



## **Ethnobotanical Study of Medicinal Plants used as Anti-Obesity Remedies in Foumban and Dschang Cities (West-Cameroon)**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors PBT and FMT designed then supervised the study which protocol was written by author NJE and the experiments performed by authors NJE and OLMD. Authors NJE, OLMD and PBT wrote the paper, did the literature search and data analysis. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aim:** Obesity is a public health problem on a global and national scale. It is associated with high blood pressure, type II diabetes and certain metabolic complications. In Cameroon, obesity is observed in both rural and urban population where the people are still very attached to traditional values to solve their health problems. The present study was aimed at determining antiobesity medicinal plants used by the traditional healers in the Foumban and Dschang Municipalities.

**Methodology:** An ethnobotanical study of medicinal plants used against obesity was conducted in 2 localities, Foumban and Dschang, of the western region of Cameroon. The questionnaire was submitted and the information was collected via oral interviews with traditional healers and the people of the localities who benefited from anti-obesity treatments based on medicinal plants.

**Results:** Twenty five medicinal plants belonging to 16 families and used in the management of obesity were identified. Leaves and bark are the most used plant parts; they are followed by fruits

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(seeds) and Roots. Most herbal remedies are prepared as decoction in Foumban (30%) and Dschang (62%) respectively. The most common plant used by these people was *Solanum indicum* (49.27%, Foumban) and *Tetrapleura tetraptera* (40%, Dschang).

**Conclusion:** Relatively to the management of obesity with medicinal plants, the population of these localities presented interesting knowledge. However, there is still a need for further pharmacological and phytochemical investigations of the above common and most used ones.

**Keywords:** *Solanum indicum*; *Tetrapleura tetraptera*; obesity; plant survey; West-Cameroon.

## 1. INTRODUCTION

Obesity is a condition that concerns people of all ages in both developed and developing countries. It is a global epidemic affecting more than 650 million people worldwide. Obesity is mainly caused by increased consumption of high-calorie foods that result in a chronic energy imbalance. Other causing factors include physical inactivity, socioeconomic and environmental changes [1-3]. Obesity is characterized by metabolic syndrome which usually manifests in insulin resistance, hypertension, dyslipidaemia, type-2 diabetes and cardiovascular risk factors that cluster within the individuals. It could even lead to death. The prevention and treatment of obesity include a healthy lifestyle with regular physical exercise and balanced diet, accompanied in some cases by pharmacological therapy and/or surgical procedures [4]. These preventive efforts at the societal and individual levels are currently not been met. Worse, surgical interventions as well as the prescription of chemical drugs such as Sibutram, Rimonabant, Isomeride, Ponderal, Xenical and Lorcaserin have either not been appropriated or presented serious side effects [5,6]. Vis a vis these limits, the development of new, safe and efficient antiobesity treatment procedures thus became a necessity. This seems realizable as natural products represent an increasingly popular option to this [7]. Indeed, some medicinal plant species were described for the treatment of obesity, such as *Camellia sinensis* (L.) [8,9], *Citrus aurantium* (L.) [10] and *Phaseolus vulgaris* L. [11]. Most of these plants were reported from studies undertaken in Asia and Latin America. As far as the African continent and Cameroon in particular are concerned few ethnobotanical surveys describing the traditional use of plants to lose weight are available. An important proportion of the Cameroonian western region population is also confronted to overweight problems [12]. Fortunately some of their traditional healers are endowed with ancestral

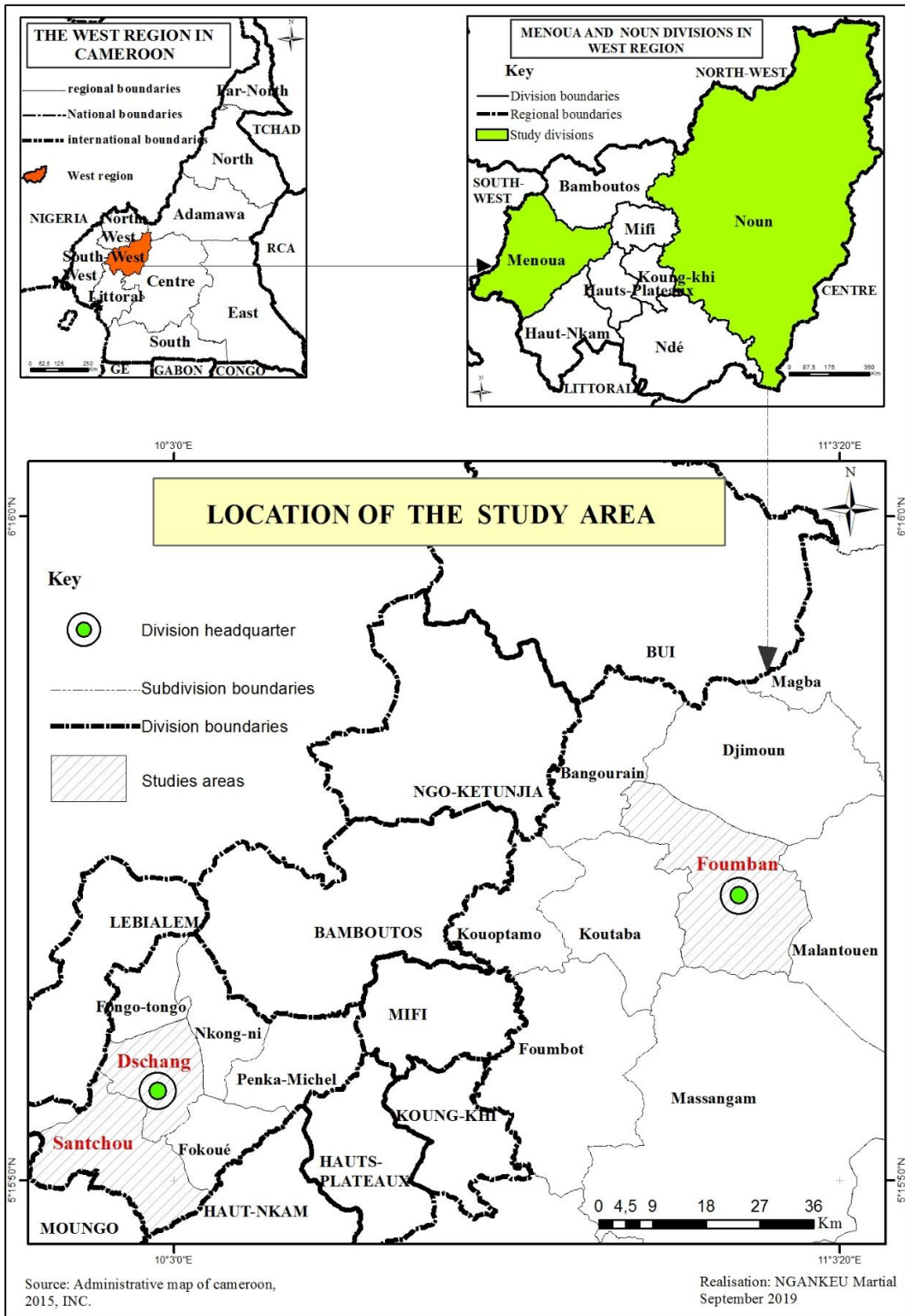
knowledge describing the use of local concoctions, prepared from medicinal plants, for the management of obesity and related complications. During the present study, medicinal plants that possess anti-obesity potential and are used by the traditional healers in the Foumban and Dschang Municipalities would be documented.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The city of Foumban covers an area of approximately 418 km<sup>2</sup> for a population of 152 728 inhabitants; 97 904 in urban areas and 54 824 in rural areas (report of the 3rd demographic census). The climate prevailing there is Sudano-Guinean with two seasons: a rainy season that runs from mid-March to mid-November and a dry season that runs from mid-November to mid-March. The annual rainfall amounts sometimes exceed 1700 mm despite malfunctions due to climate change. Temperatures vary between 18 and 23°C. On the whole, the climate is favorable for an annual and permanent practice of agricultural and pastoral activities. The relief on the whole territory of the Foumban municipality is dominated by three types namely: the plains, the plateaus and the mountains or hills. The forest reserve covers an area of 2100 ha. The incomes are generally derived from agricultural, livestock or craft activities. The inhabitants are Bamoun (Majority), the Bamileke, the Hausa, Bororo, Fulbe, the Anglophones and foreigners (Maliens, Nigerians). They live there in harmony. Foumban inhabitants are 90% Muslim, 10% Christian and animist. The ethno-pharmacological survey was carried out in 9 districts of the city of Foumban (Manka, Kounga, Njindaré, Njisse, Njinden, Njitout, Njiloum, Mambain, Njimbam).

Dschang is a city located in the West region of Cameroon. Its population is predominantly made up of the Bamileke ethnic tribe. The main activities in this locality are agriculture and



**Fig. 1.** Map of the area study (made by Ngankeu Matial, 2019)  
 NB: Santchou is area of collected plants (*Tetrapleura tetraptera* and *Ricnodendron heudelottii*)

**Table 1. Distribution of information in the localities of study**

Locality	Tradipractioner	Patient	Total
Foumban	11	62	73
Dschang	5	20	25
Total	26	82	98

animal rearing. The Division is geographically located between 5.001 to 5.501 latitude north and 9.401 to 10.251 longitude east on the map of the world. This division spreads from Santchou (altitude 600 m) to the Nkong-Ni (Djuttitsa) plateau culminating at an altitude of 2200 m. The climate is tropical-cold in a large part of the division and comprises two distinct seasons: a dry season from mid-November to mid-March and a rainy season which extends from mid-March to mid November. Average annual temperatures (from 1997 to 2006) were 25.35°C (maximum) to 13.66°C (minimum) and the average annual rainfall for the same period was 1717.70 mm [13](Fig. 1).

## 2.2 Data Collection

The ethno-pharmacological survey took place from March 2016 to October 2017. The acquisition of information required the help of two indigenous interpreters from the cities of Foumban and Dschang. Ninety eight (98) people including 16 traditional healers and 82 patients were interviewed (Table 1). They were submitted to questionnaire that enabled us to identify the following information: the diagnosis of obesity (BMI), the medicinal plant vernacular names; the specific plants part used, mode of extract preparation, adverse effects if any of the preparation as well as additional therapeutic indications of the named plant. For each collected plant, an herbarium was made using the fresh parts (stems + leaves + flowers) that were compressed between 2 sheets of paper and dried in the attic. Then, the plants were identified at the Cameroon National Herbarium (Yaounde) where their full scientific names and voucher number were obtained. Further literature investigations were also conducted relatively to their therapeutic and/or pharmacological effects and their phytochemical composition.

## 2.3 Data Analysis

Descriptive statistic was principally used in this study. Initially, the information about the popular uses of the species collected, along with botanical information, were compiled into a database. The species were listed in alphabetical

order by family, scientific name, vernacular name, voucher number, part used, mode of preparation and frequency of use. The frequencies of observations of plants were calculated as the sum of their utilizations among the questionnaires given to healers. The frequency of citation (FC) of the used plant species was evaluated using the following formula:

$$FC = (\text{number of times a particular species was mentioned} / \text{total number of times that all species were mentioned})$$

## 3. RESULTS

### 3.1 Informants and Different Plant Species Recorded

According to the information received from our investigation, 98 people including 16 traditional healers and 82 patients were interviewed. The medicinal plants recorded during this study are presented in Table 2. Twenty five (25) medicinal plants belonging to 16 families were identified from the study area. *Solanum indicum* Linn presented the highest frequency of citation (FC = 49.27%, Solanaceae) of medicinal plants used in the studied area for the management of obesity. It was followed by *Tetrapleura tetraptera* Taub (40%, Fabaceae). A second group of plants including *Ricinodendron heudelotti* (26.66%, Euphorbiaceae,) and *Drymaria cordata* (13.33%, Caryophyllaceae) showed moderate FC.

Beside their utilization in the management of obesity, the recorded medicinal plants are also used in the treatment of hypertension (11/47; 23.4%), diabetes (8/47; 17%), hyperlipidemia (5/47; 10.64%), inflammation or various pain related disorders (8/47; 17%), reproductive disorders (6/47; 12.77%).

### 3.2 Parts of the Plants used, Mode of Preparation

From the data recorded, we noticed that almost all parts of medicinal plant are used for the preparation of anti-obesity remedy. But the most

commonly used plant parts in Fouban and Dschang localities were the leaves (29%) and bark (40%) respectively (Fig. 2). In Fouban and Dschang localities, plant extracts are usually taken orally during an indefinite period of time using the following procedures: maceration (22 and 25%), decoction (30 and 62%) or infusion (12/130; 9.23%), antioxidants (8/130; 6.15%), anti-hypertensive (8/130; 6.15%), hypolipidemic (6/130; 4.62%) potentials as well as the treatment of reproductive disorders (13/130; 10%). Moreover, these recorded plants, except *Brillantaisia vogeliana* and *Vernonia guineensis*, contained diversified phytochemical compounds. The most encountered ones were flavonoids (21/130; 16.15%), alkaloids (20/130; 15.38%), saponins (15/130; 11.54%), glycosides (14/130; 10.77%), tannins (13/130; 10%), terpenoids (8/130; 6.15%) and phenolic compounds (6/130; 4.62%).

### 3.3 Pharmacological/Therapeutic Effects and Phytochemical Compositions of Recorded Medicinal Plants as Reported in the Literature

The pharmacological effects and phytochemical compounds of recorded medicinal plants in this study are summarized in Table 3. Except the

pharmacological investigation of *Hibiscus sabdariffa* and *Zingiber officinale* anti-obesity potential, the review of scientific studies undertaken on the remaining plants globally indicates that they possess important anti-inflammatory (17/130; 13.08%), antidiabetic (12/130; 9.23%), antioxidants (8/130; 6.15%), anti-hypertensive (8/130; 6.15%), hypolipidemic (6/130; 4.62%) potentials as well as the treatment of reproductive disorders (13/130; 10%). Moreover, these recorded plants, except *Brillantaisia vogeliana* and *Vernonia guineensis*, contained diversified phytochemical compounds. The most encountered ones were flavonoids (21/130; 16.15%), alkaloids (20/130; 15.38%), saponins (15/130; 11.54%), glycosides (14/130; 10.77%), tannins (13/130; 10%), terpenoids (8/130; 6.15%) and phenolic compounds (6/130; 4.62%).

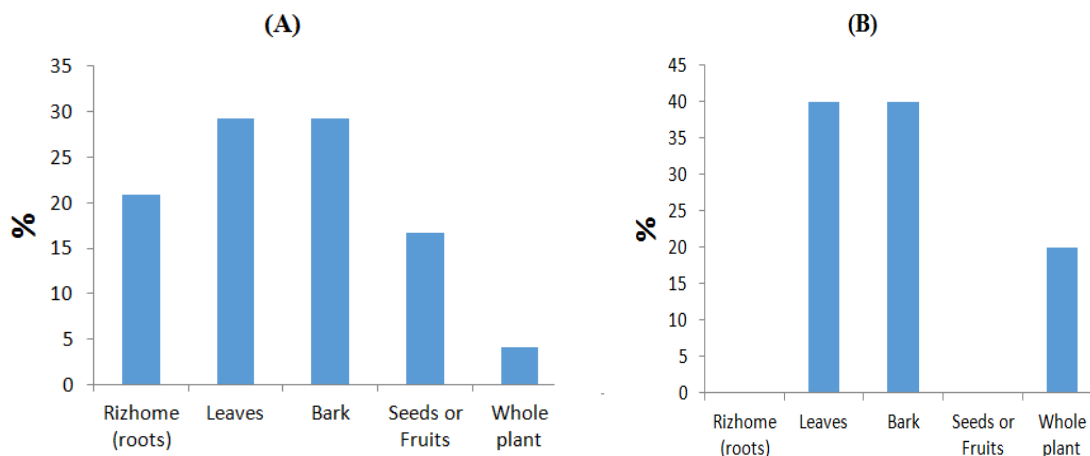


Fig. 2. Proportion of plant parts used for remedy preparation in Fouban (A) and Dschang (B)

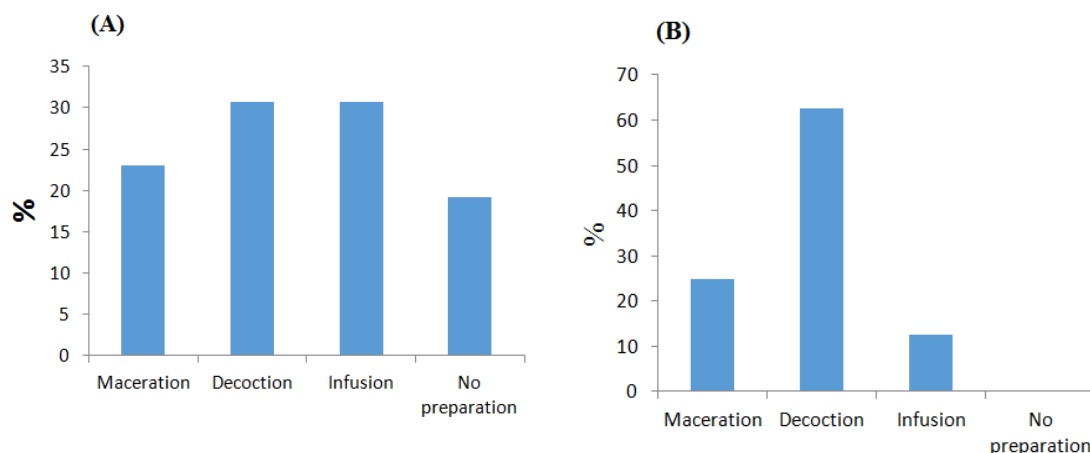


Fig. 3. Mode of preparation of anti-obesity remedy in Fouban (A) and Dschang (B)

**Table 2. Medicinal plants used as anti obesity remedies in fouban and dschang localities (West-Cameroun)**

Localities	N°	Scientific names	Families	Vernacular names	Voucher number	Plant part used	Traditional treatment	Preparation method	Frequency of used
Fouban	01	<i>Aframomum melegueta</i> K. Schum	Zingiberaceae	Sho' kuot	65639 /HNC	Rhizome (roots)	Obesity	Infusion	1/138
	02	<i>Alchornea cordifolia</i> Müll.Arg.	Euphorbiaceae	Mbuop wu	46528 SRFK	Dry leaves or roots	Obesity Anemia Pain Diabetes Hypertension	Maceration +water	5/138
	03	<i>Annona muricata</i> L	Annonaceae	Shaba shaba	1813 SRFK	Leaves	Obesity Hypertension Diabetes Heart disease	Infusion + water	1/138
	04	<i>Cajanus cajan</i> L	Fabaceae	Nkun nsüre	42602 HNC	Seeds	Obesity	Decoction or chew	1/138
	05	<i>Erythrina senegalensis</i> L	Fabaceae	Megham njù tw tw	3573 SRFK	Barks	Obesity Fever Hypertension	Decoction	1/138
	06	<i>Ficus exasperata</i> (Kharvat). Vahl	Moraceae	Ghwghw	14506/ SRF/cam	Barks or leaves	Obesity Hemorrhoids Spasmogenic	-Decoction/Barks -Infusion or Maceration/leaves	1/138
	07	<i>Ficus platyphylla</i> Delile	Moraceae	Nkène kuot	15238/ SRF/cam	Barks	Obesity Hypertension Renal diseases Rheumatism Prostate	Decoction or maceration + white wine	1/138
	08	<i>Hallea stipulosa</i> (D C)J.F Leroy	Rubiaceae	Quetum	44183/HNC	Barks	Obesity	Decoction : Barks + water	12/138
	09	<i>Harungana madagascariensis</i> . Lam.ex Poir	Hypericaceae	Ntunne	2244 SRFK	Barks or leaves	Obesity Menopausal disorders	Maceration	1/138
	10	<i>Hibiscus sabdariffa</i> L	Malvaceae	Nsaah	42812 HNC	Leaves	Obesity Hypertension	Maceration/leaves Chew fruit	8/138
	11	<i>Hibiscus</i>	Malvaceae	Saagwatngwat	3389 SRFK	Leaves /	Obesity	Infusion	1/138

Localities	N°	Scientific names	Families	Vernacular names	Voucher number	Plant part used	Traditional treatment	Preparation method	Frequency of used
		<i>surattensis L</i>				young shoots	Cough		
	12	<i>Hymenocardia acida. Tul.</i>	Phyllanthaceae	Kuo	3257 SRFK	Barks	Obesity Diabetes Inflammatory diseases Prostate	Decoction	1/138
	13	<i>Mondia whitei (Hook. F)Skeels.</i>	Apocynaceae	Kukundja	2995 SRFK	Fruits, roots	Obesity Thrush	Eat fruit, crush roots (infusion)	1/138
	14	<i>Sesamum indicumL</i>	Pedaliaceae	Ndùete	14483/SRF/cam	leaves	Obesity	Decoction	1/138
	15	<i>Sida cordifoliaL</i>	Malvaceae	Siisom ramram	8538 SRFK	Whole plant (leaves)	Obesity Hypertension	Infusion	1/138
	16	<i>Solanum incanum L</i>	Solanaceae	Shishié	34752 HNC	Fruits	Obesity	Chew fruits	1/138
	17	<i>Solanum indicum L</i>	Solanaceae	Nsussureu	60814 HNC	Fruits	Obesity Stomach aches Diabetes Hypertension Renal diseases	Chew or crush and lick, infusion	68/138
	18	<i>Vernonia guineensisBenth</i>	Asteraceae	Mgbw kuot	39292 HNC	Roots	Obesity Hypercholesterolemia Hypertension Diabetes Prostate	Maceration + water or white wine	10/138
	19	<i>Voacanga thouarsii Thouars.</i>	Apocynaceae	Pè pekpen	1813 SRFK	Barks	Obesity Diabetes Inflammatory diseases	Decoction	1/138
	20	<i>Zingiber officinaleRoscoe</i>	Zingiberaceae	Ginger	13432 HNC	Rhizome (roots)	Obesity Diabete Bronchitis	Infusion	1/138
Dschang	21	<i>Brillantaisia vogeliana(Nees) Benth.</i>	Acanthaceae	/	6351 SRF/cam	Leaves	Obesity Hypolipidemia Hypocholesterolemia	Decoction or maceration	2/30
	22	<i>Drymaria</i>	Caryophyllaceae	Lerte kiet	20550/SRF/cam	Whole plant	Hypolipedemia	Decoction or	4/30

Localities	N°	Scientific names	Families	Vernacular names	Voucher number	Plant part used	Traditional treatment	Preparation method	Frequency of used
		<i>cordata</i> (Linn.) <i>Willd.</i>		(Yemba)			Hypertension Eyes disorder	infusion	
	23	<i>Ricinodendron heudelotii</i> (Bail.)	Euphorbiaceae	Njansang (Bamileke)	508111/NHC	Stem bark	Obesity Diuretic Infertility Rheumatism	Decoction	8/30
	24	<i>Tetrapleura tetraptera</i> (Taub.)	Fabaceae	-4 côté (French) -Chelekwa (Yemba)	66344/HNC	Stem bark	Obesity Diuretic Diabetes	Decoction	12/30
	25	<i>Zehneria scabra</i> (Linn. f.)	Curcubitaceae	/	19668/SRF/Cam	Leaves	Obesity Hypocholesterolemia Infertility Fever Diarrhea	Decoction or maceration	2/30



**Table 3. Pharmacological activities and major phytochemical compounds found in the plants**

<b>Families</b>	<b>Species</b>	<b>Major phytochemical compounds</b>	<b>Therapeutic / pharmacological effects</b>
Acanthaceae	<i>Brillantaisia vogeliana</i> (Nees) Benth.	No report	Heart diseases, hypertension, infertility, gynecological diseases [14];hypocholesterolemia [15]; antidiabetic [16].
Annonaceae	<i>Annona muricata</i> L	Alkaloids, megastigmanes, flavonol triglycosides, phenolics, cyclopeptides and essential oils [17, 18, 19, 20]	Anti-inflammatory and analgesic [21]. Antinociceptive and anti-ulcerogenic [22].
Apocynaceae	<i>Mondia whitei</i> (Hook .f). skeels	Alkaloids, steroids, coumarins and reducing sugars [23]; flavonoids, tannins and carotenoids [24].	Treatment of diabetes and hypertension; male impotence and infertility; urinary tractinfections, jaundice, and headaches [25].
	<i>Voacanga thouarsii</i> <i>Thouars</i>	Alkaloids, steroids [26].	Cancer, cardi tonic, antituberculosis, anti-diarrheal activities [26].
Asteraceae	<i>Vernonia guineensis</i> Benth	No report	Syphilis, gonorrhoea, infertility, gastritis, urinary infections, prostate cancer [27].
Caryophyllaceae	<i>Drymaria cordata</i> (Linn.) Willd.	Saponins, alkaloids [28]; Flavonoid glucosides, norditerpene glycosides, Steroids [29].	Analgesic, wound healing, anti-inflammatory activity [30, 31]; antidote, appetizer, depurative, emollient, febrifuge, laxative [29].
Curcubutaceae	<i>Zehneria scabra</i> (Linn. f.)	Tannins, flavanoids, saponnis, phenols, alkaloids [32].	Infertility, bacterial diseases, skin diseases, gonorrhoea, syphilis,malaria, diarrhoea, mumps, fever, taeniasis, constipation [33]; antiinflammatory, antibacterial, antioestrogenic [34, 35] .
Euphorbiaceae	<i>Alchornea cordifolia</i> <i>Müll. Arg</i>	Fatty acids, terpenoids, flavonoids, phenolic acids, alkaloids [36].	Antibacterial [37]; antifungal [38]; inflammatory disorders, hormonal-related gynecological disorders, infertility, urinary [36].
	<i>Ricinodendron heudelotii</i> (Bail.)	Tannins, saponins, flavonoids, alkaloids, Carotenoid, phenols, steroids, cardiac glucoside, terpenoids [39, 40].	Cough, yellow fever, anemia, malaria, stomach pain, and intestinal disease [41, 42]; hypocholesterolemia, hypolipidemia and antibacterial [42, 43].
Fabaceae	<i>Cajanus cajan</i> L	Flavonoids, tannins, alkaloids, saponins, cyanogenic glycosides, glycosides and anthocyanins [44].	Anti-bacterial, anti-microbial, anti-inflammatory, hypocholesterolemic effects, anti-diabetic, anti-cancer, antimalarial, neuroactive properties, antioxidant, hepatoprotective, anthelmintic [45, 46, 47].
	<i>Erythrina senegalensis</i> L	Alkaloids, saponins, flavonoids, tannins and terpenoids [48].	Anti malarial, analgesic, anti-inflammatory, antibacterial actions [49]; gastrointestinal disorders, fever, jaundice, eye infections, body pain, liver disorders, diuretic [50]; antihypertensive, hypoglycemic, hypolipidemic, cardiomodulator and antioxidant properties [51].

Families	Species	Major phytochemical compounds	Therapeutic / pharmacological effects
	<i>Tetrapleura tetraptera</i> (Taub.)	Alkaloids, saponins, flavonoids, tannins and phenols [52].	Hypertension, diabetes mellitus, antiinflammatory, epilepsy, schistosomiasis, breast and uterus cancers, hypoglycemic, hypolipidemic, hypotensive [53, 54]; antimicrobial, antioxidant, analgesic, antimalarial [52].
Hypericaceae	<i>Harunganamadagascariensis</i> Lam.ex. poir	Alkaloids, saponins, flavonoids, anthrones, anthraquinones, xanthones, essential oils [55, 56].	Malaria, river blindness, ulcer, asthma, hepatitis, dysmenorrhea, toothache, chest pains and urogenital infections [57].
Malvaceae	<i>Sida cordifolia</i> L	Alkaloids, flavonoids, lignin, glycosides, saponins, phytosterols [58].	CNS depressant, fat lose [59] ; hypotensive, analgesic, antispasmodic, antiinflammatory, hypoglycemic and hepatoprotective properties [58, 60].
	<i>Hibiscus sabdariffa</i> L	Flavonoids, polyphenolic compounds[61].	Hypertension, diabetes mellitus, inflammation, cancer, obesity, and antidiarrheal [61] ; hypertension and hyperlipidemia [62].
	<i>Hibiscus surattensis</i> L	Alkaloids; flavonoids, tannins, steroids and triterpenoids, saponins and polyphenols [63, 64].	anti-inflammatory and antimicrobial [63]; antidiabetic [64].
Moraceae	<i>Ficus exasperata</i> (Kharvat) Vahl	Flavonoids, saponins, polyphenols, anthraquinones and tannins [65].	Analgesic, antiarthritic, diuretic, wound healing, antiparasitic, vermifuge, hemorrhoids, antidiabetic, anticonvulsant, antiinflammatory, antimicrobial, hypolipidemic, antioxidant, antiulcer, anxiolytic and hypotensive [23].
	<i>Ficus platyphylla</i> Delile	Tannins, saponins, anthraquinone, glycoside, alkaloids, flavonoids, steroids and reducing sugars [66].	Analgesic [67], anti-inflammatory and anticontraceptive activities [68]; dysentery, cough, diarrhoea, chest condition, tuberculosis, convulsive disorder and pain relief [67, 69].
Pedaliaceae	<i>Sesamum indicum</i> L	Alkaloids, flavonoids, glycosides, phenols, anthraquinones, tannins, carbohydrates and proteins extracts [70].	Hemorrhoids, dysentery, constipation, cough, amenorrhea, dysmenorrheal, ulcers, anticancer, antioxidant, antifungal [71].
Phyllanthaceae	<i>Hymenocardia acida</i> Edmond Tul	Alkaloids, glycosides, flavonoids, saponins, tannins and terpenoids [72].	Anticonvulsant, antioxidant, antibacterial, anxiolytic, antiinflammatory, antiulcer, anticancer, antiplasmodial, antitrypanosomal, antiithypoid, antitumor, antileishmanial, antidiarrhoeal, antidiabetic, antituberculosis, analgesic [73].
Rubiaceae	<i>Hallea stipulosa</i> (DC)J. F. Leroy	Alkaloids, steroids, coumarins and reducing sugars [23].	Diabetes, hypertension, diarrhea, and gastric ulcer [74].
Solanaceae	<i>Solanum incanum</i> L	Alkaloids, flavonoids, saponins, phenols, steroids and triterpenoids [75].	Sore throat, stomach-ache, head-ache, painful menstruation, liver pain [76]; antimicrobial activity, antimalarial activity, the antinociceptive effects, antioxidative property [75].

<b>Families</b>	<b>Species</b>	<b>Major phytochemical compounds</b>	<b>Therapeutic / pharmacological effects</b>
	<i>Solanum indicum L</i>	Flavonoids, glycosides, sugars, alkaloids and tannins [77].	Skin diseases, ulcers difficult breathing, abdominal pain, cough, dyspepsia, sexual disorders, insomnia, cardiac weakness and pruritis [78]; hepatoprotective, anthelmintic, antioxidant and antimicrobial activity [79].
Zingiberaceae	<i>Aframomum melegueta</i> . <i>K. Schum</i> <i>Zingiber officinale Roscoe</i>	Alkaloids, flavonoids, tannins, saponin, steroids, cardiac glycosides and terpenes [80]. Flavonoids, terpenoids, steroids, saponins, phenolics, phytosterol, cardiac glycosides [82].	Convulsion, leprosy, inflammation and/or rheumatoid pains [80]; antimicrobial activities [81]. Antidiabetic, analgesic, antiarthritic, anticancer, antioxidant, antiulcer, antimicrobial, anti-inflammatory immunomodulatory [83].; obesity[89]

#### 4. DISCUSSION

Considered as a global epidemic which evolution has been accentuated by the globalization phenomenon, obesity is nowadays a serious health challenge for all governing institution [88]. Among the treatment strategies available for obesity are plant-based medications that may contribute to body weight loss through decrease in food consumption, lipogenesis or energy intake; loss of appetite and increase in lipolysis and energy expenditure [90]. In the present ethnopharmacological survey, 25 medicinal plants traditionally used in the management of obesity and belonging to 16 families were recorded. The number of recorded medicinal plants although low attests the knowledge and concerns these local population have on this health problem. During our survey, many traditional healers and local people were accosted but few of them accepted to provide requested information arguing that it was a commercial inheritance which benefice or income could be affected through the divulgation of requested information. The parts of the medicinal plants used during the preparation of the concoction as well as the method of preparation depend on the herbalist decision and eventually its folk experience. In both localities, leaves (29%) and Bark (40%) of plants were used for the preparation through decoction of the various mixtures. Many authors revealed that decoction is the method of preparation highly used because this technic permits to collect the most active compound [98]. The high percentage of utilization of leaves for the preparation is in conformity with concoction preparation, in various area, for similar studies. Another reason would be its easier availability and specifically that of the medicinal plants protection.

Following the survey in the two localities, *Solanum indicum* (FC = 49.27%), *Tetrapleura tetraptera* (FC = 40%), *Ricinodendron heudelotii* (FC = 26.66%) and *Drymaria cordata* (FC = 13.33%) presented the highest frequencies of citation respectively. Few of the recorded plants have undergone anti-obesity pharmacological studies. Thus, the stimulating effect of the aqueous extract of *Tetrapleura tetraptera* or *Zingiber officinale* on the reduction in body weight gain, dietary intake, triglycerides, total cholesterol, insulin, leptin, lipids and increase in high density lipoprotein (HDL-C) levels has been proven [84,85]. Dietary oil from *Ricinodendron heudelotii* has been proven to possess hypocholesterolemia and hypolipidemia activities

[43]. Finally, studies with *Hibiscus sabdariffa* L. have shown greater inhibitory effect on triglyceride accumulation, reduced body weight, total body fat, liver fat and waist-hip ratio in humans [86, 87]. Many other therapeutic or pharmacological potential of the recorded plants, in connection with obesity has been cited by the participants to the survey. They include hypertension (23.4%), diabetes (17%) and hyperlipidemia (10.64%). This pharmacological diversification of the recorded plants is confirmed by data on literature review research which indicate their important anti-inflammatory (13.08%), antidiabetic (9.23%), antioxidants (6.15%), anti-hypertensive (6.15%) and hypolipidemic (4.62%) potentials. Hypertension is commonly associated with obesity, and it is possible that obese subjects are more likely to retain fluid and thus require careful attention to their fluid status [91]. Also, chronic inflammatory conditions associated during obesity with visceral adipose tissue, play an important role in insulin resistance and hyperglycemia [92]; thus the implication of some compounds present in *Camellia sinensis*, *Capsicum Annuum*, *Fucus vesiculosus*, *Allium sativum*, mint essential oil, *Piper nigrum*, that would be implicated in the secretion of GLP - 1 that increase insulin sensitivity and reduce blood glucose in a dose-dependent manner [93,94,95].

Many study undertaken on various medicinal plant compounds, including saponins, tannins, polyphenols and flavonoids have related their anti-obesity potential to their capacity in inducing lipolysis and inhibiting the pancreatic lipase enzyme [96] and enterohepatic circulation [97]. Information from the literature review of recorded plants revealed that they mostly contain some of the above phytochemicals [flavonoids (16.15%), saponins (11.54%), tannins (10%), phenolic compounds (4.62%)] and thus confirmed their local used alone or in combination for the preparation of anti-obesity concoction.

#### 5. CONCLUSION

The results of this study revealed the presence of medicinal traditionally used in these two municipalities in the management of obesity. Twenty five medicinal plants were identified from 16 families where *Solanum indicum* and *Tetrapleura tetraptera* were the most recommended. Although many of these plants are popularly used to reduce weight in overweight or obese people, there is little scientific evidence corroborating its usage. Thus,

further investigations should be carried out to reveal the pharmacological activity of the anti-obesity properties of these plants, their toxicological aspect as well as mechanisms of action.

## CONSENT

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

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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