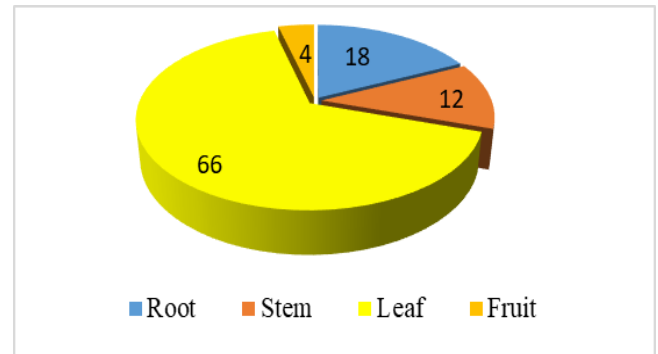


**Figure 6:** Educational level of respondents

Analysis of Figure 6 above confirms that the educational level of healers was recorded as follows:

- There are 18 illiterate individuals (36%),
- 17 (34%) have completed secondary education, and
- 15 (30%) had primary education.

Figure 7 below shows the use of plant parts as a percentage.

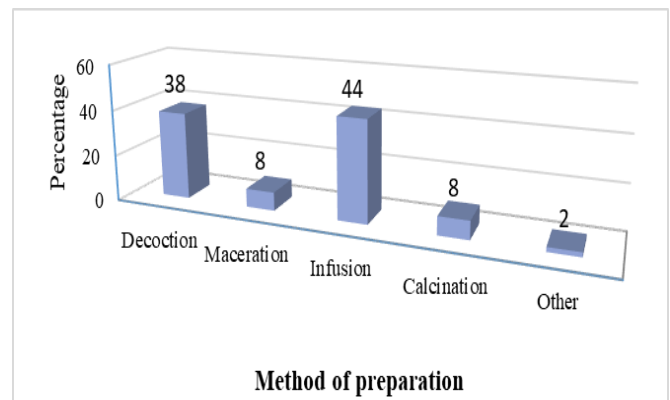


**Figure 7:** Plant parts used

The results in Figure 7 above show that

- the leaf is the most used part, accounting for 66% on its own;
- the root comes in second place with 18%;
- the stem comes third with 12 per cent; and
- the Fruit is used less frequently, at 4%.

Figure 8 shows how the recipes are prepared

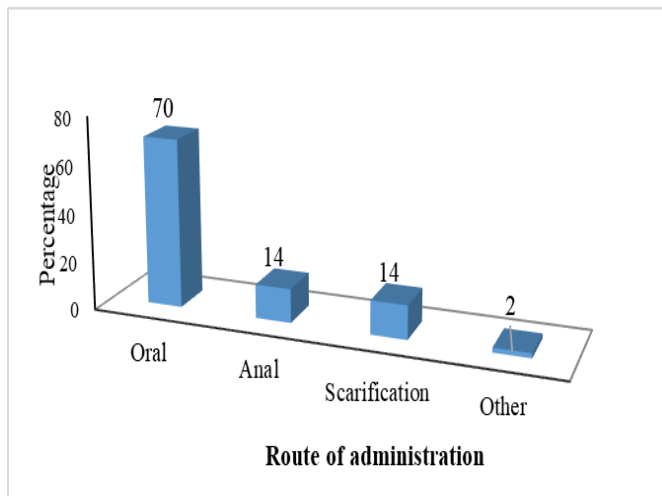


**Figure 8:** Method of preparation of recipes

Several methods of preparing recipes have been identified by healers to support couples, as shown in Figure 8 above. The results show that

- Infusion remains the most commonly used method of preparation with 44%;
- Decoction is used in 38% of cases;
- Maceration and calcination are both used at 8%;
- Other preparation methods are rarely reported and account for 2%.

Figure 9 shows the method of administration of the medicines



**Figure 9:** Method of administration

The observations in Figure 8 show that:

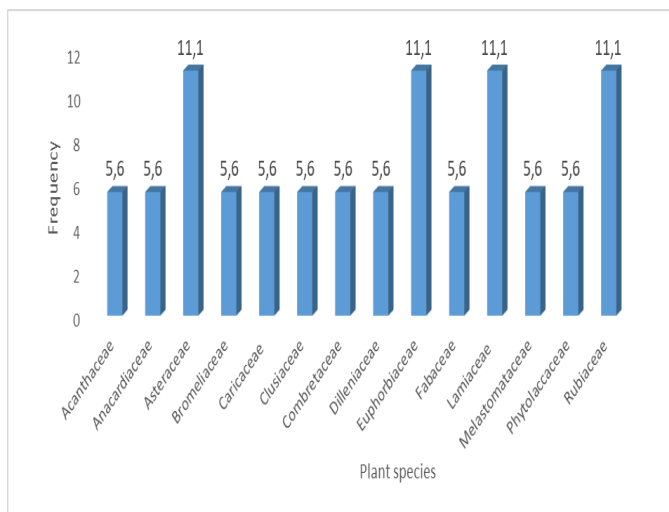
- Oral administration accounts for 70% of cases;
- The anal route and scarification each account for 14%;
- Other methods of administration are estimated at 2%

### 3.2.2. Floristic and ecological data

#### 3.2.2.1. Floristic data

Floristic list and biological, ecological and phytogeographical characteristics

Figure 10 below shows the different families of plant species

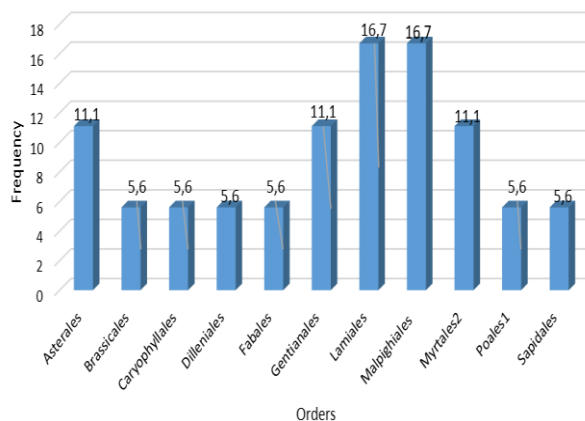


**Figure 10:** Plant families

Of the 14 families recorded, four are the most important and are ranked as follows:

2 (or 11.1%) belong to four families (*Asteraceae*, *Euphorbiaceae*, *Lamiaceae* and *Rubiaceae*). The remaining families account for 5.6% of cases. These are: *Combretaceae*, *Acanthaceae*, *Anacardiaceae*, *Bromeliaceae*, *Caricaceae*, *Clusiaceae*, *Dilleniaceae*, *Fabaceae*, *Melastomataceae* and *Phytolaccaceae*.

Figure 11 below shows the percentage of plant orders.



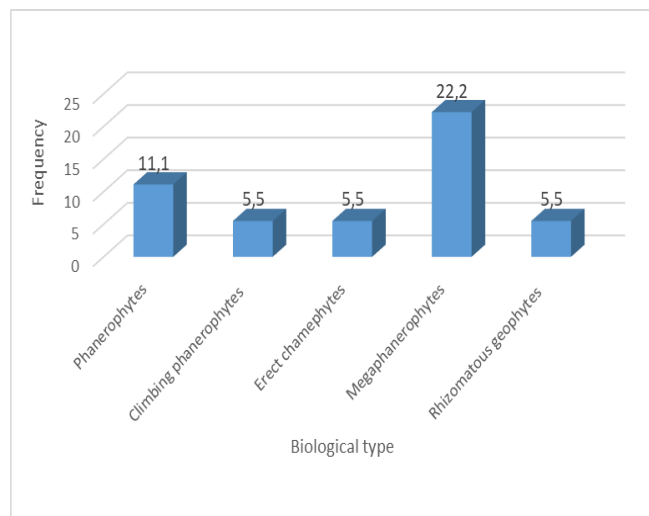
**Figure 11:** Plant orders

Figure 11 shows that of the 11 orders, 2 covered a significant frequency with 16.7% of cases each (*Malpighiales* and *Lamiales*). The remaining orders cover a small frequency, either due to the lack of knowledge of the healers surveyed or to their rarity in the field, as follows:

- 2 cases (11.1%) for the orders *Asterales*, *Gentianales* and *Myrtales*
- 1 case (5.6%) for the orders *Brassicales*, *Caryophyllales*, *Dilleniales*, *Fabales*, *Poales* and *Sapidales*

### 3.2.2.2. Ecological data

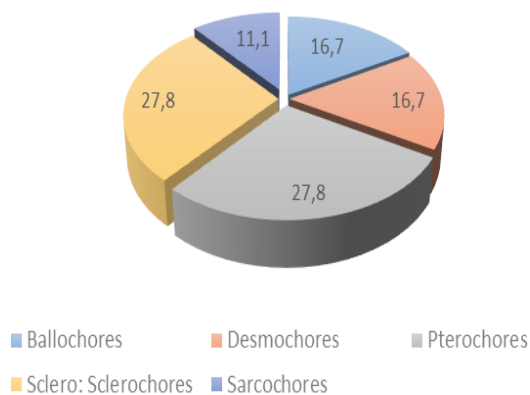
Figure 12 shows the different orders of plant species



**Figure 12:** Biological type of plants

Figure 12 above shows that of the five biological types inventoried, megaphanerophytes were the most frequent at 22.2%, followed by phanerophytes at 22.1%. The remainder are distributed as follows: climbing phanerophytes, rhizomatous geophytes and erect chamephytes, each at 5.5%.

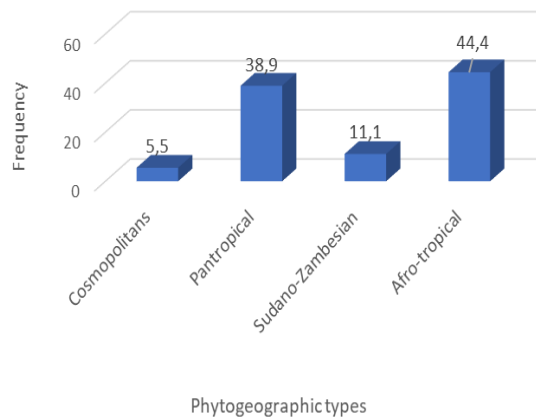
Figure 13 below shows the diaspores of plant species.



**Figure 13:** Type of diaspores

Figure 13 above confirms that of the five types of diaspores identified, two are more common: sclerochores and pterochores with 27.8%, followed by barochores and desmochores with 16.7%. The least common are sarcochores at 11.1%.

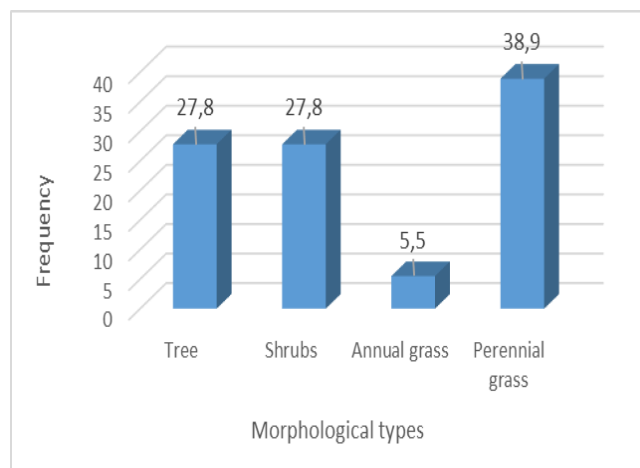
Figure 14 below shows the phytogeographic types.



**Figure 14:** Phytogeographic types

Figure 14 above shows that four phytogeographic types have been identified and presented as follows: Afro-Tropical: 44.4%; Pan-tropical: 38.9%; and Sudano-Zambesian: 11.1%.

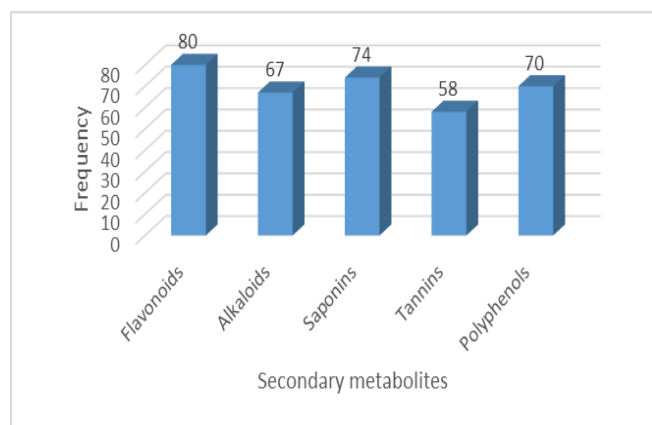
Figure 15 below shows the morphological types.



**Figure 15:** Morphological types of plants

Figure 15 above shows that the morphological types recorded the following results: trees and perennial herbs dominate with 32.4%, shrubs come second with 20.6% and annual herbs finish with 5.9%.

Figure 16 above shows the existence of secondary metabolites in the plants analysed.



**Figure 16:** Secondary metabolites of plants

Figure 16 above shows that the secondary metabolites of the analysed plants were: 80% flavonoids, 74% saponins, 70% polyphenols, 67% alkaloids and 58% tannins.

#### 4. Discussion

##### 4.1. Analysis of sociodemographic data

During our study, we consulted 50 healers, including 18 (36%) men and 36 (64%) women, and fifty infertile couples. The 31-40 age group (26%) was the most represented; 36% of illiterate individuals had to cover the endogenous knowledge level of the recorded plant species; the duration of infertility was dominated by the 4-6 age group.

During this study, a female preponderance was noted, contrary to that of Niamir [15], who found a male predominance with 78.57% of men. However, our results are close to those of Singer [16], who reported a female predominance of 88.9%. Traditional knowledge is passed down from generation to generation, from father to son, and is also acquired through apprenticeship to a guide, most often considered the guardian of tradition, as opposed to women, who were wrongly considered incapable of preserving endogenous knowledge [17].

##### 4.2. Information on plants

Our study identified 18 medicinal plant species used to treat infertility in couples in Kananga. The number of plants recorded demonstrates the floristic diversity of traditional Kananga medicine.

The species most frequently cited by healers are as follows: *Conyza sumatrensis* 72.1%; *Acanthus montanus* 64.7%; *Garcinia hullensis* 63.2%; *Euphorbia hirta* 60.3%;

*Hillidiella smithiana* and *Persea americana* 58.8% respectively; *Gardenia ternifolia* 57.4%; *Kolaharia uncinata* 55.9%; *Petiveria alliacea* 54.4%; *Senna occidentalis* and *Tetracera allinifolia* 54.4% each; *Carica papaya* 52.9%; *Ricinus communis* 52.9%; *Tristemma mauritanium* 52.9%; *Morinda morindoides* 51.4%; *Ananas comosus*, *Mangifera indica* and *Terminalia catappa*. 50% each; are considered the most relevant locally, their use by healers in the local pharmacopoeia highlights proven endogenous knowledge. These plant species are also recognised by [18, 19] for their presumed efficacy, transmitted through shared traditional knowledge.

The most represented families account for around 11.1%; these are *Asteraceae*, *Euphorbiaceae*, *Lamiaceae* and *Rubiaceae*. Other families are slightly represented and constitute a biological sample. This corroborates the results obtained in the Democratic Republic of Congo by Castel, N. [20], according to which there are 22 families and 55 species, including Fabaceae (14.5%), Euphorbiaceae (10.9%), Rubiaceae (10.9%), etc. Fabaceae and Apocynaceae are once again reported at the top of the floristic list in Kwango in the Pelende Nord chiefdom by Nsielolo [21].

The orders of: *Malpighiales* 11 (16.2%); *Fabales* 9 (13.2%); *Caryophyllales* and *Gentianales* 6 (8.8%) are the most commonly used, while the remaining orders cover a low frequency, either due to the lack of knowledge of the healers surveyed or their rarity in the field, as follows: *Asterales* and *Lamiales* 4 (5.9%); *Myrtales* and *Koman*, *Polypodiales* 3 (4.4%); *Alismatales*, *Arecales*, *Asparagales*, *Magnoliales*, *Malvales*, *Rosales*, *Sapindales* and *Solanales* 2 (2.9%) and finally *Brassicales*, *Dilleniales*, *Laurales*, *Ophioglossales*, *Poales* and *Zingiberales*. 1 (1.5%). These results are consistent with those of Nogaret-Ehrhart, A-S [22]. Michel, P, [23] emphasised *Fabales* at 13.5%; *Malpighiales* at 10.8%, *Lamiales* at 7.4%; in traditional treatment in cases similar to our research.

##### 4.3. Parts used

In the preparation of recipes, all parts of the plant are used, but it is the leaves that are used most, at 66.0%, with the others being used to a lesser extent: root 18.0%; stem 12.0%; and finally fruit 4.0%. In most cases, the leaf is the most useful and most widely used part for reasons unknown to practitioners, according to Le maitre, C [24]. On the other hand, according to Dufour, E [25], the use of plant species organs depends on the intelligence of healers. In Italy (Rome), Moreau, F [26], noted that leaves were the most commonly used part in traditional recipes, at 44.26% and 53% respectively, as their use poses little danger to the plant.

#### 4.4. Method of preparation and route of administration

The most commonly used method of preparation is infusion (44.0%), followed by decoction (38%) and others with a low percentage: maceration and calcination (8.0% each) and others (2.0%). The results reinforce those of Giraud, P. [27], who argues that the preparation of recipes depends on the type of plant and that infusion is the most preferred method in many cases. The master, C. [24], also noted that decoction was the most commonly used method of administration and that product dosages were arbitrary, justified by unhygienic preparation methods.

Surveys show that: 70.0% administer orally; 14.0% administer orally and via anal scarification; 2.0% administer via other methods not revealed in our survey. Dufour, E. [25] notes that all recipes are used orally in most African pharmacopoeias.

Five biological types were inventoried as follows: megaphanerophytes at 22.2%, phanerophytes at 11.1%, and prostrate or creeping chamephytes at 9 (13.2%). These results are almost identical to those of Nsielolo [21] on the floristic inventory in the Pelende Nord chiefdom in Kwango.

Two of the five types of Diaspores are more common, accounting for 27.8% (Pterochores and Sclerochores). These results are similar to those reported by Nzodia, M.P. [28]

Afro-Tropical (44.4%) and Pantropical (38.9%) are the most common of the four phytogeographic types recorded. These results corroborate those of Paul Latham et al. and Adjanohoun, E., [17, 29].

The perennial grass type, one of the four morphological types, was recorded with a high percentage of 38.9%, followed by trees and shrubs at 27.8%. The annual grass type was used less frequently at 5.6%. These results are similar to those of Nsielolo et al. and Moreau, F [21, 26].

#### 4.5. Qualitative analysis of secondary metabolites

The secondary metabolites of the plant extracts analysed are as follows: flavonoids at 80%, saponins at 74%, polyphenols at 70%, alkaloids at 67% and finally tannins at 58%. Similar studies conducted in the DRC and other African and global countries have reported proportions comparable to our results, confirming that the plants surveyed contain phytochemical compounds that could scientifically justify their traditional use [3, 26, 30, 31].

#### Conclusion

The results obtained have highlighted the diversity of Kananga's flora in treating infertility among couples in Kananga, Central Kasai Province, DR Congo.

The ethnobotanical survey conducted in the city's five communes identified 18 medicinal plants of high value, divided into 18 genera, 14 families and 11 orders, used by healers to treat infertility.

The floristic analysis revealed nine biological types, four phytogeographic types, four morphological types, and five types of diaspores.

Phytochemical analyses confirmed the presence of secondary metabolites as follows: flavonoids at 80%; saponins at 74%; polyphenols at 70%; alkaloids at 67%; and tannins at 58%.

This study highlights the importance of phytochemical analysis as an essential step towards the scientific validation, standardisation and safety of these traditional remedies.

The phytochemical study aims to establish a rigorous framework for the phytochemical analysis of medicinal plants used to treat infertility in couples, contributing to the enrichment of knowledge on traditional practices and potentially to the discovery of new treatments.

In view of the current stage of our study's results, collaboration between traditional and modern medicine should be considered.

Further research is needed to identify, isolate and purify the compounds present in the plants we have selected, and to study their respective roles in treating infertility in couples in Kananga.

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