Plants used in the traditional treatment of female infertility in Kita, Mali

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ABSTRACT

Aims: The aim of this study was to identify the plants used in the traditional treatment of female infertility in Kita, Mali.
Place and Duration of Study: The ethnobotanical investigation has been conducted in the town of Kita (Mali) from April to July, 2021. The data management and analysis were carried out at Faculty of Sciences and Techniques (FST), University of Sciences, Techniques and Technologies of Bamako (USTTB), Mali, between August 2021 and January 2023.
Methodology: Ethnobotanical survey was carried out using questionnaire addressed to the available people who gave their free consent.

Results: An ethnobotanical survey was carried out among fifty-two (52) people, including twenty (20) traditional practitioners, ten (10) herbalists, six (6) people who are both herbalists and traditional practitioners, and sixteen (16) housewives inside the town of Kita.The surveyrevealed 38 plant species belonged to 25 botanical families. The most represented families were Moraceae (28.94%), Sapotaceae (26.31%), Fabaceae (26.30%), Apocynaceae (21.05%).The most coveted plant species by the local populations to treat female infertility were *Ficus capensis*with 26.31%, *Vitellaria*p*aradoxa*with 23.68%, *Stereospermumkunthinum*with 21.05*%,* Leptadenia hastata with 21.05%. The leaves have been the most frequently used organs (43%). These plants were mostly used as decoctions (80%) and administered by oral route (89%). The commonly associated ailments with female infertility included pelvic pains, dysmenorrhea and Toxoplasma gondii infections.
Conclusion:This survey has enabled us to gain a better understanding of the anti-fertility plants used in the town of Kita.

Keywords: Ethnobotanical survey, female infertility, Kita, Mali.

1. INTRODUCTION

Procreation has always been a vital objective for human beings and particularly for housewives. Today, women's ability to have children can be significantly impacted by environmental and social factors (Ménézo et al., 2012). These pressures, if poorly managed, could lead to infertility in women. This concept of infertility can be defined as a woman's inability to conceive a pregnancy after 12 months of regular unprotected sex. The infertilityis estimated to affect between 8% and 12% of couples trough the world (Mélodie & Christine, 2018). Very high rates of female infertility have been recorded in in sub-Saharan Africa (Koman et al., 2019) 11.7% in Kayes, Mali (Diassana et al., 2023).
It is well known that the procreation always remains the fundamental reason for marriage in Africa As a result, the problems related to procreation negatively affect the life and well-being of individuals, couples and families until they become a heavy burden on their socio-

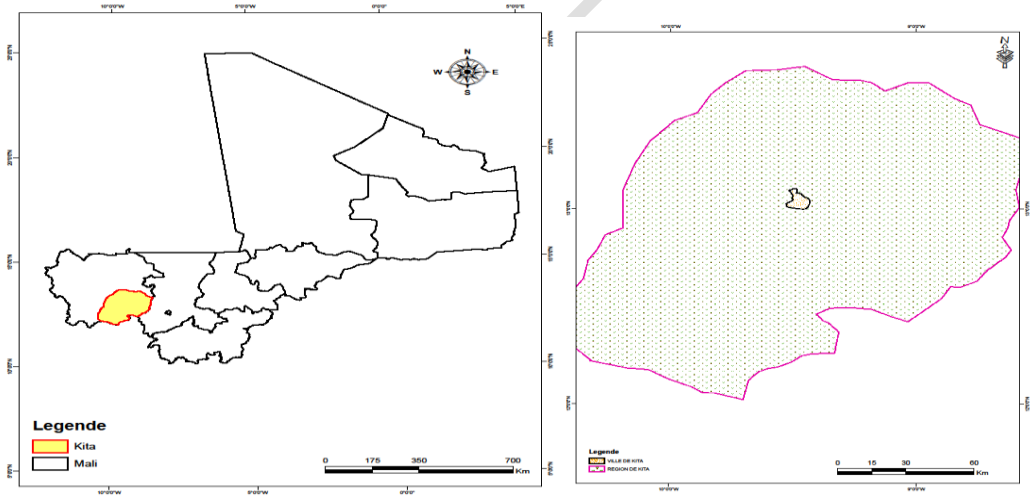
economic development (Houmenou et al., 2017). In Mali, marital infertility is a real social scourge, considered to be a specifically female concernin order to avoid to highlight the man's virility (Traore, 2010). Accused of infidelity and prostitution, infertile women are ridiculed in their homes.Faced to this calvary, they become an easy prey for fetishists and charlatans. (Tembely, 2008).

However, female infertility needs to be handled delicately, because it is often a divorce reason for couplesin Africa, and generate psychological disorders in the Western countries(Kouamé et al., 2012).. Its treatment in modern medicine is costly and sometimes presents many side effects (Koman et al., 2019).That's why the use of medicinal plants appears to be an appropriate alternative for resolving this infertility problem in the worldwide and singularly in Africa(Françoise et al., 2018). Indeed, studies have reported that the African flora in general, and Malian flora in particular, is made up of a large reserve of medicinal plants, occupying an important place in African pharmacopoeia (Togola et al., 2022).(Traoré et al., 2023). According to (Sanogo, 2010), traditional medicine offers effective and accessible options for the predominated pathologies in the local communities. It is also a national cultural heritage and a better way to connect people with their own history and culture.But, this common traditional practice for managing pathologies, like infertility, deserves to be framed by scientific research. That's why this study was initiated, with the aim of contributing to a better understanding and rational use of local plants used in the treatment of female infertility by the local populations of Kita in Mali.

2. MATERIAL AND METHODS

2.1 Study sites

The ethnobotanical survey was carried out in the region of Kita, located at 187 km from Bamako, Mali (Figure 1).



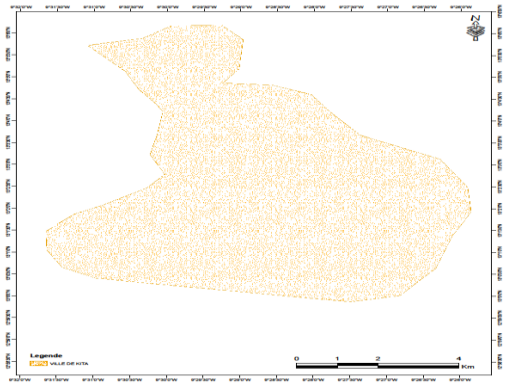


Figure 1. Map of Mali with survey site location

2.2 Data collection

The survey took place from April 03 to July 28, 2021 in the town of Kita. It concerned anyone with some knowledge of medicinal plants who was willing to answer the semi-structured questionnaires. The randon sampling and the snowball method were used to select the 52 respondents in the that study. After obtaining the free written consent from each participant, a questionnaire form (containing the opened and closed questions) wasaddressedto them. Questions focused on the plant species used to treat female infertility, the organs/parts used, and methods of preparation and administration. In addition, the sociodemographic characteristics of the respondents were registered. Interviews were conducted in the locallanguage ‘’Bamanankan’’. The species cited were identified through search engines and resource persons. The genera and specific diversities were estimated based on the formula used by(Togola et al., 2022).

2.3 Data analysis:

Excel version 2017® and SPSS Statistics 17 were used to analyze the data.

3. RESULTS AND DISCUSSION

3.1 RESULT

3.1.1 Socio-demographic characteristics of respondents

3.1.1.1 Distribution of respondents by gender

The Figure 2 shows therepartition of respondents by gender. Of the 52 people surveyed, 38 were female (73%) and 14 male (27%).

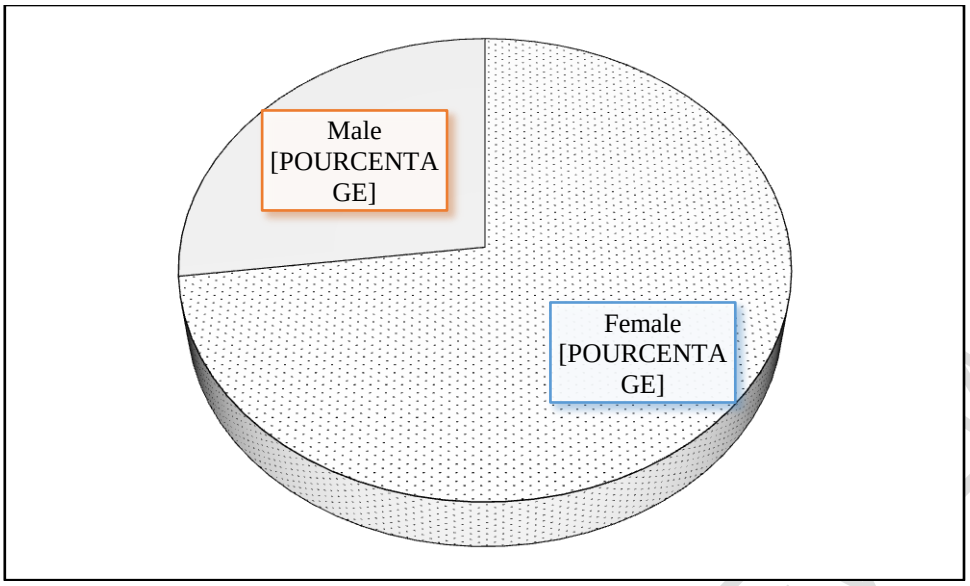


Figure 2.Distribution of respondents by gender

3.1.1.2 Distribution of respondents by age and profession

The **Table 1** shows the distribution of 52respondents by age and profession. The survey participants came from diverse backgrounds, encompassing ages from 20 to 80. Traditional practitioners and herbalists formed the majority, representing nearly 50% of those interviewed. Housewives (30.77%) also constituted a significant group, reflecting the community's involvement in traditional knowledge. While younger individuals participated, the most frequent respondents fell within the [50-65] age range, highlighting the value placed on experience in managing female infertility locally.

Table 1. Distribution of respondents by age and profession

Age groups (years)	Number& Percentages	Professions	Number & Percentages
[20-35[	9 (17.31%)	Traditional healers	20 (38.46%)
[35-50[	17 (32.69%)	Herbalists	10 (19.23%)
[50-65[	18 (34.62%)	Traditional herbalists	6 (11.54%)
[65-80]	8 (15.38%)	Housewives	16 (30.77%)
Total	52 (100%)	Total	52 (100%)

Table 2. Normality test Shapiro-Wilk.

Characteristics	Statistic	degree of liberty	P-value
Gender of respondent	0.554	52	0.000
Profession of respondent	0.786	52	0.000
Age of respondent	0.882	52	0.000

*The test is considered to be significant if P-value <0.05

The Shapiro-wilk normality test reveals an asymmetrical distribution (P= 0.000<0.05) of respondents by gender, profession and age.

3.1.2 Distribution of species by botanical family and morphological types

The **Figure 3** shows the listof botanicalfamilies registered and their frequencies. Twenty-five(25) families were identified. The most represented families were Moraceae, Fabaceae, Sapotaceae, Apocynaceaeand Bigoniaceaewith more than 21.05% as citation frequencies. These species are belonged to four (4) morphological groups as indicated in the Table 3. The shrubs (42.10%) followed by the trees (31.59%) were the most important morphological types used by the respondents.

While 25 plant families were identified, Fabaceae and Rubiaceae showed the highest diversity in number of genera (Idg = 0.36 and 0.12, respectively). However, Moraceae had the highest diversity in number of species (Ids = 2).

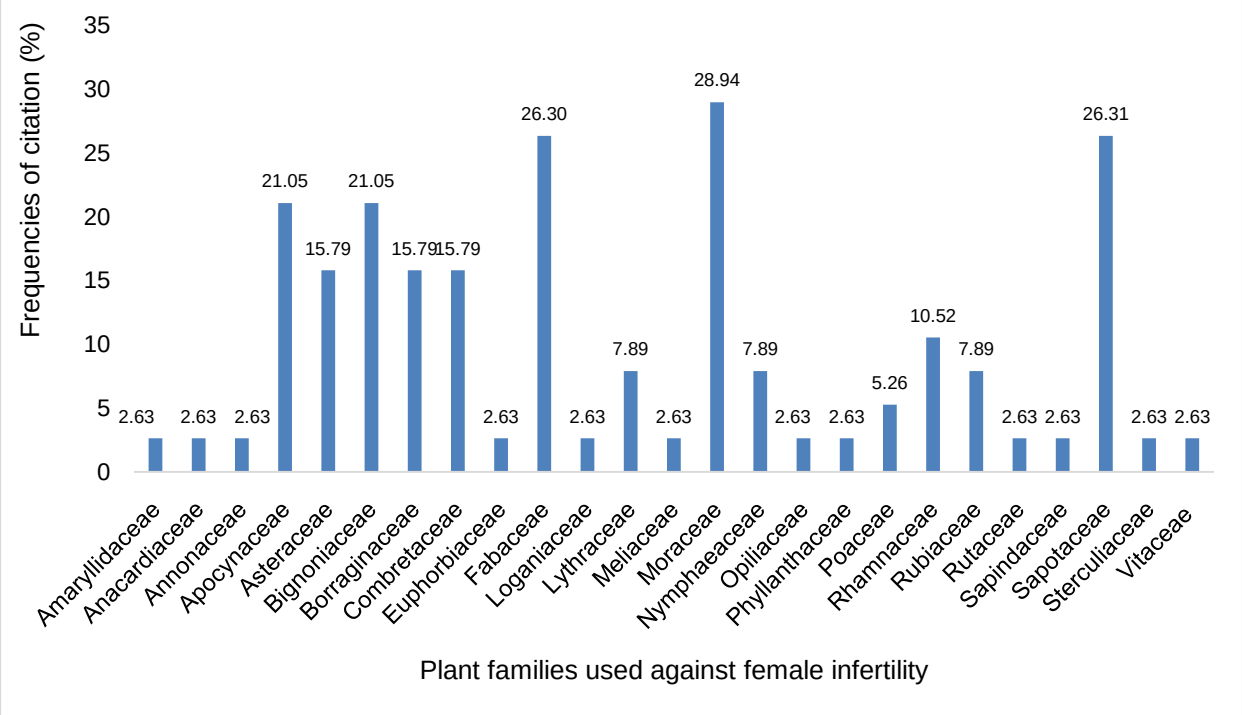


Figure 3. Distribution of species by botanical family

Table 3. Distribution of species according to morphological groups

Morphological types	Tree	Shrub	herbaceous	Liana	**Total**
Effectives	12	16	08	02	**38**
Frequencies (%)	31.59	42.10	21.05	5.26	**100**

Table 4. Index of genera and specific diversity

Botanical families	**Number of genera**	**Number of species**	**Idg**	**Ids**
Amaryllidaceae	1	1	0.04	1.00

Anacardiaceae	1	1	0.04	1.00
Annonaceae	1	1	0.04	1.00
Apocynaceae	1	1	0.04	1.00
Asteraceae	1	1	0.04	1.00
Bignoniaceae	1	1	0.04	1.00
Borraginaceae	1	1	0.04	1.00
Combretaceae	3	3	0.08	1.00
Euphorbiaceae	1	1	0.04	1.00
Fabaceae	7	7	0.36	1.00
Loganiaceae	1	1	0.04	1.00
Lythraceae	1	1	0.04	1.00
Meliaceae	1	1	0.04	1.00
Moraceae	1	2	0.04	2.00
Nymphaeaceae	1	1	0.04	1.00
Opiliaceae	1	1	0.04	1.00
Phyllanthaceae	1	1	0.04	1.00
Poaceae	2	2	0.08	1.00
Rhamnaceae	1	1	0.04	1.00
Rubiaceae	3	3	0.12	1.00
Rutaceae	1	1	0.04	1.00
Sapindaceae	1	1	0.04	1.00
Sapotaceae	2	2	0.08	1.00
Sterculiaceae	1	1	0.04	1.00
Vitaceae	1	1	0.04	1.00

*Idg: index of genera diversity; Ids: index of specific diversity

3.1.3 Plant organs used

The Figure 4 shows the plant parts used and their frequencies. Several parts were cited, including leaves, bark, fruit, roots, stems, sheaths, the whole plant and the young plant. The leaves are the most frequently used, with 43% of mentions.

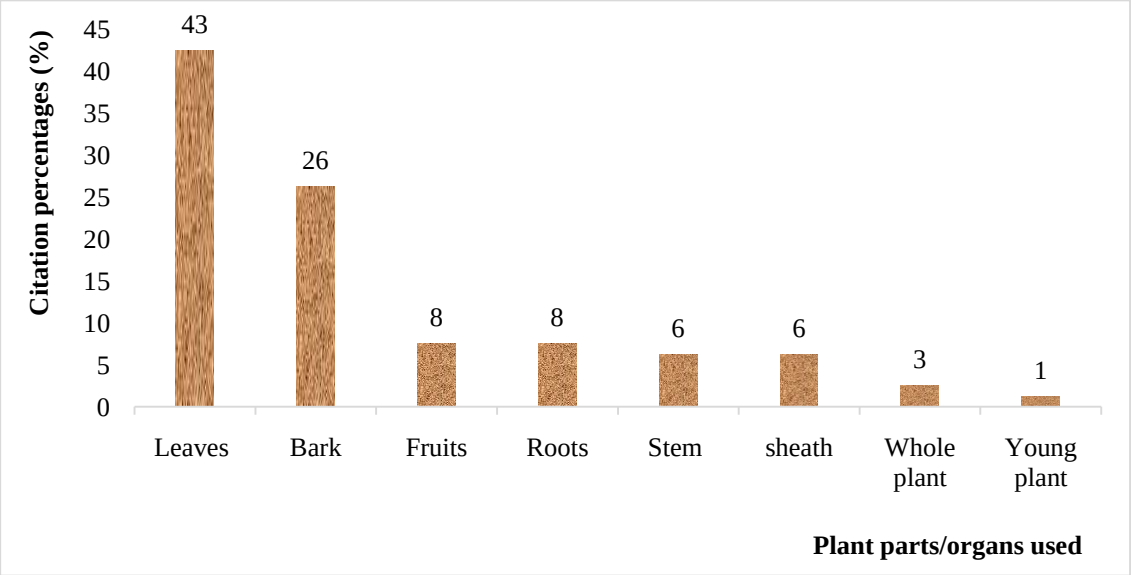


Figure 4. Frequencies of use of plant organs or parts

3.1.4 Preparation and administration modes

The Figure 5illustrates the different preparation methods and administration routes for the plant parts used.

Three main preparation methods were mentioned by respondents: decoction (80%), maceration(14%), spraying (5) and other methods (1%). These different recipes were administered by several routes, mainly byoral one (89%). Vaginal steaming was also noted.

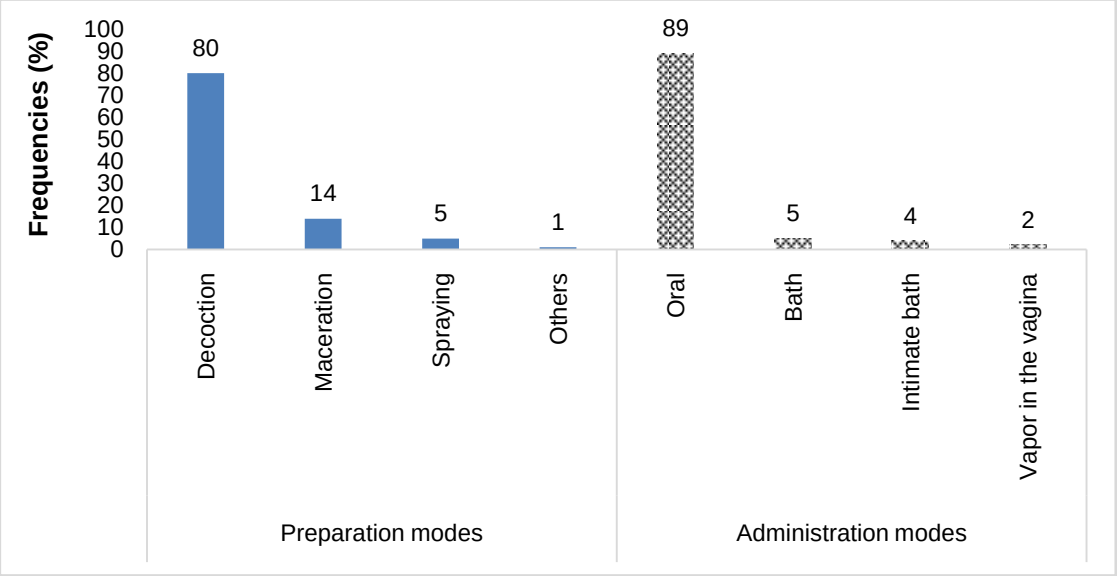


Figure 5. Preparation and Administration modes of plant organs/parts

3.1.5 Conditions favoringinfertility

The survey results shed light on the multifaceted understanding of female infertility within the local context. Respondents attributed infertility to a spectrum of factors, with pelvic pain (54%) topping the list. Reproductive health concerns, including dysmenorrhea (17%) and abnormal menstrual cycles, were also prominent. Notably, respondents recognized the potential impact of infectious diseases like toxoplasmosis (17%) and other infections (4%). Additionally, a range of gynecological conditions, including uterine fibroids (3%) and candidiasis (3%), were identified as potential contributing factors.

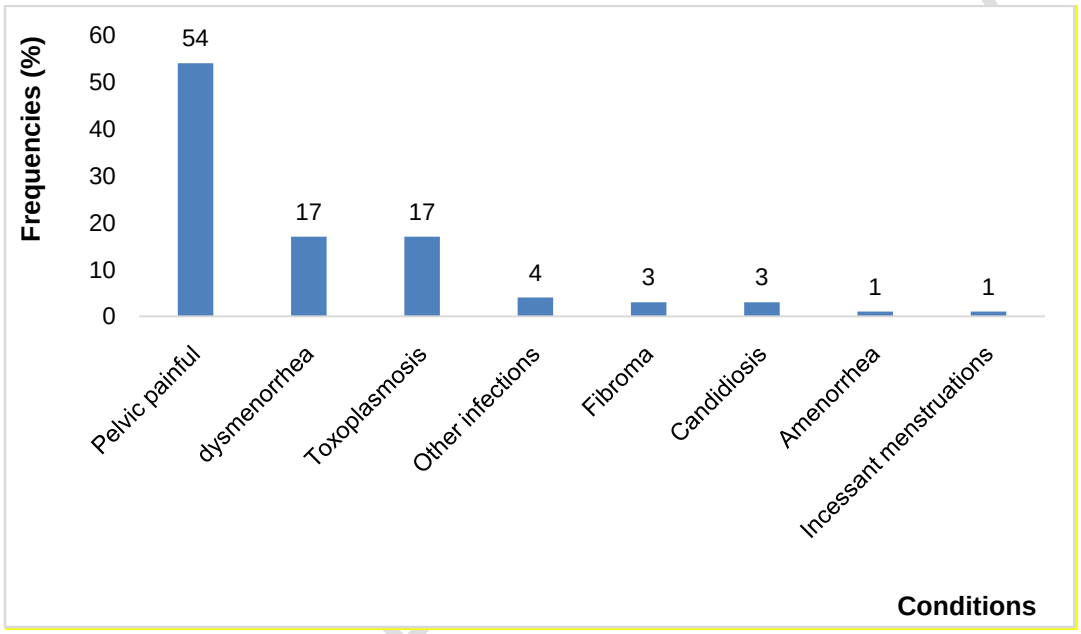


Figure 6. Conditions leading to infertility

3.1.6 Plant species surveyed

Analysis of Table 2 shows that a total of 38 different species belonging to 25 families used in the treatment of female infertility at Kita were recorded. *Ficuscapensis* (26.31%), *Vitellariaparadoxa* (23.68%), *Leptadeniahastata* (21.05%) and *Stereospermum kunthinum* (21.05%) were the mostcoveted species by the local populations of Kita. Respondents have also mentioned incessant menstruations (1%) or heavy menstrual bleeding or metrorrhagia.

Table 5. List of plants: Families, organs used, preparation and administration methods and frequencies of use

N°	Families	Scientific names	Local names	Treated conditions	Parts used	Preparation mode	Mode of administration	Frequencies of citation (%)
1	Amaryllidaceae	*Allium ursinum*L.	Bakani-sabali	Fibroma	Whole plant	Decoction	Exposing the vagina to steam	2.63
2	Anacardiaceae	*Sclerocaryabirrea*(A.Rich.) Hochst	Gouna	Pelvic pains	Barks	Decoction	Oral	2.63
3	Annonaceae	*Annona senegalensis*L.	Sounsoundiè	Pelvic pains	Leaves	Spraying	Oral	2.63
4	Apocynaceae	*Leptadenia hastata* (Pers.) Decne	Sarafaté / zoyé	Pelvic pains / dysmenorrhea / incessant menstruation	Leaves	Decoction	Oral	21.05
5	Asteraceae	*Eclipta prostrata*(L.) L.	Moussofing	Pelvic pains /Infection/candidose/toxoplasmosis	Leaves	Decoction	Oral/bath	15.79
6	Bignoniaceae	*Stereospermum kunthinum* Cham.	Mogoyiri	Pelvic pains/ toxoplasmosis	Leaves / Barks	Decoction / Maceration / Spraying	Oral	21.05
7	Borraginaceae	*Heliotropium indicum*L.	Nonsikou	Pelvic pains/toxoplasmosis	Leaves/whole plant	Decoction	Oral	15.79
8	Combretaceae	*Combretumnigricans*Lepr. ex Guill.&Perr	Dianbagatawoulè	Pelvic pains	Roots	Decoction	Oral	2.63
9		*Guierasenegalensis*J. F.Gmel.	Koundiè	dysmenorrhea	Leaves	Decoction	Oral/Bath	2.63
10		*Pteleopsissuberosa*Engl et Diels	Tèrèni	Pelvic pains /candidosis	Barks	Decoction	Oral/Intimate bath	10.53
11	Euphorbiaceae	*Euphorbia hirta*L.	Denbasidji	Infection	Leaves	Decoction	Oral	2.63

12	Fabaceae	*Acacia nilotica*L.	Bouana	Infection/Candidosis	Fruits	Decoction	Oral / Intimate bath	7.89
13		*Cassia occidentalis* L.	Balan-balan	Pelvic pains	Roots	Maceration	Oral	2.63
14		*Dichrostachysglomerata*(Forssk.) Chiov	Triki	Pelvic pains	Leaves	Decoction	Oral	2.63
15		*Erythrina senegalensis* DC.	Ntébiléni	Pelvic pains	Leaves/Bark	Decoction	Oral	5.26
16		*Parkia biglobosa*(Jacq.)R.Br. ex G.Don	Néré	Pelvic pains	Barks	Maceration	Oral	2.63
17		*Pilostigmatonningii*(Schum.) Milne-Redh	Niama	Toxoplasmosis	Leaf	Decoction	Oral	2.63
18		*Tamarindus indica*L.	N'tomi	Pelvic pains	Leaf	Decoction	Oral	2.63
19	Loganiaceae	*Strychnosspinosa*Lam.	Kera / gangoro	Pelvic pains	Leaves	Decoction	Oral	2.63
20	Lythraceae	*Lawsonia inermis*L.	Diabi	Pelvic pains	Leaves	Decoction/spraying	Oral	7.89
21	Meliaceae	*TrichiliaemeticaVahl*	soulafinsan	Pelvic pains	Roots/Bark	Spraying	Oral	2.63
22	Moraceae	*Ficus capensis*Thumb	Seretoro	Pelvic pains /toxoplasmosis	Leaves/Fruit/Bark	Decoction	Oral	26.31
23		*Ficus lecardii*Engl. &Diejs	Céré-diatikifaga	Pelvic pains	Leaves	Decoction	Oral	2.63
24	Nymphaeaceae	*Nymphaea lotus*L.	Djilagokou	dysmenorrhea / Pelvic pains	Leaves	Decoction	Oral	7.89
25	Opiliaceae	*Opiliaceltidifolia*(Guill. &Perr.) Endl.	Koronkoii	Pelvic pains	Leaves	Decoction	Oral/ bath	2.63
26	Phyllanthaceae	*Hymenocardiaacida*Tul.	Kalakari	Pelvic pains	Leaves	Decoction	Oral	2.63
27	Poaceae	*Pennisetumclandestinum*H	Sinkiri	Pelvic pains	Whole plant	Decoction	Oral	2.63

		ochst. ex chov.						
28		*Vetiverianigritana*(Benth.) Stapf	komourouni	Pelvic pains	Leaves	Decoction	Oral	2.63
29	Rhamnaceae	*Ziziphus mauritania* Lam.	N'tomono-missin	dysmenorrhea	Barks	Decoction	Oral	10.52
30	Rubiaceae	*Gardeniaerubescens*Stapf et Hutch	M'bourémuso	Pelvic pains / dysmenorrhea	Mistletoe	Spraying	Oral	2.63
31		*Mitragynainermis*(Willd.) Korth.	Djoun	dysmenorrhea	Fruits	Decoction	Oral	2.63
32		*Sarcocephalus latifolius*(Sm.) Bruce	Bati / Baro	Pelvic pains	Leaves	Decoction	Oral	2.63
33	Rutaceae	*Citrus lemon*(L.) Burm.f.	Lemouroucoumouni	Pelvic pains	Leaf	Decoction	Oral	2.63
34	Sapindaceae	*Paulinia pinnata*L.	Sokoni-nonfon	Toxoplasmosis	Leaves	Decoction	Oral	2.63
35	Sapotaceae	*Manilkaramultinervis*(Baker) Dubard	Chi-sina	Pelvic pains	Leaves/Bark	Spraying	Oral	2.63
36		*Vitellariaparadoxa*C.F. Gaertn.	Chi	Toxo/ Pelvic pains	Bark / Mistletoe / Young plant	Decoction / Maceration / Spraying	Oral	23.68
37	Sterculiaceae	*Waltheria indica*L.	Dabada	Amenorrhea	Leaves	Decoction	Oral	2.63
38	Vitaceae	*Cissuspopulnea*Guill& Perr	Goumban / Ngaro	dysmenorrhea / Pelvic pains	Bark	Decoction	Oral	2.63

3.2 DISCUSSION

3.2.1 Socio-demographic data

The analysis of sociodemographic characteristics of 52 people surveyed show thatonly 14 were male gender(27%) against 38 females (73%) (Figure 2). The target population was made up of three occupational categories, of which 38% were traditional practitioners, 19% herbalists, 12% traditional practitioner-herbalists and 31% housewives. Respondents ranged in age from 20 to 80, with the majority between 35-65 age group(***Table 1***). Otherwise, the Khi^2 test shows that the tradional treatment are strongly dominant by the female among the respondents (P= 0.000<0.05). This activity is also dependent of the profession and age (P=value<0.05). These results are contrary to those of several authors(Françoise et al., 2018; Houmènou et al., 2018; c who have reported that the majority of respondents are male gender.

3.2.2 Medicinal plants used

Examination of the survey forms revealed 38 plant species belonged to 25 botanical families (Figure 3).The most frequently cited species was *Ficus capensis* with 26.31% followed by *Vitellariaparadoxa* (23.68%). The survey conducted by Diawara (2010) in two Bamako markets showed that the various Ficus species are frequently used in the treatment of dysmenorrhea in Mali, which is one of the best-known factors that can cause female infertility. Among these 38 plant species used to treat the female infertility, 28.94%of them were Moraceae, 26.30% were Fabaceae and Sapotaceae and 21.05% wereApocynaceae and Bigoniaceae. Furthermore, these species are belonged to four (4) morphological. The shrubs (42.10%) followed by the trees (31.59%) were the most important morphological forms used by the local populations of Kita.The same families and morphological groups have been reported by (Koman et al., 2019) in Dabakala's department in Ivory coast. In opposite, 48% of these found plant species were herbaceous against only 16% for shrubs. These differences could be linked to the geographical and climatic conditions of investigated areas.

The most frequently used organ was the leaf, with 43% of citations, followed by bark (26%), stems, and mistletoe (6%) each. (Figure 4). Ethnobotanical surveys conducted by Kemadji et al. (2022) and Koman et al. (2019) on plants used in female infertility have also reported high rates of leaf utilization; 35% and 46% respectively. This high use of leaves could be due to the availability and the ease of collection (Tuttolomondo et al., 2014).Furthermore, the literature have attributed this high use of leaves to their richness in bioactive compounds which are endowed with many pharmacological properties (Telefo et al., 2012; Togola et al., 2023)

Thanks to their pharmacological properties, thesebioactive compounds are responsible for their use in the treatment of female infertility (Kemadji et al., 2022).. The use of leaves must be encouraged as it represents no danger to plant regeneration and ensures the conservation of floristic richness (Savio et al., 2020).

These organs were prepared mainly as decoctions by the majority of local populations (80%) and generally administered orally (89%). These results corroborate those of many authors (Houmenou et al., 2017; Koman et al. (2019); Savio et al., 2020). According to Savio et al.

(2020) this could be justified by the fact that decoction allows the most active principle to be collected and cancels out the toxic effect of certain recipes.The preference of oral route could be explained by the fact that the disease is linked to bacterial and fungal infections most often located in the deep organs (Koman et al., 2019); so to reach them, the biocompounds must transit through the digestive tract (Tra Bi et al., 2008).
As the treatment of female infertility is traditionally complex, local populations provided better management of factors that contribute to it. Among these factors favoring female infertility, they are pelvic pains(54%), dysmenorrhea (17%) and toxoplasmosis (17%).

These collected data, could be affected by people's perceptions and methods of respondents' recruitement (snowball, random sampling). To address these limitations, future investigations must be understaken to gain deeper insights into local understandings and practices related to female infertility and to establish causal relationships between identified factors and infertility outcomes.

4. CONCLUSION

This study explored local knowledge and practices in managing female infertility in Kita. Participants revealed a diverse arsenal of plant species, favoring leaves and barks prepared as decoctions and administered orally. Notably, pelvic pain, dysmenorrhea, and toxoplasmosis were recognized as potential contributors. These findings hold significant value. Further research should delve into the scientific potential of these plants (phytochemical composition, toxicity and anti-fertility activities), while recognizing the importance of understanding their cultural significance, traditional knowledge systems, and ecological sustainability. This holistic approach could benefit numerous stakeholders – from traditional healers who can enhance their practices to healthcare professionals who can better communicate with patients seeking traditional remedies. Ultimately, such collaboration bridges the gap between traditional knowledge and scientific exploration, paving the way for improved health outcomes in Kita and beyond.

Consent

As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

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