An Ethnobotanical Survey of Medicinal Plants used in the Preparation of "*Atikédi*": Local Alcoholic Beverages Commonly Consumed in Lomé Togo

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Abstract

Ethnobotanical relevance: Local alcoholic beverages "*Atikédi*" are produced in Lomé and consumed not only for pleasure but also for therapeutic purposes. They are produced out of "*Sodabi*", distilled palm wine, mixed with plant organs. However, the exact composition of these beverages and the diseases they are supposed to treat are poorly documented to date in Togo. *Aim of the study*: To make an inventory of plants used by "*Atikédi*" beverages producers in Lomé. *Materials and methods*: Data collection was made through Semi Structured Interview. Data processing and analysis were done using Excel and Epi Info. *Results*: 267 outlets were identified with a predominance of stores (53.18%). 192 women and 75 men were interviewed. They belonged to 12 different ethnic groups with the majority being Ewe (127) and Ouatchi (71). Their age range varied from 25 to 70 years with an average of 42.6±7.9 years. 61 plants species were recorded belonging to 58 genera and 35 families. The most represented

family was the Apocynaceae with five species followed by the Rutaceae and the Poaceae with four species each. Among 43 diseases managed by the plants, bacterial infections (ICF=0.95) and sexual weakness (ICF=0.95) were the most important pathologies. *Conclusion*: Producers of "*Atikédi*" used a wide range of medicinal plants. Pharmacological and toxicological studies of these plants will improve the quality of care provided by traditional medicine.

Keywords: Ethnobotany; Medicinal plants; Alcoholic beverages "*Atikédi*"; Lomé Togo

Introduction

Togolese, as any other people in the West Africa subregion, use traditional medicine for primary health care (Kpodar et al., 2016, Gbekley et al., 2018) despite the progress of conventional medicine in the management of diseases. Previous studies have shown various forms of preparation of plant products with various extraction solvents (Koudouvo et al., 2011). Alchoholic beverages are among the most common solvents used by traditional healers. These drinks, which are *a priori* consumed for pleasure, serve *a posteriori* as a solvent in the production of some phytomedicines (Totelin, 2015).

The consumption of alcohol drink is an old practice of many ethnic groups in West Africa and in South America. In Togo, the Ewe and Ouatchi people have been since the pre-colonial period, well-known for the production of a local alcohol drink called "*Sodabi*", produced out of artisanal distillation of fermented palm wine. It has different names depending on the country: "*Sodabi*" mostly being used in Benin and Togo, *Ondotol* or *hâ* in Cameroon, *Koutoukou* in Côte d'Ivoire, *Akpeteshie* in Ghana, *Ogogoro* in Nigeria (Tchacondo et al., 2011).

Once the beverage is prepared, people infuse for a few days, roots, barks or leaves of plants to give it a taste or medicinal properties. The beverage, far from being a simple alcoholic beverage, becomes a traditional liquor called in local name Ewé "*Atikédi*" which means etymologically "*containing drug*". This practice of mixture of "*Sodabi"* with plants used for therapeutic purposes is therefore an integral part of traditional medicine. It is widespread in Lomé and is sold in kiosks all over the city.

It is important to look into this type of phytomedicines to ensure the quality of care they provide to the population. In addition it is necessary to explore all areas where tradional medicine is practiced (Kunwar et al., 2009).

Many studies about alcoholic beverage have been undertaken around the world: *Bitter-cups* by Odonne et al. (2006) in Suriname; Jamaican root

tonics by Mitchell (2011); *Tifey* by Volpato et al. (2008) in Cuba. However, no ethnobotanical study until today, has been conducted among producers of local beverage "*Atikédi*" in Togo. Ethnobotanical surveys may be therefore a good approach to drug discovery (Koudouvo et al., 2016; Umair et al., 2017). Thus many compounds have been discovered from plants based on ethnobotanical survey information (Attah, et al., 2016).

What are the medicinal plant compositions of these beverages? What diseases the plants are supposed to treat? These questions stand for the rationale for the conduct of this research. We expected this practice would certainly overflow information whose knowledge will improve the quality of care given by traditional medicine. In this respect, this survey was conducted to prospect "*Atikédi*" producer's herbal medicine practices in Lomé. The specific objectives were (i) to identify plants species used in the production of the alcoholic beverages "*Atikédi*" in Lomé and (ii) to identify the ailments treated by plants species in order to contribute to the progress of the traditional medicine.

Methodology

Description of the study area

The study was conducted in Lomé, the capital city of Togo, a Western African country with a population of 6,191,155 inhabitants and a density of 109 inhabitants per km^2 (DGSNA Togo, 2011). The country shares borders with Burkina Faso in the North, the Gulf of Guinea in the South, Benin in the East and Ghana in the West. It is divided into five economic regions namely Savannah Region, Kara Region, Central Region, Plateaux Region and Maritime Region (Fig. 1). Many languages are spoken in Lomé but the most popular are Ewé and Mina.

Lomé lies between latitude 6°08'14" North, longitude 1°12'45" East and an average altitude of 10 m. It sprawls along the coast of the Gulf of Guinea and covers an area of 90 km^2 with a population of 837,437 inhabitants, a density of 9305 inhabitants per km^2 (DGSNA Togo, 2011). The climate is subequatorial. Lomé is surrounded by the Maritime Region towards North and East, Ghana towards West and the Gulf of Guinea towards South. Lomé is composed of five Districts namely N°I to V (Fig. 1).

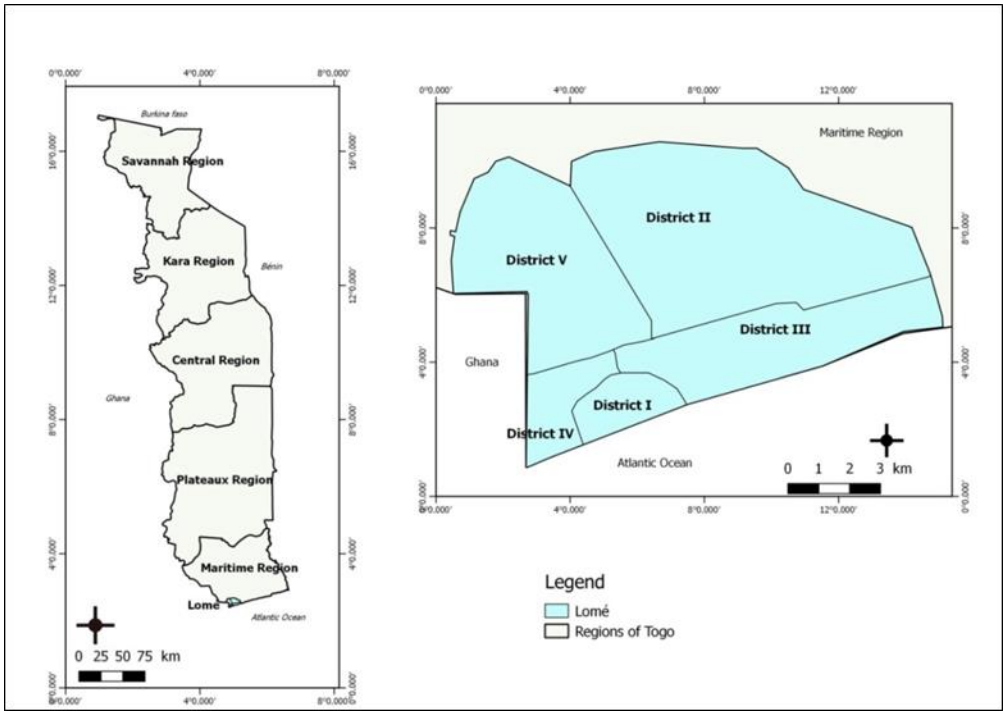

Fig. 1. Map of the study area (Performed by QGIS software)

Data collection

The ethnobotanical survey was conducted from March to October 2015 in Lomé. All interviews were conducted in Ewe, Mina and French. The data was collected from kiosks owners who produce beverages on site by infusing plant organs into *Sodabi*, the local alcoholic drink, for a few days before serving to their clients. We conducted a census of all beverage outlets in Lomé by Semi-Structured Interview method (Koudouvo et al., 2011, Soejarto et al., 2012). During this survey, the main information focused on sociodemographic data, plant species, plant parts used and diseases treated. Each person in charge of a point of sale was questioned so that the number of points of sale corresponds to the number of respondents. The plant organs used were known from the respondents' answers. They had answered mainly to the questions relating to the name of each beverage sold, name of the plants and organs of plants used, diseases against which the beverages are consumed. Each respondent was interviewed two or three times a week in his shop and there was no consensus between them during the census.

Plant species were collected in October 2015 considering their vernacular names, with a the help of four informants. Three informants were beverages producers who had indicated to us most of the plants involved in the preparation of these beverages. The last one was a knowledgeable local

person who helped us to obtain more information particulary on plant habitat (Balayogan et al., 2014).

The plants were collected in Lomé and in two villages in the Maritime Region : Wogba and Tabligbo.

Plant identification

Herbarium specimens were prepared and pictures of the plants were taken. Plants were identified through comparison with available voucher specimens at the Herbarium of the Department of Botany, Faculty of Sciences, University of Lomé using taxonomic keys of online databases of West African Plants: http://www.westafricanplants.senckenberg.de/root/index.php. Nomenclature of species was done using the International Plant Names Index (IPNI) online database: http://www.ipni/plantnamesearchpage.do.

A specimen of each plant was deposited at the Herbarium of the University of Lomé and a voucher specimen number was assigned to each plant.

Data analysis

Data processing and analysis were carried out using Epi Info 3.5.1 software. The map was designed by QGIS software.

The informant consensus factor (ICF) was calculated for each disease treated to improve the consensus of the informants on the reported plant species. It was calculated as follows:

ICF = $\frac{\text{Nuc}-\text{Ns}}{\text{Nuc}-1}$ where Nuc was the number of citations of each disease treated; Ns the number of species used (Heinrich et al., 1998; Njoroge and Bussmann, 2007). The ailments were grouped per category according to Balayogan et al. (2014).

Results

Sociodemographic data

The sociodemographic data of the respondents are displayed in Table 1. Among the total of 267 producers interviewed, were 75 males and 192 females. Their average age was 42.6 years with a standard deviation of 7.9 years. The youngest was 25 and the oldest was 70. Half of the respondents were aged between 38 and 50. The 30-40 age group was the most represented with 44.6% followed by the 40-50 age group with 34.0%. The respondents belonged to 12 different ethnic groups. The majority were Ewe (127) and Ouatchi (71) followed by Adja (33) and Mina (20). The other ethnic groups were less important in size. The combined size of Ewe-Ouatchi ethnic groups was 74.2%. The seniority of the respondents ranged

from 9 months to 20 years' experience in the production and sale of the beverages "*Atikédi*". The majority had 5 to 10 years' experience (90). Most of the producers (79.0%)mentioned family inheritance as the main source of their knowledge of medicinal plants.

Frequency of plants species and disease treated

The scientific and vernacular names, voucher specimen number, habitat, parts used, frequencies of citation, and medical uses of the 61 medicinal plant species recorded in this study are reported in Table 2.

The frequency of citation was high for *Mondia whitei* (75.28%) and *Khaya senegalensis* (56.18%). It is followed by *Sorghum caudatum* (38.20%), *Phyllantus amarus* (36.33%), *Caesalpinia bonduc* (34.83%), *Nauclea latifolia* (32.21%), *Syzygium aromaticum* (26.97%), *Conyza aegytiaca* (25.84%) and *Aframomum melegueta* (24.72%).

Infection (Nu=668) and sexual weakness (Nu=598) recorded the highest number of citation with an informant consensus factor of 0.95 followed by stomach aches (Nu=132) and malaria (Nu=175) with ICF values of 0.95 and 0.89 respectively (Table 3).

Table 1. Sociodemographic data of the respondents

Parameters	Respondents N(%)
Gender	
Male	75(28.1)
Female	192(71.9)
Age	
[25-30]	17(6.4)
[31-50]	260(78.6)
[51-70]	40(15.0)
Educational level	
Illiterate	76(28.5)
Primary	142(53.2)
Secondary	46(17.2)
Superior	3(1.1)
Ethnic group	
Ewe	127(47.6)
Ouatchi	71(26.6)
Adja	33(12.4)
Mina	20(7.4)
Other*	16(6.0)
Seniority	
≤2	37(13.9)
]2 – 5]	53(19.9)
]5 – 10]	90(33.7)
]10 – 15]	61(22.8)

>15	26(9.7)
Origin of the knowledge	
Familial inheritance	211(79.0)
Initiation from a tradional healer	43(16.1)
Divine revelation	13(4.9)

*Kabyè 6(2.2), Ana 3(1.1), Akposso 2(0.7), Bassar, Losso, Anago, Fon and Yorouba 1(0.35) each.

Table 2. Plants species used in the production of alcoholic beverages "*Atikédi*".

Name of species (Family) [Voucher number] Vernacular name	Habit at [a]	Parts used [b]	Respondents N(%)	Diseases treated
Aframomum melegueta, (Roscoe) K. Schum. (*Zingiberaceae*) [TOGO15339] Ataku	Wild	Sd(60.6%) Rt(39.4%)	66(24.72)	Sexual weakness, Diabetes, Joint pain, Stomach aches, Infection
Allium sativum L. (Alliaceae) [TOGO15341] Ayo	Cult.	Bb	16(5.99)	Hypertension, Infection
Alstonia boonei De Wild. (Apocynaceae) [TOGO15374] Nyamidua	Wild	Trb	8(3.00)	Sexual weakness, Infection
Anthocleista nobilis G. Don (Gentianaceae) [TOGO15363] Gboloba	Wild	Rt	10(3.75)	Sexual weakness
Azadirachta indica L. (Meliaceae) [TOGO15335] Kiniti	Wild	Rt	12(4.49)	Sexual weakness, Malaria, Varicella
Beta vulgaris L. (Amaranthaceae) [TOGO15366] Betterave	Cult.	Tb	3(1.12)	Anemia, Eating disorder
Bridelia ferruginea Benth. (Phyllanthaceae) [TOGO15378] Kameti	Wild	Trb	14(5.24)	Gum disease, Infection
Byrsocarpus coccineus (Schum. & Thonn.) (Connaraceae) [TOGO15330] Tomégavi	Wild	Rt	1(0.37)	Infection
Caesalpinia bonduc Roxb.(Fabaceae) [TOGO15368] Adikou	Wild	Sd(1.1%) Rt(98.9%)	93(34.83)	Sexual seakness, Diabetes, Joint pain, Infection, Prostate, Sinusitis
Carica papaya L. (Caricaceae) [TOGO15369] Adibatsu	Wild	Fw	1(0.37)	Sexual weakness
Carissa spinarum L. (Apocynaceae) [TOGO15351] Bloetcho	Wild	Rt	3(1.12)	Sexual weakness
Cassia sieberiana DC. (Caesalpiniaceae) [TOGO15353] Gati-gati	Wild	Trb	4(1.50)	Sexual weakness, Stomach aches, Infection, Malaria
Cissus populnea Guill. & Perr (Vitaceae) [TOGO15375] Adéflo	Wild	Trb	4(1.50)	Sexual weakness, Constipation
Citrus aurantifolia (Christm. & Panzer) Swingle (Rutaceae) [TOGO15337] Donti	Wild	Fr	45(16.85)	Eating disorder, Weakness, Nausea, Obesity, Malaria
Citrus grandis L. *Osbeck* (Rutaceae) [TOGO15328] Pamplemouse	Cult.	Fr	1(0.37)	Eating disorder
Citrus sinensis (L.) *Osbeck* (Rutaceae) [TOGO15377] N'tivivi	Wild	Fr	4(1.50)	Anemia, Eating disorder, Lack of vitamin, Diabetes
Cocos nucifera L. (Arecaceae) [TOGO15359] Néti	Cult.	Hk	1(0.37)	Diabetes
Coffea sp Bridson (Rubiaceae) [TOGO15358] Café	Cult.	Sd	12(4.49)	Drowsiness
Cola acuminata (P. Beauv) Schott & Endl. (Malvaceae) [TOGO15346] Evi	Wild	Sd	1(0.37)	Infection
Combretum micranthum G. Don (Combretaceae) [-] Kinkéliba	Wild	Sd(50%) Rt(50%)	2(0.75)	Stomach aches, Hypertension
Conyza aegyptiaca L. Ait (Asteraceae) [TOGO15355] Danyigbe	Wild	Le	69(25.84)	Constipation, Diabetes, Stomach aches, Hernia, Infection, Intestinal worms

Cryptolepis sanguinolenta (Lindl.) Schltr.(Apocynaceae) [TOGO15360] Avédzitogbé	Wild	Rt	5(1.87)	Appendicitis, Sexual weakness, Stomach aches, Infection
Curcuma longa L. (Zingiberaceae) [TOGO15342] Dotèdzin	Cult.	Rz	3(1.12)	Infection
Cymbopogon citratus (DC.) Stapf (Poaceae) [TOGO15325] Tsigbe	Cult.	Le	87(32.58)	Eating disorder, Bad breath, Constipation, Hepatitis, Fever, Infection, Malaria, Nausea, Hypouresis
Cyperus esculentus var *esculentus* (Cyperaceae) [-] Efio	Wild	Rz	58(21.72)	Eye ache, Sexual weakness
Euphorbia hirta L. (Euphorbiaceae) [TOGO15327] Anonsikan	Wild	Ap	2(0.75)	Intestinal worms
Garcinia kola Heckel (Clusiaceae) [TOGO15348] Ewo	Wild	Sd	1(0.37)	Infection
Griffonia simplicifolia (Vahl ex DC.) Baill. (Caesalpiniaceae) [TOGO15326] Gboduti	Wild	Rt	1(0.37)	Sexual weakness
Hibiscus sabdariffa L. var. *sabdariffa* (Malvaceae) [TOGO15334] Bissap	Cult.	Le	4(1.50)	Anemia, Eating disorder
Illicium verum Hook. F. (Illiciaceae) [TOGO15345] Badiane	Wild	Fr	7(2.62)	Stomach aches, Premature ejaculation, Sexual weakness
Indigofera tinctoria L. (Fabaceae) [TOGO15357] Zokon	Wild	Rt	1(0.37)	Infection
Khaya senegalensis (Desr.) A. Juss. (Meliaceae) [TOGO15367] Mahogen	Wild	Trb	150(56.18)	Anemia, Constipation, Stomach aches, Belly wounds, Infection, Malaria, Sexual weakness
Landolphia owariensis P. Beauv. (Apocynaceae) [TOGO15352] Cocotikpa	Wild	Trb	21(7.87)	Hemorrhoid
Lannea kerstingii A. Rich. (Anacardiaceae) [TOGO15371] Mononkou	Wild	Trb	21(7.87)	Anemia, Infection
Laurus nobilis L. (Lauraceae) [TOGO15365] Laurier	Wild	Lst	1(0.37)	Constipation
Mangifera indica L. (Anacardiaceae) [TOGO15332] Mangoti	Wild	Trb	8(3.00)	Hemorrhoid, Infection
Mezoneuron benthamianum Baill. (Leguminosae) [TOGO15356] Wodoe-Egbigbo	Wild	Rt	2(0.75)	Sexual weakness
Momordica charantia L. (Cucurbitaceae) [TOGO15364] Agnagnra	Wild	Lst	3(1.12)	Sexual weakness, Varicella
Mondia whitei (Hook.F.) Skeels (Periplocaceae) [TOGO15350] Kanabo	Wild	Rt	201(75.28)	Sexual weakness
Monodora myristica (Gaertn.) Dunal. (Annonaceae) [TOGO15349] Ayikou	Wild	Rt	6(2.25)	Sexual weakness, Infection
Moringa oleifera L. (Moringaceae) [TOGO15333] Yovovigbe	Wild	Fr	67(25.09)	Anemia, Eating disorder, Constipation, Diabetes, Eye ache, Stomach aches, Belly wounds, Hemorrhoid, Hypertension, Infection, Malaria, Weakness, Sexual weakness
Nauclea latifolia Sm. (Rubiaceae) [TOGO15354] Nyimon	Wild	Rt	86(32.21)	Stomach aches, Malaria
Ocimum canum Sams (Lamiaceae) [TOGO15324] Ahamè	Wild	Rt	2(0.75)	Sexual weakness
Ocimum gratissimum L. var *gratissimum* (Lamiaceae) [TOGO15336] Esrou	Wild	Le	33(12.36)	Belly wounds, Infection
Parkia biglobosa (Jacq.) R.Br. ex G.Don (Mimosaceae) [TOGO15362] Ewotsippo	Wild	Trb	4(1.50)	Infection, Sexual weakness
Phoenix dactylifera, L. (Arecaceae) [TOGO15361] Datte	Cult.	Fr	3(1.12)	Anemia, Constipation, Sexual weakness

Phyllanthus amarus Sch. et Th. (Phyllanthaceae) [TOGO15331] Ehlinvi	Wild	Wp	97(36.33)	Constipation, Stomach aches, Belly wounds, Hernia, Infection, Intestinal worms
Piper guineense Schum. & Thonn. (Piperaceae) [TOGO15344] Linlinkou	Wild	Fr	11(4.12)	Infection
Senna occidentalis (L.) Link (Caesalpiniaceae) [TOGO15376] Bessissan	Wild	Rt(60%) Sd(40%)	10(3.75)	Hepatitis, Infection, Sexual weakness, Sickle cell, Skin rash
Sorghum caudatum L. var. *colorans* (Poaceae) [TOGO15334] Adako	Cult.	Le	102(38.20)	Anemia, Eating disorder, Lack of vitamin, Infection, Malaria
Strophantus hispidus DC (Apocynaceae) [TOGO15372] Amagan	Wild	Rt	5(1.87)	Infection, Sexual weakness
Syzygium aromaticum (L.) *Merr. & L.M. Perry* (Myrtaceae) [TOGO15347] Plêngota	Wild	Sd	72(26.97)	Belly wounds, Stomach aches, Infection, Sexual weakness
Tetrapleura tetraptera (Schumach. & Thonn.) Taub. (Mimosaceae) [TOGO15323] Prekese	Wild	Fr	27(10.11)	Anemia, Eating disorder, Lack of vitamin, Constipation, Stomach aches, Infection
Uvaria chamae P. Beauv (Annonaceae) [TOGO15329] Agbanla	Wild	Rt	3(1.12)	Infection, Sexual weakness
Vetiveria nigritana (Benth.) Stapf (Poaceae) [TOGO15373] Kédéké	Wild	Rt	152(56.93)	Hepatitis, Infection, Stomach aches, Gum disease, Lower abdominal pain, Premature ejaculation, Prostate, Sexual weakness, Urinary tract infection
Vitex doniana (Sweet) (Verbenaceae) [TOGO15320] Efontsi	Wild	Trb	3(1.12)	Sexual weakness
Waltheria indica L. (Malvaceae) [TOGO15370] Adouwèti	Wild	Rt	80(29.96)	Abortion, Irregular menstruation, Stomach aches, Infection, Infertility, Joint pain, Malaria, Lower abdominal pain, Weakness, Premature ejaculation, Sexual weakness
Xylopia aethiopica (Dunal) A. Rich. (Annonaceae) [TOGO15343] Etso	Wild	Fr	164(61.42)	Hernia, Hypertension, Infection, Stomach aches, Belly wounds, Sexual weakness
Zanthoxylum xanthoxyloides (Lam.) Zepernick & Timler (Rutaceae) [TOGO15321] Xeti	Wild	Rt(96.4%) Trb(3.6%)	55(20.60)	Difficult childbirth, Stomach aches, Belly wounds, Gum disease, Infection, Sexual weakness, Tooth decay, Prostate
Zea mays L. (Poaceae) [TOGO15340] Ebliti	Cult.	St	1(0.37)	Diarrhea
Zingiber officinale (Roscoe) (Zingiberaceae) [TOGO15322] Dotè	Wild	Rz	190(71.16)	Sore throat, Cold, Cough, Stomach aches, Belly wounds, Infection, Sexual weakness

[a] Habitat: Cult. Cultivate. [b] Part used: Ap, Arial part; Bd, Bulb; Fr, Fruit; Fw, Flower; Hk, Husk; Le, Leave; Lst, leafy steam; Rt, Root; Rz, Rhizome; Sd, Seed; St, Stalk; Tb, Tuber; Trb, Trunk bark; Wp, Whole plant.

Table 3. The recorded ailments grouped per categories.

Ailment categories	Ailments	Number of citations (Nuc)	Number of plants species used (Ns)	Informant Consensus Factor (ICF)
Childbirth problems	Difficult childbirth	1	1	-
Circulatory diseases	Anemia	82	10	0.89
	Hemorrhoid	23	3	0.91
	Hypertension	9	4	0.63
Contraception	Abortion	1	1	-
Dentistry	Gum disease	11	4	0.70
	Bad breath	22	1	1.00
Dermatological problems	Skin rash	6	1	1.00
Eye problems	Eye ache	2	2	0.00
Female problems	Irregular mentruation	1	1	-
Fertility problems	Infertility	1	1	-
Gastro-intestinal problems	Eating disorder	52	9	0.84
	Constipation	27	9	0.69
	Diarrhea	1	1	-
	Stomach aches	132	16	0.89
	Hernia	6	3	0.60
	Nausea	3	2	0.50
	Belly wounds	23	8	0.68
Hemoglobinopathies	Sickle cell	1	1	-
Infection (Bacterial)	Infection (Unspecified)	668	34	0.95
	Tooth decay	3	1	1.00
	Urinary tract infection	1	1	-
Infection (Viral)	Varicella	3	2	0.50
Inflammations and pains	Appendicitis	1	1	-
	Fever	1	1	-
	Joint pain	3	3	0.00
	Lower abdominal pain	3	2	0.50
	Prostate	18	3	0.88
Liver problems	Hepatitis	3	3	0.00
Male fertility problems	Premature ejaculation	7	3	0.67
	Sexual weakness	598	32	0.95
Metabolic disorders	Diabetes	5	5	0.00
	Obesity	1	1	-
Neurological disorders	Drowsiness	12	1	1.00
	Weakness	5	3	0.50
Nutritional disorders	Lack of vitamin	3	3	0.00
Parasitic intestinal	Intestinal worms	89	3	0.98

Parasitic sanguicole	Malaria	175	10	0.95
Respiratory problems	Cold	5	1	1.00
	Cough	4	1	1.00
	Sore throat	2	1	1.00
	Sinusitis	1	1	-
Urinary problems	Hypouresis	5	2	0.75

Nuc, Number of citations in each category; Ns, Number of species used; ICF, Informant consensus factor.

Discussion

Sociodemographic data

The production of the local alcoholic beverages "*Atikédi*" has been part of traditional medicine practice since producers use plants for medicinal purposes. This study showed that this practice is the preserve of adults (31-70) since they represent 93.6% of the respondents (210/267). These results are in accordance with previous studies which revealed the predominance of senior adults (Kpodar et al., 2017; Aburjai et al., 2007). The results also indicated that 79.0% of the respondents acquired their medicinal practice knowledge as a family inheritance and 16.1% from a traditional healer's initiation. Moreover, the respondents had a good experience in the field since 33.7% and 22.8% had respectively experience ranging from 5 to 10 years and 10 to 15 years in the production of beverages.

Regarding the educational level, 53.2% of the respondents had a primary educational level followed by 28.5% of non-literates. These results show that the literacy level of the majority of the respondents is rather low. Despite the educational level, this does not impede the acquisition of herbal medicinal pratices (Kpodar et al., 2017) but it is a parameter that allows the researchers to understand easily their ability in the field. Indeed, non-literates mentioned as diagnosis "infection" but were not able to locate the anatomic site of the infection or to distinguish between microbial or viral infection (Table 3). As a result, this fact is a limit of this study.

In this study, there were 192 women recorded compared to 75 men (Table 1); with a sex ratio (F/M) of 3 reflecting a slight predominance of women in this activity, unlike traditional healers who were mostly men (Aburjai et al., 2007). This predominance of women is explained by the fact that the production of beverages was not the unique activity of practitioners because it was coupled with the direct sale of the local drink "*Sodabi*" in kiosks. The large representation of Ewe and Ouatchi ethnic groups can be explained not only by the fact that the survey was conducted in Lomé, which is more populated by these two ethnic groups (DGSNA, 2011), but also, Ewe

and Ouatchi have had an old tradition in the production and consumption of these beverages (Tchacondo, 2011).

Frequency of plant species and ailments

This study aimed at making an inventory of plant species used in production of the local alcoholic beverages "*Atikédi*" in Lomé. It was a new insight given by the study compared to earlier ethnobotanical studies which have been undertaken on plants used against specific diseases such as malaria, fungal infection, diabetes and hypertension.

The study has recorded 61 medicinal plant species belonging to 58 genera and 35 families. The most represented family was Apocynaceae with 5 plant species followed by Rutaceae and Poaceae with 4 plant species. This study showed also that Apocynaceae and Poaceae have been identified as the most frequently plant families used in the management of infections according to Hoekou et al. (2016), Karou et al. (2012) and in the management of sexual weakness according to Sunmonu et al. (2015). Rutaceae is mainly used in the treatment of malaria according to Agbodeka et al. (2016) and Koudouvo et al. (2011). However, Hernández et al. (2004) reported more plants in the Eastern Region of Cuba. Indeed they reported 170 species used in the preparation of 199 plant mixtures belonging to 71 families. Among them Fabaceae, Poaceae and Rutaceae have high prevalences. These results are close to what we found for the most represented families.

The producers of "*Atikédi*" used medicinal plants to treat a wide range of ailments. In fact, the 61 plants species recorded were used in management of 43 diseases (Table 3). Among these plants, the highest record was 41.0% species used to treat one ailment, followed by 26.2% species which were used to treat two ailments. The fruits of *Moringa oleifera* were used to treat 13 different ailments and the roots of *Waltheria indica* were used to treat 11 different ailments. The leaves of *Cymbopogon citratus* and the roots of *Vetiveria nigritana* were used to treat 9 ailments. Both roots (96.4%) and trunk barks (3.6%) of *Zanthoxylum xanthoxyloïdes* were used to treat 8 ailments. *Caesalpinia bonduc* (roots 98.9% and seeds 1.1%); trunk barks of *Khaya senegalensis* were used to treat 7 ailments. The use of one species to treat many diseases indicated the plurality of the active compounds contained in plants (Balayogan et al., 2014). Although the root of *Mondia whitei* Skeels was used only for the management of sexual weakness, it remained the most used plant species recorded, with a frequency of citation of 75.28% (Table 2). This could be due to the fact that the root of

Mondia whitei is a traditional plant containing aphrodisiac potentials (Oketch-Rabah, 2012; Chauhan et al., 2014) and contains androgenic property (Watcho et al., 2004).

Bacterial infections and sexual weakness were the most recorded pathologies with respectively 672 citations and 598 citations (Table 3) followed by malaria and stomach aches. Malaria accounted for 175 citations with 10 plants species used. Intestinal worms, anemia and eating disorder were also mentioned with 89 citations and 3 plants species used for intestinal worms, 82 citations and 10 plants species used for anemia, 52 citations and 9 plants species used for eating disorder. Finally, constipation, hemorrhoid, belly wounds and bad breath were identified. Constipation accounts for 27 citations and 9 plants species used; belly wounds for 23 citations and 8 plants species used; hemorrhoid for 23 citations and 3 plants species used; and bad breath for 22 citations with only 1 plant species used. Diseases like prostate, drowsiness, hypertension and gum disease were less recorded. Indeed, 4 plants species were used for gum disease and hypertension and 3 plants species for prostate. In fact, although people used "*Atikédi*" for many medical purposes in Lomé, bacterial infection and sexual weakness remained the most important diseases for which these beverages were used.

A concern in this study is the issue of the dose administered. This is one of the major problems with traditional medicine (Karou et al., 2011). In fact "*Atikédi*" producers declared that the doses depend on each person's ability to withstand alcohol. Alcohol having its toxicity, the ideal would be to use it just as an extraction solvent and to avoid drinking it as part of a plant-based treatment. This fact challenges the researchers to check whether a water infusion could give the same effects.

Conclusion

The study pointed out that beverages producers were in fact tradional healers due to their knowledge on medicinal plants that they used for therapeutic purposes. The beverages recorded were prepared with medicinal plants mainly contained in the pharmacopoeia of West Africa. Our hypothesis is justified by the fact that the area of production of these beverages is full of information about plants whose management will contribute to the improvement of traditional medicine in Togo, Africa and the whole world. Pharmacological and toxicological studies will be certainly necessary to assess the roles that most of these plants play in healing diseases not only in prospected populations but also in the world.

Declaration of conflict of interest

We declare to have no conflict of interest.

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