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Valorization of the Endogenous Knowledge of Plants Used in the Treatment of Female Infertility in the District of Abomey-Calavi in Benin

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Abstract **Original Research Article**

The child is the foundation for the consolidation of a couple's home in the world. Thus, the absence of the fruit of the union (child) in the couple is subject to criticism and is a source of problems between the spouses. The first cause cited is female infertility. This study aims at solving the problems of female infertility through the knowledge and valorization of plants used for its treatment. The methodology used consisted of an ethnobotanical survey based on a pre-established questionnaire and complemented by individual semi-structured interviews with the target group. A total of 96 people were interviewed. Correspondence Factorial Analysis (CFA) using R software was used to establish the relationships between ethnic groups and their knowledge of female infertility. The calculation of ethnobotanical indices allowed the diversity and importance of plants to be assessed. The study population has specific knowledge about the symptoms of the causes of a woman's infertility. A diversity of 61 plant species belonging to 35 botanical families was identified. The most represented families are: Anonnaceae, Euphorbiaceae, Leguminoseae-Mimosoideae and Rubiaceae. Also, the plants: Xylopia aethiopica, Monodora myristica, Syzygium aromaticum, Allium cepa and Hybanthus enneaspermus are frequently used in recipes for the treatment of female infertility symptoms. This work constitutes a database for other studies on pharmacology, toxicology of useful plants and their valorisation.

Keywords: Herbalists, Absence of pregnancy, Endogenous knowledge, Plants, South-Benin.

INTRODUCTION

Parenthood is one of the desires in adulthood of most men and women (Boivin *et al*., 2007; Abondo-ngono *et al*., 2015). Being à progenitor is more important in African communities because of the place à child occupies in the life of à couple. In Africa, social maturity is accompanied by marriage and having offspring (Wembulua Shinga, 2012). Children provide the opportunity to form marital bonds. They provide social security, help with work, confer social status, secure property and inheritance rights. They provide continuity through reincarnation and maintenance of family lineage, and meet emotional needs. The need to be a progenitor confers many roots and depths between families (Dyer *et al*., 2005). Thus, having a child is essential for the survival of a couple. The absence of children after a certain period of marriage is often the source of infidelity, family conflicts and divorce (Nana *et al*., 2011). Delayed start of desired pregnancy is a psychological and emotional problem within the couple. This delay causes an existential and symbolic rupture (David and Revidi 2000; Errol and Schorge, 2001).

The primary cause of lack of desired pregnancy is infertility which refers to the absence of pregnancy within one year despite regular and unprotected sex (Imthurn *et al*., 2008; Maubon *et al*., 2008; Anwar, 2016). Global statistics show that about 48.5 to 72.4 million (7-9%) couples have this non-fertility problem (Boivin *et al*., 2007). In sub-Saharan Africa, the rate of infertility varies from 10 to 21% (Aboughe Angone, 2009; Assongba *et al*., 2014). Infertility is therefore a public health problem (Wembulua shinga, 2012). In a couple, infertility can come from the man (35%), the woman (40%), both (15%) (AbougheAngone, 2009).

The responsibility of the woman is therefore greater. Especially in Africa where a childless woman is considered a dishonour to her family (Déléké Koko *et*

al., 2009 ; Houmènou *et al*., 2017). The woman is often incriminated and seeks more than the man, the remedies to the couple's infertility (Nkounkou-Loumpangou *et al*., 2005). In this search, several means are available to her. She resorts to both types of medicine (modern and traditional) (Imthurn *et al*., 2008; Mbungu *et al*., 2010; Nana *et al*., 2011; Anwar, 2016). Other women resort directly to traditional medicine (Nkounkou-Loumpangou *et al*., 2005; Aboughe Angone, 2009). Traditional medicine, long fought against, has become the last resort thanks to the recognition of the effectiveness of plant treatments (Damme, 2008 ; Jiofack *et al*., 2010; Adomou *et al*., 2012). The treatment of female infertility has a place in traditional medicine (Adomou *et al*., 2012 ; Houmènou *et al*., 2017).

In the African sub-region, studies have mainly focused on identifying the traditional plants used (Nkounkou-Loumpangou *et al*., 2005 ; Aboughe Angone *et al*., 2009 and Telefo *et al*., 2011). In Benin, studies conducted in the case of infertility treatment (Houmènou *et al*., 2017 and 2018). The male sex is exclusively targeted. It is therefore necessary to conduct further investigations on the female sex for a better exploration of plants that enter the treatment of female infertility symptoms. Thus, the present study aims to enhance the endogenous knowledge on plants that treat the causes of female infertility in the district of Abomey-Calavi and the perception of the populations on the different causes of female infertility.

Presentation of the study environment

The city of Abomey-Calavi is one of the eight district of the Atlantic department in Benin. It is bordered by the communes of Zè, Sô-Ava, Cotonou, Adjohoun, Toffo and Ouidah. The Atlantic Ocean constitutes one of its limits.

Biophysical characteristics

The climate is sub-equatorial with two rainy seasons and two dry seasons. The total annual rainfall is 1300 mm of water. The hydrographic network is essentially made up of two bodies of water, Lake Nokoué and the coastal lagoon. The vegetation cover varies according to the facies crossed. Thus, we find mangrove (*Rhizophora racemosa* and *Avicennia germinans*) in the coastal zone, a degraded savannah on the plateau, market gardening along the marshes and a grassy grouping in the swamps along the banks of Lake Nokoué. (Adomou *et al.*, 2012). The commune of Abomey-Calavi has a population of 656358 according to the RGPH4 (INSAE, 2015). The sociolinguistic groups encountered are: Fon, Yoruba, Toffin, Goun and Adja. The dominant ethnic group is Aïzo (84%).

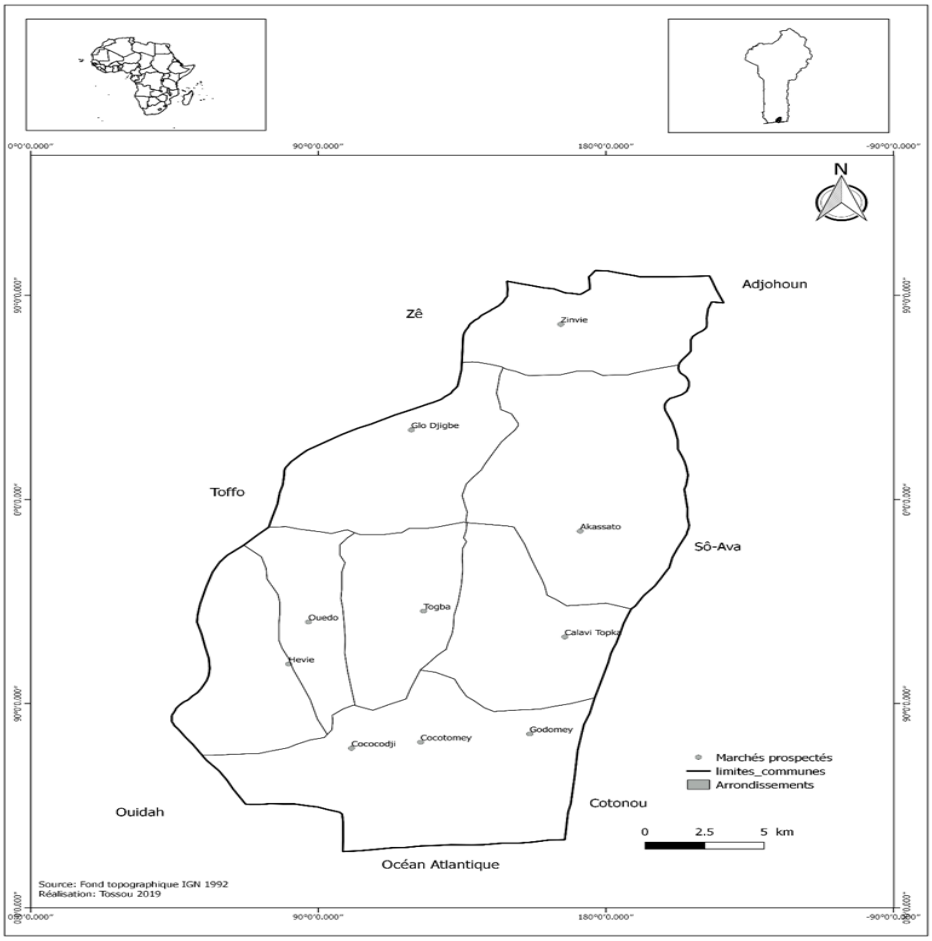

Fig-1: Map showing surveyed locations

Study methods

This is an ethnobotanical study based on qualitative and quantitative approaches. The plant material for this study is made up of plants used in recipes for female infertility. The study population is made up of herbalists, traditional medicine practitioners and resource persons with good knowledgefemale infertility.

Sampling

The sample size is determined after the exploratory survey conducted. It was used to identify the various herbalists who have knowledge of plants that treat female infertility. For this purpose, 30 people were randomly surveyed, 15 of whom know at least one plant that treats female infertility. Then, the real size of the informants was calculated by the formula of Dagnelie (1988), whose composition is as follows:

$$n = \frac{U^2(1 - \propto/2) * p\,(1-p)}{d^2}$$

Where: n: the size of the sample considered, p: the proportion of people (herbalists and herbalists) knowing the plant species that treat female infertility, U1-α/2 = 1.96 is the value of the normal random variable for a probability value of α = 5%, d is the margin of error set at 10% in this study. Hence, p= 15/30 = 0.5, 1- p = (0.5) and d = 10%, n = [(1.96)² × 0,5 × 0.5] / (0.1)² = 96.04. Thus, 96 people were surveyed in the nine districts of the commune. The survey took into account gender, age and sociolinguistic group.

Criteria for selecting locations and including informants

In order to collect the data, all the districts with a herbalist association and a market where there is a herbalist are visited. The herbalists are visited on the market day of the district. A herbalist here is a seller of medicinal plants. The herbalist who is taken into account as an informant must be in the exercise of the profession at least five (5) years. He/she is a person who masters the vernacular name, the distinction of plants, the plant drug used and has at least twenty (20) plants on his/her display. The herbalist interviewed must have knowledge of the causes of infertility and the means of treatment.

DATA COLLECTION AND PROCESSING

During data collection in the field, the semi-structured individual interview technique is advocated (Saadou, 2008; Dansi *et al.*, 2008; Dassou *et al.*,, 2015). This technique is chosen because it is simple and suitable (Houéwanou *et al.*, 2016).

The socio-demographic information collected from the respondents is: age, sex ratio, literacy level, and ethnic group (Assogbadjo *et al*., 2008). Thus we have: young people (less than 30 years old), adults (30 to 60 years old) and the elderly (more than 60 years old).

Diversity of herbal recipes in the treatment of female infertility

The diversity and importance of herbal recipes in the treatment of female infertility were assessed by individual semi-structured interviews (Saadou, 2008; Dansi *et al.*, 2008; Dassou *et al*., 2015). It is also collected, from the herbalists the phytomedicines (their composition, duration of treatment, dosage, mode of preparation: alcoholature, infusion, ... etc.). The date of the beginning of the intake of the phytomedicine after menstruation or during menstruation. After the individual interview and in focus group, walks are made in the markets, the botanical garden of the phytotherapists, in the premises of manufacture of the phytomedicines for taking photos of the plants and those of the modes of preparation.

DATA PROCESSING

In order to better understand the treatments for female infertility, a Correspondence Factorial Analysis (CFA) was carried out with the R software. The CFA was used to relate the socio-cultural groups surveyed to their opinions on the causes of female infertility. Then, a Pearson's Chi 2 test was done to check if there is a significant difference between the perceptions of the different ethnic groups on the causes of female infertility. Frequency calculations with graphical representations were made in order to better analyze some variables (importance of plants, floristic composition, mode of administration, modes of preparation). The Relative Frequency of Citation (RFC) of each species was then calculated using the formula of Dossou *et al.* (2012):

$$FRC = S/N \times 100$$

Where S is the number of times a species was cited and N is the total number of plants cited. The Degree of Fidelity characterizes the importance of a plant species among the indicated plant species (Teklehaymanot *et al*., 2007) was determined by the formula:

$$DF = Np / Nx100$$

Where **Np is** the number of respondents who cited the plant and **N is** the total number of respondents.

RESULTS

Characteristics of respondents

Table 1 presents the socio-demographic characteristics of the respondents. Analysis of Table 1 show that more than half of the respondents were women (71.87%), compared with 28.13% of men. The distribution of informants according to age gives 79.17% to adults, 13.54% to the elderly and 7.29% to youth. We also note that the majority of respondents are herbalists (60.42%). Herbalists and resource persons represent respectively 22.92% and 16.67% of the total sample.

Most of the respondents were illiterate (53.13%). With regard to ethnicity, of the four ethnic groups encountered in our study sample, 63.54% are Aizo, 14.58% Fons, 13.54% Toffins and 8.33% Goun.

Table-1: Socio-demographic characteristics of respondents

Ethnicities	Socio-professional category					Sex				Age group					Level of education					
	He	Pers Res	Phy	Total	P (%)	Female	Male	Total	P (%)	Age <30	30 <Age< 60	Age>60	Total	P (%)	Anal	Pri	Dry	Univ 1st Cycle	Total	P (%)
Aizo	45	4	12	61	63,542	46	15	61	63,542	7	48	8	63	65,625	35	6	13	7	61	63,54167
Fon	10	0	4	14	14,583	10	4	14	14,583	0	12	0	12	12,5	8	3	3	0	14	14,58333
Goun	0	4	4	8	8,3333	2	6	8	8,3333	0	7	1	8	8,3333	4	2	2	0	8	8,333333
Toffin	3	8	2	13	13,542	11	2	13	13,542	0	9	4	13	13,542	4	6	2	1	13	13,54167
Total	58	16	22	96		69	27	96		7	76	13	96		51	17	20	8	96	
P(%)	60,42	16,66	22,92		100	71,87	28,13		100	7,29	79,17	13,54		100	53,13	17,71	20,83	8,33		100

Note: He = Herbalist; Pers Res = Resource person; Phy = Herbalist; F = Female; M = Male; Anal = Illiterate; Pri = Primary; Sec = Secondary; Univ ^{1st} Cycle = University ^{1st} cycle

The symptoms (causes) of female infertility

A total of nine (09) symptoms or causes (figure 2) are identified and could be the cause of female infertility. The most cited with respectively, painful menses (47.92%), abdominal hyperthermia (41.67%), malodorous menses (38.54%) and 9.37% for white discharge (infection).

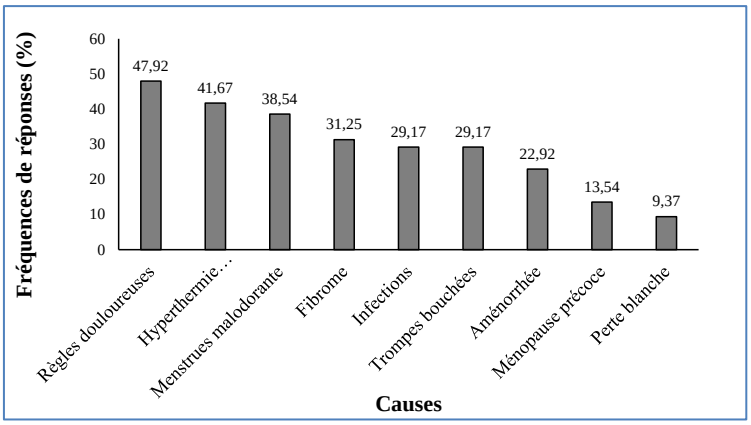

Fig-2: Histogram of female infertility symptoms according to traditional medicine

Informants' perception of female infertility

The analysis of the survey data revealed that the symptoms of female infertility are not equally important for different socio-cultural groups (Table 2). Indeed, there are significant differences in informants' perceptions of female infertility symptoms from one ethnic group to another with probability: $p < 0.05$.

Table-2: Symptoms of female infertility by ethnicity

Ethnicities / Symptoms of infertility	Aïzo (%)	Fon (%)	Toffin (%)	Goun (%)	Pearson's Chi-2 test (P-Value)
Fibroma	19,79	5,21	4,17	2,08	0,00
Abdominal hyperthermia	4,69	4,17	1,04		0,018
Infections	30,21	7,29	2,08	2,08	0,00
Malodorous menstruation	13,54	10,42	6,25	8,33	0,01
Painful periods	27,08	6,25	8,33	6,25	0,02
Menopause	7,29	1,04	5,21	0,00	0,02
Amenorrhea	15,63	6,25	5,21	2,08	0,03
White Loss	2,08	3,13	0,00	4,17	0,01
Clogged trumpets	12,50	2,08	3,13	5,21	0,00

The Correspondence Factor Analysis (CFA) applied to the symptoms of female infertility in relation to ethnicity shows that 100% of the information was explained by the first two axes (figure 3). Considering the contribution of the elements of each of these two variables to the construction of the axes, we can see that smelly menses, painful menses and blocked tubes are more reported by the Gouns. Menopause and infections are mentioned by the Toffins. While the Aïzos find amenorrhea and fibroids. The main symptoms of female infertility reported by the ethnic group are: abdominal hyperthermia and white discharge.

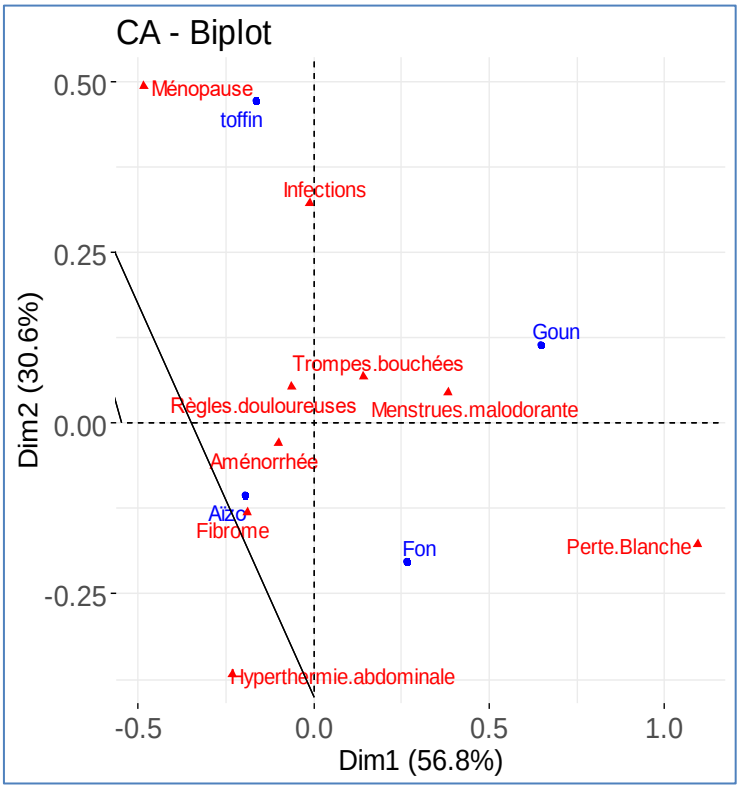

Fig-3: Relationship between female infertility symptoms and ethnicity.

Type of plant, drug used, method of preparation and route of administration of recipes

The analysis of the morphology of the plants identified in the treatment of female infertility reveals a strong predominance of trees (37%). They are followed by grasses (15%). Lianas are poorly represented (figure 4). As regards the plant drugs used in recipes for the treatment of this pathology, stems and leaves are more used (32%). They are followed by barks (22%) (Figure 5). Among the cited preparation methods (figure 6), decoction is the most used method (72%). As for the route of administration (figure 7), the oral route is the most used (96%).

Tables 3 and 4 present respectively, the list of plants (scientific name, local name), the drug used, the symptom treated by the part of the plant, the method of preparation and the route of administration.

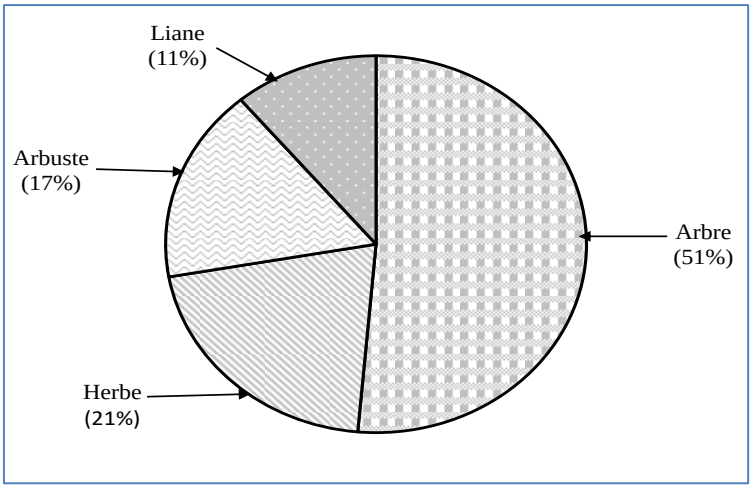

Fig-4: Spectrum of morphological typesof plant species

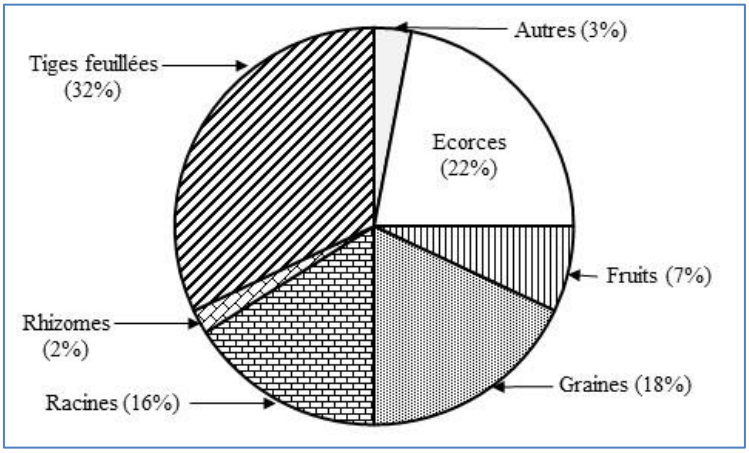

Fig-5: Pie chart of plant drugs used

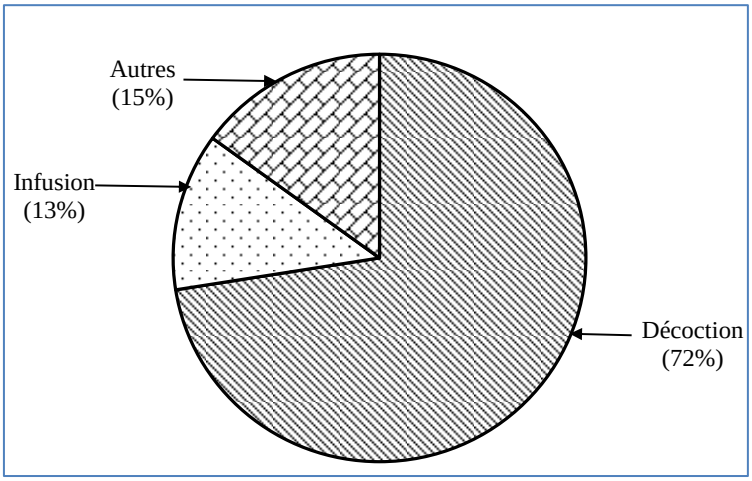

Fig-6: Diagram of preparation modes

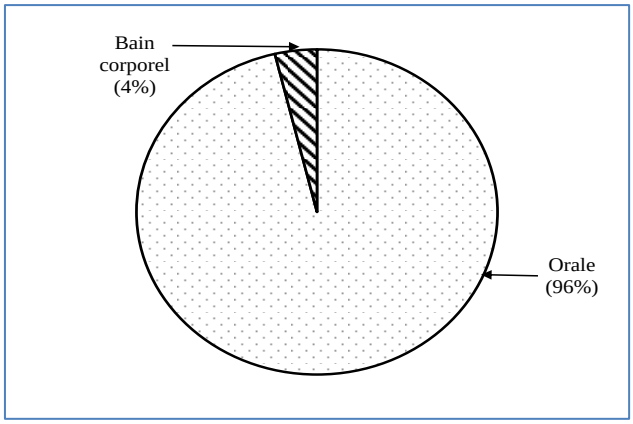

Fig-7: Route of Administration Diagram

Number of plants used in the treatment of a female infertility symptom

Figure 8 presents the number of plants involved in the treatment of a cause of female infertility. The analysis of this figure 8 reveals that abdominal hyperthermia and painful menstruation solicit respectively 67 and 20 species. On the other hand, 3 plants are involved in the treatment of white discharge.

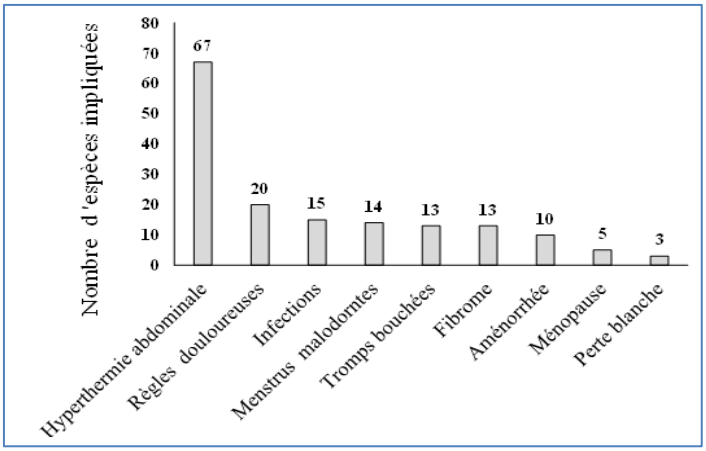

Fig-8: Histogram of species involved in the treatment of female infertility

Table-3: Single herbal recipes for the treatment of female infertility symptom.

Scientific name	Local name	Drug used	treated symptom	Method of preparation	Route of administration / Dosage
Elaeis guineensis Jacq.	Dekin	Spadice male	Painful periods	Decoction	Oral and 1 bamboo glass, once a day
Heliotropium indicum L.	Koklodenpaja	Leafy stem	Malodorous menstruation	Decoction	Oral and 1 talokpemi glass, once daily
Tetrapleura tetraptera (Schumach. & Thonn.) Taub.	Lenja	Fruit	Malodorous menstruation	Decoction	Oral and 1 bamboo glass, once a day
Pterocarpus erinaceus Poir.	Gbéjama	Leafy stem	Amenorrhea	Decoction	Oral and 1 bamboo glass, once a day
Alchornea cordifolia (Schumach. & Thonn.) Müll.Arg.	Kamala	Bark	Painful rule	Decoction	Oral and 1 bamboo glass, once a day
Adansonia digitata L.	Zinzon	Leafy stem	Amenorrhea	Decoction	Oral and 1 talokpemi glass, once daily
Uvaria chamae P.Beauv.	Ayalaha	Leafy stem	Clogged trumpet	Decoction	Oral and 1 bamboo glass, once a day
Annona senegalensis Pers. ssp. oulotrieha Le Thomas ex Le Thomas.	Nyiglué	Leafy stem	Fibroma	Decoction	Oral and 1 bamboo glass, once a day
Ocimum gratissimum L.	Tchiayo	Leafy stem	Infection	Trituration	Body bath
Jatropha gossypiifolia L.	Nyikpotin vovo	Leafy stem	Infection	Infusion	Body bath

Table-4: Recipes for combining herbs to treat a cause of female infertility

Scientific names	Local name	Drug used	Method of preparation	Cause treated	Route of administration / Dosage
Monodora myristica (Gaertn.) Dunal.	Sasalikun	Fruit	Decoction	Abdominal hyperthermia	Oral and 1 bamboo glass, 3 per day
Xylopia aethiopica (Dunal) A.Rich.	Kpédjélékun	Seed			
Syzygium aromaticum (L.) Merr. & Perry.	Atinken gbadota	Flower buds			
Allium cepa L. cv. Common Onion group.	Masa	Bulb			
Allium sativum L.,	Ayo	Bulb			
Piper guineense Schumach. & Thonn.	Linlinkoun	Seed			
Hybanthus enneaspermus (L.) F.Muell. var. enneaspermus.	Abiwèlè	Leafy stem			
Cucumeropsis mannii Naud.	Cègba	Seed	Decoction	Clogged trumpet	Oral and 1 bamboo glass, once a day
Dialium guineense WiIld.	Asonswen	Leafy stem			
Syzygium aromaticum (L.) Merr. & Perry.	Atinken gbadota	Flower buds	Decoction	Fibroma	Oral and 1 bamboo glass, once a day
Monodora myristica (Gaertn.) Dunal.	Sasalikun	Fruit			
Xylopia aethiopica (Dunal) A.Rich.	Kpédjélékun	Seed			
Uvaria chamae P.Beauv.	Ayalaha	Leafy stem			
Copaifera salikounda	Apkaflo	Whole plant			
Schwenckia americana L.,	Zlonzron	Leafy stem			
Hybanthus enneaspermus (L.) F.Muell. var. enneaspermus	Abiwèlè	Leafy stem	Decoction	Malodorous menstruation	Oral and 1 bamboo glass, once a day
Rourea coccinea (Thonn. ex Schumach.) Benth.	Vikplomba	Leafy stem			
Rhodognaphalon brevicuspe (Sprague) Roberty.	Déhon	Leafy stem			
Cleistopholis patens (Benth.) Engl. & Diels	Hunsikuntin	Bark	Decoction	Infection	Oral and 1 bamboo glass, once a day
Kigelia africana (Lam.) Benth.	Nyanblikpo	Bark			
Khaya senegalensis (Desr.) A.Juss.	Zunza	Bark			
Sida acuta Burm.f. ssp. Aeuta.	Adon	Stem	Decoction	Clogged trumpet	Oral and 1 bamboo glass, once a day
Cola millenii K.Sebum.	Alovi aton	Bark			
Combretum racemosum P.Beauv.,	Ogan	Root	Decoction	Clogged trumpet	Oral and 1 bamboo glass, once a day
Anchomanes difformis (BIume) Engl.	zwinho xweso	Tuber			
Gardenia erubescens Stapf & Huteh,	Dakpla	Root	Decoction	Early menopause	Oral and 1 bamboo glass, once a day
Khaya senegalensis (Desr.) A.Juss.	Zunza	Bark			
Monodora myristica (Gaertn.) Dunal.	Sasalikun	Fruit	Decoction	Abdominal hyperthermia	Oral and 1 bamboo glass, 3 times a day
Xylopia aethiopica (Dunal) A.Rich.	Kpédjélékun	Seed			
Allium cepa L. cv. Common Onion group.	Masa	Bulb			
Rourea coccinea (Thonn. ex Schumach.) Benth.	Vikplomba	Leafy stem			
Hybanthus enneaspermus (L.) F.Muell. var. enneaspermus.	Abiwèlè	Whole plant			
Curculigo pilosa (Schumach. & Thonn.) Engl.	Ayoglen	Root	Decoction	Malodorous menstruation	Oral 1 bamboo glass, once a day
Kigelia africana (Lam.) Benth.	Nyanblikpo	Leafy stem			
Albizia lebbeck (L.) Benth,	Agba	Pulp (floral)			
Monodora myristica (Gaertn.) Dunal.	Sasalikun	Fruit			
Xylopia aethiopica (Dunal) A.Rich.	Kpédjélékun	Seed			
Allium cepa L. cv. Common Onion group.	Masa	Bulb			

The photo panel below shows some images of plant species that are used to treat the symptoms of female infertility.

Plate-1: Recipe of association of plants against female infertility *1)* Cleitophobis patens; 2) Khaya senegalensis; 3) Kigelia Africana

Plate-2: Recipe of association of plants against female infertility *1)* Monodora myristica ; 2) Xylopia aethiopica; 3) Syzygium aromaticum; 4) Allium Cepa; 5) Uvaria chamae; 6) Schwenkia americana.

DISCUSSION

Informants' perception of the causes of female infertility

Majority of the respondents in the sample of this study are female (71.67%), illiterate and adults. This could be explained by the location of the survey which was conducted mainly among people of given professional activities (Espinosa *et al*., 2014; Assongba *et al*., 2014). Yet, it happens that it is particularly women who are the herbalists. This finding has already been made by Fah *et al.,* (2013). Similarly this result is consistent with that found in Côte d'Ivoire by authors N'Guessan *et al.,* (2010) and Béné *et al.,* (2016) with respectively 62.50% and 66.67% of women herbalists. Also, the majority of the respondents are illiterate (53.13%). This could be due to the low schooling rate of girls even though efforts are being made nowadays to address this problem. This result is also obtained by Benkhnigue *et al.,* (2010) who showed that 60.7% of herbalists are illiterate. In addition, adults outnumber the young and the old, with a dominance of the aïzos. This finding was made by Fah *et al.,* (2013) where majority of the respondents were above 50 years of age. The General Census of Population and Housing (RGPH) 4 (INSAE, 2015) revealed that the dominant ethnicity in the commune of Abomey-Calavi is the Aïzo ethnicity; which is confirmed by this study with 63, 54% of informants belonging to this ethnicity.

The Pearson's Chi2 test showed a significant difference in the perception of female infertility symptoms from one ethnic group to another. This was confirmed by the Factorial Component Analysis which showed that the causes cited by the respondents are diversely distributed within the ethnic groups. There are nine (09) of these causent. This makes it possible to assert that the study population indeed has specific knowledge on the causes of infertility of a woman. This result is confirmed by the studies of Assouma *et al.,* (2018) who had also identified 9 causes are the basis of a woman's infertility. However the type of symptom identified and the number varies from one study to another. Houmènou *et al.,* (2017) identified eleven (11) causes. These differences can be explained by the sample size of the study, the level of knowledge of the respondents on infertility in the study area. It should be noted that despite this difference, some symptoms are repeated, namely abdominal hyperthermia and amenorrhea.

The consequences of female infertility mentioned by the informants, namely discrimination and rejection of women, are mainly due to the place that a child occupies in African society. An offspring ensures the perpetuation of the lineage, so it is essential to have them. In Benin, a child is an asset that brings joy and harmony to the family. Its absence is so badly experienced. These observations were also made by Nana *et al.,* (2011), who identified feelings of shame, rejection, stress, among infertile women.

These different marginassions lead, the majority of infertile women to seek solutions to their infertility in traditional medicine. This fact was also previously reported by Nana *et al* (2011), who found that 56% of infertile women in her study population consulted traditional practitioners. Aboughe Angone *et al.,* (2009) stated that herbalists usent several plants to treat infertility in women.

Diversity of herbal recipes in the treatment of female infertility

This study showed that plant species used to treat female infertility are dominated by trees (37%), grasses (15%), shrubs (12%) and lianas (8%). These results are in line with those of Zerbo *et al*., (2011) and Houmènou *et al*., (2017) who conducted such a study in the departments of Ouémé and Plateau in southern Benin. Similar results are obtained by Assouma *et al*., (2018) in Togo with (36.78%) for trees (27.58%) shrubs (24.14%) grasses and lianas (5.75%).

Regarding the use of plant drugs in female infertility treatment recipes, leafy stems are more used in this study with a proportion of 32%. This could be explained by their accessibility and ease of harvesting. This is in line with Cunningham (2001) and Houmènou (2017) who point out that harvesting the roots of a tree and/or its bark seems to have more adverse ecological impacts than harvesting the leaves. However, this result is contrary to that of Assouma *et al*., (2018) who found that herbalists in his study area use roots more for the treatment of female infertility. This difference could be explained by the diversity of ways in which the recipes are composed among traditional therapists.

Regarding the modes of preparation and routes of administration, this study showed that decoction is the most used form and the oral route the most used to administer the treatment. These results are consistent with those of Houmènou *et al.,* (2018) and Nkounkou-Loumpangou *et al*.. (2005) who had identified decoction and maceration as the most used forms of preparations with decoction as a high percentage.

Abdominal hyperthermia and painful menstruation required 67 and 20 plant species respectively. This is due to the high rate of receipts given by the respondents for the treatment of these two conditions. This result differs from that of Houmènou *et al* (2017) who cited myoma and sperm rejection as the main causes with a total of 35 plant species for the former and 18 for the latter. This difference could be explained by the proportion of respondents and the number of recipes which differ in the two studies.

In this study, 61 species of plants are used in the treatment of female infertility. Among them, we note an exotic species, *Syzygium aromaticum* which is not present in the flora of Benin; its flower buds (cloves) are imported from Nigeria and sold in the markets. This was already noted by Houmènou *et al* (2017). The 60 other species of the flora of Benin, represents a floristic richness but lower than that of the study of Assouma *et al*. (2018) in Togo which had found respectively a total of 89 plant species. But, higher than the studies conducted by Nkounkou-Loumpangou *et al*. (2005) and Telefo *et al*. (2011) who recorded 53 and 46 plant species respectively for the treatment of female infertility in Brazzaville in Congo and Bahamm in Cameroon. Previous ethnobotanical studies on female infertility have identified 75 plant species (Soladoye *et al*., 2014), 46 plants (Telefo *et al*., 2011) and 25 plant species (Hadj-Seyd *et al*., 2016). This could be explained by the fact that plants are involved in many recipes especially in abdominal hyperthermia which is the most cited by the respondents.

In this study, twenty (20) recipes were recorded equally, of which ten (10) were for combination of herbs and ten (10) for single herbs. There is almost an equality of recipes in the association or not of plants in the treatment of female infertility. However, it is more desirable that the proportion of multispecific recipes is as low as possible because the associations of plants poorly known are sometimes dangerous and the preponderance of monospecific recipes is to the advantage of patients (Zerbo *et al.,* 2007 and Bené, 2016). In addition, many plants cited by the respondents of this study are recognized as medicinal plants used in Benin and in the sub-region. This is the case of *Adansonnia digitata*, *Allium sativum*, in Brazzaville (Nkoukou-Loumpangou *et al.,* 2005), in Togo (Assouma *et al*., 2018) for the treatment of female infertility. We can also mention the plants: *Sarcocephallus latifolius*, *Psidium guajava*, *Bridelia ferruginea*, *Schwenckia americana*, *Sida acuta*, *Anchomanes difformis, Milicia excelsa, Piper guineense* and *Aframomum melegueta* all used in the treatment of female infertility symptoms.

CONCLUSION

This study provided information on the various symptoms of female infertility. 61 plant species are used in 20 recipes. This confirmed that the study population has knowledge of the causes of female infertility and the means of treatment. Regardless of ethnicity or age, the oral route remains the main route of administration of herbal recipes.

This study provides a scientific basis for further studies. Chemical tests could be done to verify the mode of action of the active ingredients of the plant species used in the treatment of female infertility for a possible formulation of recipes based on endogenous knowledge and the results obtained from the laboratory tests, in order to help the many women suffering from this ailment. Subsequently come out new molecules of medicinal plants entering the treatment of female infertility.

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