



(RESEARCH ARTICLE)



Testicular hernia and herbal medicine in Dodinda and Ngondong in western Logone occidental province in Chad

MBAÏHINGAM Djayo ¹, DJEKOTA Christophe ^{1,*} and BAKARNGA-VIA Issakou ²

¹ University of N'Djamena, Faculty of Exact and Applied Sciences, Laboratory of Natural Substances, B.P. 1027, N'Djamena/T chad.

² University of N'Djamena, Faculty of Human Health Sciences, Laboratory of Pharmacology and Toxicology, B.P. 1027, N'Djamena/T chad.

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Abstract

In Chad, testicular hernia is one of the public health problems with more than 1,423 cases treated in 2015. Medicinal plants are widely used by the local population to treat this disease. The objective of this work is to make an evaluation of the contribution of ethno-pharmacological knowledge of plants used in the treatment of testicular hernia in the villages of Dodinda and Ngondong, Department of Lac-Wey in Chad (Province of Logone Occidental).

Data on traditional testicular hernia treatments reviewed as well as surveys were carried out using semi-structured questionnaires between September 2019 and January 2021. A total of 100 active traditional practitioners and knowledgeable villagers estimated their contribution to this treatment. Data were analyzed based on use value (UV), fidelity level (FL) and relative citation frequency (RFC). Then, the most cited species were the subject of a photochemical study. All of six (06) plant species belonging to four (04) families have been reported. In the study area, 40% of healers use the combination of *Cassia sieberiana* bark with *Cassia occidentalis* roots. 35% use the combination of the bark of *Indigofera tinctorium* with the roots of *Ipomoea hederifolia*. 25% use the combination of the bark of *Sarcocephalus latifolius* with the roots of *Salix alba*. Biochemical characterization of these six (06) main species used in the treatment of testicular hernia revealed considerable levels of chemical constituents with different colorations. Such results are a prerequisite for the development of improved traditional medicines.

Keywords: Ethno pharmacology; Medicinal plant; Testicular hernia; Biochemistry; Chad

1. Introduction

Relationships between plants and humans have existed for a long time (Mpondo et al., 2012). Medicinal plants are valuable resources for the majority of rural populations in Africa, where more than 80% of people use them for their health care (Jiofack et al., 2010; Nguinambaye et al., 2021).

Chad is a floristic crossroads. Between West Africa and Sudan, between the Saharan domain and the Sudano-Guinean savannahs, the floristic entities overlap and mingle. In the current state of our knowledge of the flora of Chad, 2098 species belonging to 156 families and 842 genera have been mentioned.

* Corresponding author: DJEKOTA Christophe

University of N'Djamena, Faculty of Human Health Sciences, Laboratory of Pharmacology and Toxicology, B.P. 1027, N'Djamena/T chad.

Pteridophytes 33 species, Chlamyosperms 2 species, Monocotyledons 641 species and Dicotyledons 1421 species. The south and east of the country in particular probably contain many species that have not yet been mentioned (Jean César et al., 2019).

Local folk medicine continues to be an important source of remedies for primary health care (WHO, 2010). Previous studies have revealed the importance of medicinal plants due to several benefits; They are affordable, easily accessible. However, in Chad and particularly in the study area, very little published information is available on medicinal plants that treat testicular hernia.

Hernia is a condition that can affect various organs of human bodies, and there are many types of hernias: disc herniation (back), cervical disc herniation (neck), hiatal hernia (stomach), testicular hernia, abdominal hernia etc. It is an outgrowth, which, following any situation, is found outside its natural cavity, and therefore of the affected organ (HUG, 2022).

In Chad, testicular hernia is one of the public health problems with more than 1,423 cases treated in 2015. Medicinal plants are widely used by the local population to treat this disease.

The objective of this work is to identify the species of medicinal plants commonly used to treat testicular hernia by the population of Dodinda and Gondong villages, Lac-Wey Department in Chad (Logone Occidental Province) where there is no such survey.

2. Material and methods

2.1. Hardware

2.1.1. Study area

The departments of Dodinda and Ngondong are located west of Moundou, capital of Logone Occidental province in southern Chad (16° 20' 0" East longitude and 9° 0' 0" Latitude North). The population of this study area is predominantly ethnic Ngambaye.

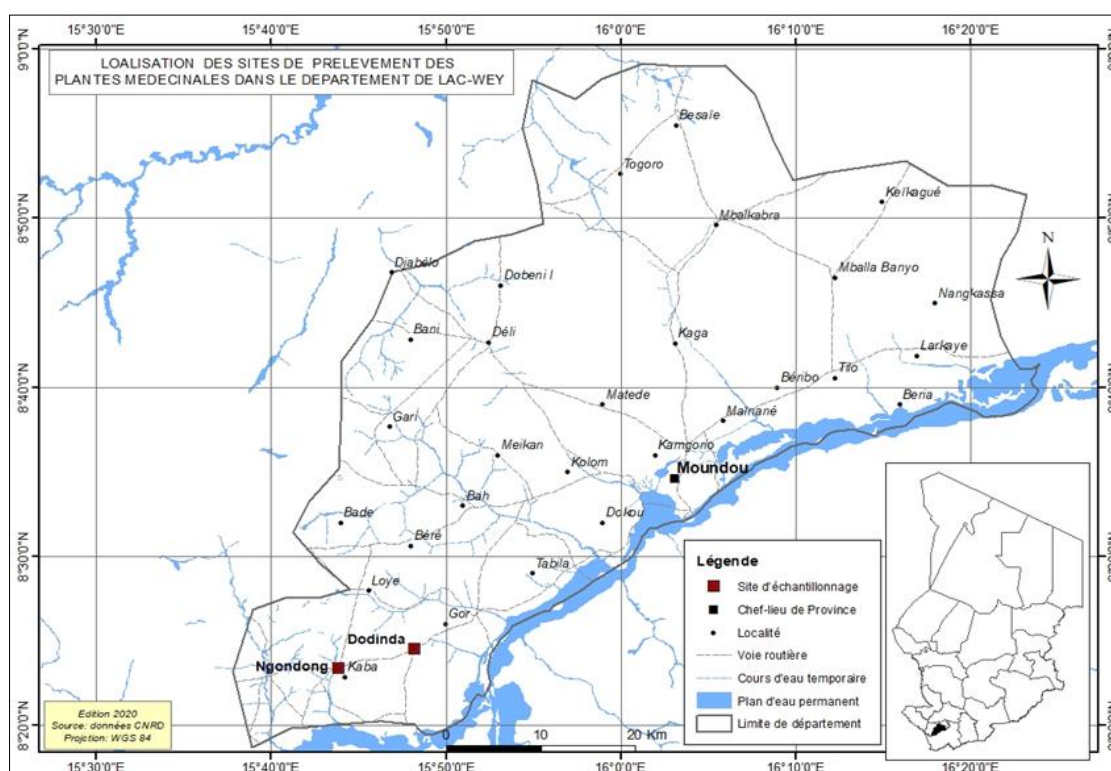


Figure 1 Location map of study sites

It coexists with ethnic minority groups such as Laka, Sara, Arabs, etc. It is a Sudanese bioclimatic zone that is characterized by two seasons: a long dry season of about 08 months and a short rainy season. Precipitation averages 1 200 mm per year and the average temperature is 25.6°C. They are home to vegetation characterized by open forests and wooded to grassy savannahs forming excellent pastures.

Extensive agriculture with the use of techniques and means that are not very modern is the main activity of the population of this study area. It is followed by breeding, fishing, gathering, hunting, trade and crafts. The soils are generally ferralitic and ferruginous. (OSS, 2015).

2.2. Methods

2.2.1. Data collection and processing

Data on traditional testicular hernia treatments reviewed as well as surveys were conducted using semi-structured questionnaires between September 2019 and January 2021. A total of 100 active traditional healers and knowledgeable villagers were able to estimate their contribution to this treatment.

Data were analyzed based on use value (UV), fidelity level (FL) and relative citation frequency (RFC): the number of informants who mentioned a species, divided by the total number of respondents (N). $RFC = FC/N$ (Tardío and Pardo-de-Santayana, 2008).

2.2.2. Analysis of the composition of secondary metabolites of the different extracts:

The analysis of the secondary metabolite composition of the different extracts, in order to justify the differences in the activity of the extracts observed on yeasts, was done according to the protocols described by Harbone (1976), Odebeyi and Sofowara (1978), Trease and Evans (1989), Sofowara (1993).

The alkaloid test

50 mg of an extract or a fraction of extract were diluted in 10ml of H₂SO₄ 2%. The mixture was homogenized and then boiled for 2 minutes and filtered. To 1ml of the filtrate, 5 drops of Mayer's reagent were added; the development of turbidity confirms the presence of alkaloids (Odebeyi and Sofowara, 1978).

The flavonoid test

5 ml of a dilute ammonia solution were added to an aqueous solution of extract; to the mixture of concentrated sulfuric acid was made. The presence of flavonoids is characterized by yellow colouration that disappears over time (Harbone, 1976).

The saponin highlighting test

25 mg of extract or fraction were mixed with 15 ml of distilled water in a test tube and the whole was heated in a boiling water bath for 5 min. After cooling, a sufficient volume of solution was introduced into a test tube and stirred vigorously for 10 seconds in the vortex. The presence of a foam about one centimeter thick that persists more than a minute after agitation materializes the presence of saponins (Harbone, 1976).

The tannin highlight test

To an alcoholic or aqueous solution of extract, a few drops of ferric chloride were added. The presence of tannins is manifested by a change in the coloration of the solution that turns dark blue (gallic tannins) or blackish green marking the presence of catechic tannins (Harbone, 1976).

The triterpene detection test

To 10 ml of a 10% extract solution (w / v), 2 ml of chloroform were added and the whole was homogenized; Then 3 ml of sulfuric acid were added to form two phases. The formation of a reddish-brown interface reflects the presence of terpenoids (Trease and Evans 1989).

The steroid highlight test

200 mg of extract were dissolved in 10 ml of chloroform; 2 ml of acetic acid were then introduced into the solution and the whole was cooled in an ice bath. Concentrated sulfuric acid was added and the formation of a blue-grey ring is indicative of the presence of steroids (Sofowara, 1993).

The anthocyanin detection test

50 mg of extract were mixed with 15 ml of 1% HCl and the whole was brought to a boil. The variation in colour from orange-red to orange-blue highlights the presence of anthocyanins (Odebeyi and Sofowara, 1978).

The anthraquinone test

50 mg of an extract or fraction of an extract were diluted in 4 ml of a mixture of chloroform and light petroleum (v/v), homogenized and filtered; to 1 ml of filtrate, an equal volume of 10% NaOH was added. The development of a red colour is characteristic of anthraquinones (Odebeyi and Sofowara 1978).

The glucoside test

1 g of extract was dissolved in 5 ml of HCl, then neutralized by 5 ml of a 5% NaOH solution; to the mixture we added drop by drop a solution of Fehling (A + B). The presence of glucosides is manifested by the appearance of a brick-red precipitate (Odebeyi and Sofowara, 1978).

3. Results

3.1. Demographic characteristics of the healers surveyed

A total of 100 informants, including traditional healers, herbalists and knowledgeable villagers, participated in the study. Thirty-four of the respondents are women and 66 are men. The age of respondents ranges from 25 to 75 years and the average age is 62.5 years. The age group [50-70] was the most represented at 42.6%. This age group is the most relevant in terms of ethno medical knowledge. Indeed, in the study area, interviews show that the elderly were particularly competent.

3.2. Peasant perception of testicular hernia disease

Symptoms of hernia occur when the ambient temperature is low. Strong chills lead, depending on the case, to loss of consciousness, sometimes leading to paralysis of the limbs in the victim. In order to remedy this disease, farmers resort to treatments based on medicinal plants including *Cassia sieberiana* and *Ipomoea hederifolia* which are the most used in the treatment of hernia in this study area.

3.3. Botanical diversity and determination of plants used in the treatment of testicular hernia

A total of six (06) plant species belonging to 04 families are used for hernia treatment in the study area. They are: Fabaceae (58%), Euphorbiaceae (14%), Rubiaceae (14%) and Tiliaceae (14%). These six (06) species frequently used by these traditional healers to treat hernia are: *Annona senegalensis*, *Bridelia scleroneura*, *Zizyphus abyssinica*, *Hygrofilao uriculota*, *Momordica charantia*.

In this study area, 40% of healers use the combination of *Cassia sieberiana* bark with *Cassia occidentalis* roots for the treatment of testicular hernia. 35% use the combination of the bark of *Indigofera garckeana* with the roots of *Ipomoea hederifolia*. 25% use the combination of the bark of *Sarcocephalus latifolius* with the roots of *Salix alba*.

3.4. Biochemical analysis of six (06) medicinal plants

The work of the biochemical analyses was carried out at the Department of Biology, Laboratory of Natural Substances of the Faculty of Exact and Applied Sciences of the University of N'Djamena (Chad). The organs used are: roots, bark and leaves.

The biochemical characterization of these six (06) main species used in the treatment of testicular hernia revealed considerable levels of chemical constituents with different stains. Table I presents the results of the saponoside tests that were recorded in terms of foam heights in centimeters.

Table 1 Saponoside Test

Saponoside Test	
Species	Foam height in cm
<i>Cassia siéberiana</i>	170
<i>Cassia occidentalis</i>	30
<i>Indigofera garckeana</i>	290
<i>Ipomoea hederifolia</i>	190
<i>Salix alba</i>	210
<i>Sarcocephalus latifolius</i>	110

This table I explains the enormous presence of saponosides in the following species: *Indigofera garckeana* which is the very first plant with a moss height of 290 cm. It is followed by *Salix alba* which has a foam height of 210 cm. The presence of moss at the level of the species *Cassia occidentalis* has a moss height of 30 cm.

The phytochemical characterization test of the roots of *Cassia sieberiana* revealed the presence of tannins, flavonoids, alkaloids, anthocyanins, sterols and terpenoids, cardiotoxic glycosides, anthraquinones.

Table 2 Synopsis of the different tests

Test	<i>C. sieberiana</i>	<i>C. occidentalis</i>	<i>I. garckeana</i>	<i>I. hederifolia</i>	<i>Salix alba</i>	<i>S. latifolius</i>
Alkaloids	+	+	+	+	++	++
Anthraquinones	++	+	-	-	+	-
Anthocyanins	++	+	+	++	+++	++
Flavonoids	+	-	+	+	-	+
Cardiac glycosides	Green+	Green+	Green	Green	Green	Green+
Sterols	+++	++	++	++	++	+
Terpenoids	+++	++	+++	+++	++	+++
Tannins	Gallic	Catechic	Catechic	Gallic		Catechic

+++ : High precipitate ; ++ : Average precipitate ; - : Absent

Table II shows considerable levels of chemical constituents with different colourations. These results show the presence of tannins (gallic) in *Cassia siéberiana*, catechic in *Indigofera garckeana*. Flavonoids (orange flavones) in *Ipomoea hederifolia*, *Cassia occidentalis*, in *Salix alba*, in *Sarcocephalus latifolius*.

Alkaloids are positive in *Sarcocephalus latifolius* with the Mayer and Wagner test, Terpenoids and sterols are positive in all six (06) species with the Salkowski and Lieberman test. Cardiotoxic glycosides and anthocyanins are positive in all six (06) species. None of the six (06) species showed anthraquinones and free quinones.

4. Discussion

4.1. Phytotherapy in traditional medicine and its limits

Biochemical analysis of plants used in the traditional treatment of testicular hernia in Dodinda and Ngondong identified six (06) plant species belonging to four (04) families. The leaves, bark and roots of these medicinal plants are used in various forms of preparation (infusion, decoction, maceration) and administered to patients orally without taking into

account problems of toxicity and or interactions. Several studies of traditional treatments in Africa have reported these complications in some patients (Pousset, 2006).

4.2. Biochemical characterisation of plant extracts used in the treatment of testicular hernia

Our results on phytochemical characterization revealed the significant presence of effective active ingredients in medicinal plants that are used by traditional healers in the study area for the treatment of testicular hernia.

Thus, the roots of *Cassia sieberiana* revealed the presence of tannins, flavonoids, alkaloids, anthocyanins, free quinones, sterols and terpenoids, cardiotoxic glycosides, anthraquinones, and saponosides. These identified compounds corroborate the work of N'Guessan (2015) who reports that the leaves and roots contain sterols, polyterpenes, polyphenols, flavonoids, catecholic tannins and alkaloids. Saponosides are known for their effectiveness in treating many diseases. The tannins found in *Cassia sieberiana*, *Ipomoea hederifolia* and *Sarcocephalus latifolius* could prevent or cure testicular hernia. These results are similar to those of Carrau et al., (2013) who showed hernia phytotherapy with tannins. According to Bruneton (1999), tannins, flavonoids, alkaloids, secondary metabolites from medicinal plants are involved in the treatment of testicular hernia.

5. Conclusion

This study is the first to focus on ethno pharmacological knowledge of plants for the treatment of testicular hernia by local traditional healers in Chad. The results revealed important local knowledge, as shown by the variety of species used to treat testicular hernia.

In the study area, 40% of local healers use the combination of *Cassia sieberiana* bark with *Cassia occidentalis* roots. 35% use the combination of the bark of *Indigofera tinctorium* with the roots of *Ipomoea hederifolia*. 25% use the combination of the bark of *Sarcocephalus latifolius* with the roots of *Salix alba*. Biochemical characterization of these six (6) main species used in the treatment of testicular hernia revealed considerable levels of chemical constituents with different stains. This work represents useful documentation, which can help preserve local knowledge on the use of medicinal plants and explore the biochemical and pharmacological potential of medicinal plants.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflict of interest

Statement of ethical approval

The present research work does not contain any studies performed on animals/humans subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study

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