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In vivo hypotensive activity on the albino's rat and *in vitro* antioxidant activities of aqueous extract from *Guibourtia tessmannii* (Harms) J. Leonard (Cesalpiniaceae) stem barks

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In Central Africa, stem bark from *Guibourtia tessmannii* is used in traditional pharmacopeia for the treatment of hypertension. The aim of this study was to scientifically verify the traditional use in the treatment of metabolic pathologies such as arterial hypertension and evaluated its pharmacological potential. Phytochemical tests were evaluated by standard method of laboratory. Antioxidant activities were determined by DPPH and FRAP scavenging methods and hypotensive activity was achieved by the invasive method. The results showed that the aqueous stem bark extract caused a hypotensive effect. Pretreatment on normotensive rats with atropine had provoked a significant hypotensive effect ($p < 0.05$), suggesting that muscarinic receptors are involved in the hypotensive effect of the extract. Applying adrenaline or epinephrine did not abolish the hypotension caused by the extract, suggesting that α_1 and β_1 receptors are involved in the hypotensive induction. Furthermore, phytochemical analyses indicated that *G. tessmannii* stem barks exhibit high levels of polyphenols, high antioxidant activity index (AAI=1.53), and high chelating activity (3.65 ± 0.021 mmol EAA/g of extract). Thus, the results suggest that *G. tessmannii* might be considered a natural resource for the formulation of treatments against hypertension and as an antioxidant.

Key words: *Guibourtia tessmannii,* plant extract, normotensive rat, hypertension, antioxidant, polyphenols.

INTRODUCTION

Hypertension is a major health problem worldwide. Individuals with hypertension matters are at an increased risk for stroke, heart disease, and kidney failure (Bakris, 2021).

Although the etiology of hypertension has a genetic component, lifestyle factors such as diet also playing

important in the pathophysiology. Excess sugar and salt or deficiencies of antioxidant vitamins in the diet play a vital role in the etiology of hypertension (Maarman, 2017).

The relationship between hypertension, oxidative stress and antioxidants is complex and inadequately understood. Oxidative stress may play a role in the pathophysiology of hypertension (Pereira et al., 2022). Studies on humans and animals have revealed that hypertension is accompanied by an increase in oxidative stress. However, the evidence for this in humans is not definitive (Sinha et al., 2015).

Hypertensive effects of oxidative stress are mostly due to endothelial dysfunction resulting from disturbances of vasodilator systems, particularly the degradation of nitric oxide (NO) by oxygen-free radicals (*Guizoni* et al., 2020).

Plant species are powerful factories of bioactive compounds, thanks to their ability to synthesize a wide range of secondary metabolites with human health benefits (ku et al., 2020). These compounds include those having analgesic, antifungal, anti-cancerous, anti-inflammatory and antiviral properties, in addition to their antioxidant properties (radical capture or metal chelation) (Fu et al., 2022; Malu et al., 2017). Polyphenols, tannins, alkaloids, and essential oils are responsible for the antioxidant activities of plants (Iman et al., 2017; Yu et al., 2021). Antioxidants have the potential to fight against several diseases such as cancer, atherosclerosis, cerebro-vascular conditions, diabetes, hypertension and Alzheimer's disease, and delay the ageing process (Gullón et al., 2017; Shohag et al., 2022). In addition, plants synthesize products that have the potential in chelating iron (Shi et al., 2015), which plays a major role in oxidative stress.

In Central Africa, *Guibourtia tessmannii*, locally named ″Bubinga″ or ″Kevazingo″, is widely used by traditional healers for the treatment of hypertension. Indeed, ethnobotanical and pharmacological surveys on isolated organs have led to a better understanding of the mechanisms of action of the plant *in vitro* (Koumba et al., 2019; Ngene et al., 2015).

Moreover, an attention has been paid to its antioxidant and cardiovascular properties, to verify the use and potential implementation of an improved traditional drug.

MATERIEL AND METHODS

Plant material

Stem barks from *Guibourtia tessmannii* (Harms) J. Léonard were collected in the south of Gabon in August 2019. The plant was authenticated in the National Herbarium of Gabon at the Institute of Pharmacopeia and the Traditional Medicine (IPHAMETRA), in Libreville (Gabon), where a voucher specimen (SRFG 879 LBV) has deposited in the Herbarium of IPHAMETRA. Plant samples were collected and air-dried at room temperature for a total period of six weeks and pulverized into powder using a clean electric blender (Model Phillips 190). Powder samples were conserved in the flasks until utilization.

Aqueous extract

The amount of 1 kg of stem bark powder of *Guibourtia tessmannii* was macerated in 2000 ml of distillated water during 48 hours at room temperature and filtered using Whatman Millipore filter papers. The filtrate obtained was then lyophilized at - 40°C. The lyophilized sample (67,7g) was stored at + 4°C until used (Manohar and Ramesh, 2019).

Animal

Albinos rats of the *Wistar* strain (*Ratus ratus*) weighing 180 - 220 g were used. Rats were raised at the pet store of the Institute for Research in Health Sciences (Ouagadougou, Burkina Faso) under standard conditions (12 h day and 12 h night at room temperature).

Preparing the animal and measuring cardiovascular parameters using the invasive method (Koumba, 2020)

The rats were anesthetized with urethane (ethyl carbamate) 15% at dose of 1.5 g/kg, i.p correct 1 mL/100 g body weight. The jugular vein then the carotid artery was intubated with fine polyethylene catheters according to the appropriate protocol of experimentation using animals was carried out in accordance with protocols already validated by the Research Institute of Health Sciences (IRSS, Burkina Faso) for the invasive method. The catheter is connected to a pressure sensor itself connected via an amplifier to a recorder (oscillograph). Any changes in blood pressure perceived by the pressure sensor were amplified and recorded on an oscillograph paper using a writing pen. The paper speed was 1 mm/s and the gain was set to 5 gauges. The dome of the transducer is connected to a syringe filled with physiological solution: 0.09% heparinized sodium chloride (NaCl).

After 30 min stabilization of cardiovascular parameters, all substances were administered through a syringe attached catheter in the rat's jugular vein at a volume of 0.1 mL/100 g body weight (b.w).

Hypotensive effect of the aqueous extract of G. tessmannii on normotensive rats (Bouazi et al., 2019)

The aqueous extract of *Guibourtia tessmannii* (EAGt) was administered in cumulative doses of 0.1 mg/kg, 0.3 mg/kg, 1 mg/kg, 3 mg/kg, 10 mg/kg and 20 mg/kg on the normotensive rat (NTR=6). Variation in blood pressure was observed over time (second (s).

Influence of atropine on hypotensive effect of aqueous extract of G. tessmannii (Bouazi et al., 2019)

Atropine (100 µg/kg, i.v) was administered 5 min prior to intravenous administration of the aqueous extract of *G. tessmannii*

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in cumulated dose to RNT (n = 6). The effect of the extract is observed until the return to the basal blood pressure.

Effects of G. tessmannii aqueous extract on high blood pressure induced by adrenaline and phenylephrine (Bouazi et al., 2019)

Adrenaline (25 µg/kg) and phenylephrine (75µg/kg) were administered to NTR (n = 6) in a single dose to normotensive rats (n = 6) before single-dose administration of the aqueous extract of *G. tessmannii* (10 mg/kg, i.v). The effect of adrenaline and phenylephrine on blood pressure was observed until the return to basic blood pressure.

Phytochemical screening

The plant extracts were screened for their qualitative chemical composition, using standard methods described in the literature with small modifications (Nsi Akoué, 2017; Nsi Akoué et al., 2019). All the diverse tests were performed in triplicate.

The detection of Alkaloids was as follow: extracts of 20 mg as well as 10 mL of a dilute 10% sulfuric acid solution were transferred into a test tube. The combination was strong stimulated for 2 min as well as some Mayer's reagent drops were then added. The color yellowish hurried was characteristic of the alkaloids presence.

Flavonoids occurrence determination is gotten by dissolution of 2 mg of extracts in 2 mL of 95% ethanol with a few hydrochloric acid drops as well as 0.5 g of magnesium ribbon. The appearance of a cherry pink coloring indicates the presence of flavonoids.

The polyphenols detection was realized by adding a drop of 10% aqueous iron perchloride solution in 2 mL of extracts solution (1 g/L). An intense Dark coloration indicated the presence of polyphenols.

The saponins were identified by mixing 50 mg of extracts with 30 mL of purified water in a water bath at 30°C for 5 min. After cooling, 10 mL of this solution were presented into a test tube as well as energetically vortex-shaken for 10 seconds. The presence of 1 cm thick determined foam shows the saponins presence.

Detection of sterols as well as terpenes was performed by mixing 20 mg of extracts, 2 oleum drops, 10 drops of acetic anhydride into 3 mL of chloroform affecting the appearance of a purple ring, turning blue as well as then green in the test tube.

Total phenolic content

Determination of total polyphenols was by Folin-Ciocalteu method as described by (Nsi Akoué et al., 2019) with small modifications. Aliquots (125 µL) of methanolic extract (10 mg/ml) were mixed with 625 µL Folin-Ciocalteu reagent (0.2 N). After 5 min, 500 µL of aqueous Na_2CO_3 (75 g L^{-1}) were added as well as the mixture was vortexed. After 2 h of incubation in the dark at room temperature, the absorbance was read at 765 nm in contradiction of a blank (0.5 mL Folin-Ciocalteu reagents +1 mL Na_2CO_3) on a UV/visible light spectrophotometer (CECIL CE 2041, CECIL Instruments, England). The trials were performed out in triplicate. A standard correction curve was plotted using gallic acid (Y = 0.0289x-0.0036; R^2 = 0.9998). The results were stated as mg of gallic acid equivalents (GAE)/100 mg of drug.

Total flavonoids content

The estimation of total flavonoids was according to the Dowd technique as adapted by (Nsi Akoué et al., 2019) with small modifications. The quantity of 0.5 mL of $AlCl_3$ (2%, w/v) was mixed with 0.5 mL of stem bark methanolic extract (0.1 mg.mL^{-1}). After 10 min of incubation at room temperature (20°C), the absorbance was measured at 415 nm against a blank (combination of 0.5 mL methanolic extract solution as well as 0.5 mL methanol) on a UV/visible light spectrophotometer (CECIL CE 2041, CECIL Instruments, England) as well as likened to a quercetin calibration curve (Y= 0.0289x-0.0036; R^2 = 0.9998). The data gotten were the means of three determinations. The flavonoids amounts in plant fractions were stated as mg of Quercetin Equivalents (QE)/100 mg of drug.

Total flavonols content

Flavonols content was determined as adapted by Nsi Akoué (2017). Aliquots were prepared by mixing of 750 µL methanolic extract solution (0.1 mg mL-1) of plant as well as 750 µL aqueous AlCl3 (20%, w/v). The absorptions were read at 425 nm after 10 min incubation against a blank (mixture of 750 µL methanolic extract solution of plant as well as 750 µL methanol) on a UV/visible light spectrophotometer (CECIL CE 2041, CECIL Instruments, England). All determinations were performed in triplicate. A standard calibration curve was plotted using quercetin (0-50 µg mL-1). The results were stated as mg of quercetin counterparts (QE)/100 mg of fractions.

Determination of tannins contents

Determination of total tannins contents was by using tannic acid as a standard, as termed by the European community adapted by Nsi Akoué et al. (2019). In test tube, 200 µL aqueous plant fraction, 1 mL purified water, 200 µL ammonium ferric citrate (3.5 g/L^{-1}) as well as 200 µL ammoniac (20%) were diversified. After 10 min, the samples absorbance was measured at 525 nm against a blank (200 µL aqueous fraction of plant +1.2 mL distilled water) on a UV/visible light spectrophotometer (CECIL CE 2041, CECIL Instruments as well as England). The data gotten was the three mean determinations. The results were uttered as mg of tannic acid equivalents (TAE) per 100 mg of fraction (mg TAE/100 mg fractions).

Antioxidant activity

Different extracts of antioxidant activity was evaluated using (2.2-diphenyl-1-picrylhydrazyl) radical (DPPH) and Ferric ion Reducing Antioxidant Power assay (FRAP). Ascorbic acid and gallic acid were used as reference antioxidant compounds.

DPPH free radical method

The scavenging plant fractions activity against stable DPPH (2.2-diphenyl-1-picrylhydrazyl) radicals was determined with a UV/visible light spectrophotometer (CECIL CE 2041, CECIL Instruments, England) at 517 nm as defined by Dibala et al. (2016). Preparation of fraction solutions was by dissolving 10 mg of dry extract in 10 mL of methanol. The samples were homogenized in an ultrasonic bath. Aliquots of 1 mL prepared at different concentrations of plant samples were mixed with 1 mL of methanolic DPPH solution (20 mg/ mL). After 15 min in the dark at room temperature, the decrease in absorption was measured. The antioxidant extracts activity (AA) was planned in percentage relative to the control (DPPH alone in methanol without extract) according to the following equation:

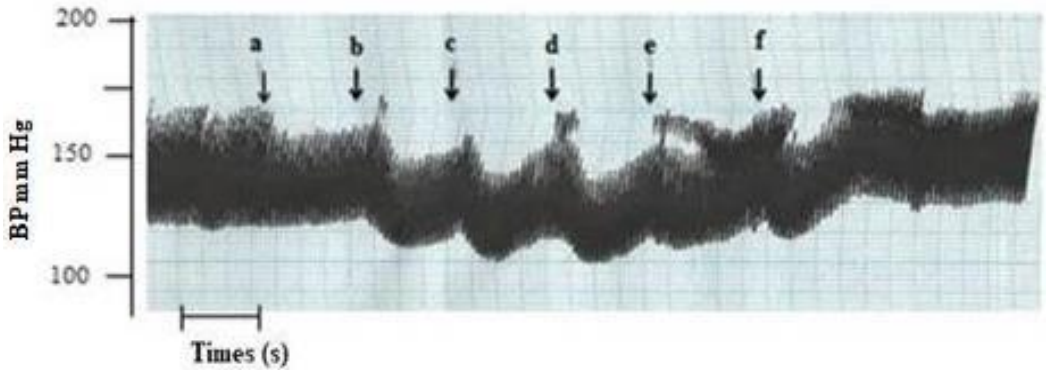

Figure 1. Recording of the effect of EAGt in cumulative doses ranging from 0.1 to 20 mg/kg b.w. with doses (mg/kg) a = 0.1; b = 0.3; c = 1; d = 3; e =10; f = 20.
Source: (koumba, 2020)

$$AA = \frac{A_0 - A}{A_0} \times 100$$

Where A_0 is the control absorbance (DPPH alone in methanol without extract) as well as A the absorbance of the DPPH solution in the extracts presence. The IC_{50} (concentration providing 50% inhibition) of extracts and standards was determinate using regression curves in the linear range of concentrations. The antioxidant activity index (AAI) was calculated as following formula

$$AAI = \frac{\left[DPPH\left(\mu g/mL\right)\right]}{IC_{50}\left(\mu g/mL\right)}$$

Where [DPPH (µg/mL)], is the final concentration of DPPH.
A criteria of Scherer and Godoy (2009) was considered with small modification (Nsi Akoué et al., 2019) according to which plant extracts show poor antioxidant activity when AAI is below 0.5, moderate antioxidant activity when AAI ranges between 0.5 and 1.0, strong antioxidant activity when AAI stands between 1.0 and 2.0, and very strong when AAI is above 2.0.

FRAP Method

This method is based on the ability of the sample to reduce Fe^{3+} to Fe^{2+} ions. Performance of the FRAP assay was according to Pooja and Modi (2015). The 0.5 mL of each fraction (1 mg mL^{-1}) was mixed with 1.25 mL of phosphate buffer (0.2 M, pH 6.6) as well as 1.25 mL of aqueous potassium hexacyanoferrate [$K_3Fe(CN)_6$] solution (1%). After 30 min incubation at 50°C, 1.25 mL of trichloroacetic acid (10%) was added as well as the mixture was centrifuged at 2000x*g* for 10 min. Then, the upper layer solution (0.625 mL) was mixed with purified water (0.625 mL) and a freshly ready $FeCl_3$ solution (0.125 mL, 0.1%). The absorbance was recorded at 700 nm on a UV/visible light spectrophotometer (CECIL CE 2041, CECIL Instruments, England) as well as ascorbic acid was used to produce the calibration curve (Y = 0.008x-0.0081; R^2 = 0.9999). The iron (III) decreasing activity determination was done in triplicate as well as expressed in mmol of ascorbic Acid Equivalent per gram of fractions. Gallic acid, a position compound was used as positive control.

Statistical analysis

The data were stated as Mean ± Standard Deviation (SD) of three determinations. Statistical analysis (ANOVA with a statistical meaning level set at $p<0.05$ as well as linear regression) was performed with Microsoft Exce

RESULTS AND DISCUSSION

The aqueous extract of *Guibourtia tessmannii* caused a decrease in blood pressure on the normo-tensive rats.

Phytochemical and polyphenols dose studies showed the presence of several chemical compounds and good antioxidant activity.

Hypotensive effect of aqueous extract of *G. tessmannii* on normotensive rats

The variations in blood pressure in the presence of *G. tessmannii* extract provoked a decrease in cumulative administration of doses from 0.1mg/kg to 20 mg/kg (Figure1), with a significant decrease from 89.20 ± 0.21 % to 3 mg/kg.

Influence of atropine on hypotensive effect of aqueous extract of *G. tessmannii*

Atropin significantly inhibited ($p < 0.05$) the immediate hypotensive activity caused by EAGt at doses of 0.1 mg/kg, 0.3 mg/kg and 1 mg/kg (Figure 2). The decrease in blood pressure (BP) from the 20 mg/kg dose was reduced by 2.35% compared to the decrease in the absence of atropine. The BP varied by 24.17 ± 4.7%, 33.17 ± 6.3%, 41.67 ± 0.318% and 51.67 ± 0.02%, respectively, at doses of 1 mg/Kg, 3 mg/kg, 10 mg/Kg and 20 mg/kg, in the presence of atropin. The effect of extract was partially inhibited in the presence of atropin (100 µg/ kg).

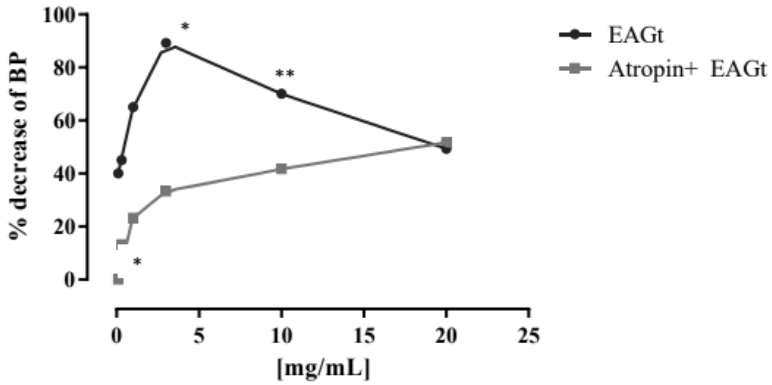

Figure 2. Effect of *G. tessmannii* aqueous extract (EAGt) in cumulated doses on BP in the absence and in the presence of atropine 100µg/mL. Values are expressed as a percentage of regression. Each value is represented by the MES mean (n=6). * p <0.05; ** p <0.01.
Source: (Koumba et al., 2019).

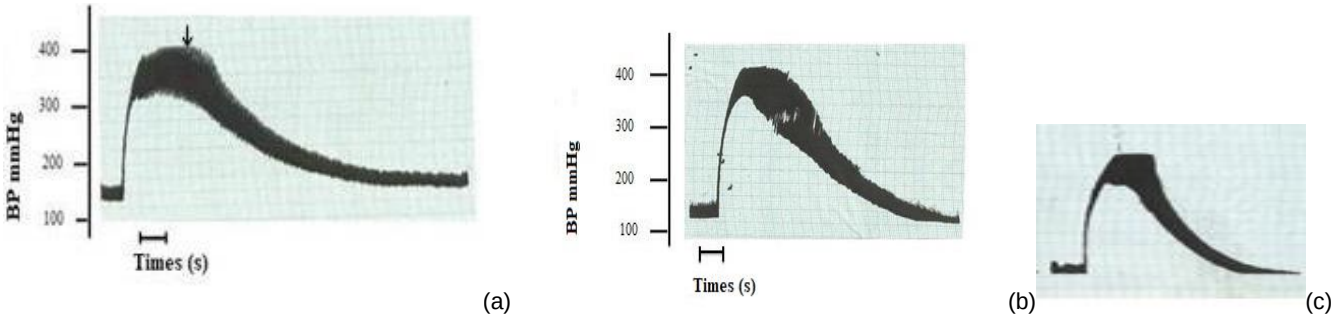

Figure 3. Effect of extract (0.3 mg/kg) on the induction of BP by the phenylephrine (a), effect of phenylephrin on the BP on NTR (b), effect of adrenalin on the BP on NTR (c).
Source: (Koumba, 2020).

Effects of *G. tessmannii* aqueous extract on high blood pressure induced by adrenalin and phenylephrine

Figure 3 shows effect of extract (0.3 mg/kg) on the induction of blood pressure (BP) by the epinephrin (a), effect of phenylephrine (Phe) (b) and effect of adrenalin (Adr) (c) on the BP on NTR. The effects of aqueous extract of *Guibourtia tessmannii* (0.3 mg/kg) and the prazosin, a hypotensor of reference, were represented on the Figure 4.

The single-dose of 0.3 mg/kg was used to cause an immediate decrease in blood pressure after induction of hypertension with phenylephrine or adrenaline, similarly to the effects of pazosine, the reference hypotensor.

The dose of 0.3mg/ kg caused a decrease in blood pressure about 5 s and significative from 10 s ($p<0.01$) after its administration followed by a progressive decrease up to 45 s in the presence of adrenaline. In the presence of phenylephrin the extract caused an immediate drop in blood pressure after its administration ($p<0.5$ to 10s) to stabilize about 30 s later. The prazosine provoque an immediate decrease of blood pressure after her administration ($p<0.5$).

The study on the blood pressure showed that extract of *G.tessmannii* provoked a hypotensive effect on the normotensive rat. Atropine significantly inhibited the hypotensive effect of extract at low doses (0.1 mg/kg to 3 mg/kg). Persistent hypotension was observed at the high doses used (10 mg/kg and 20 mg/kg).This reduction in the hypotensive effect of EAGt suggest that the plant contains cholinomimetic substances and that they would probably act through muscarinic cholinergic receptors (Matora and Gazzola, 2017; Takahashi et al., 2021).

These receptors cause inotropic and chronotropic negative effects on the heart due to cell hyperpolarization following the opening of the potassium channels linked to G proteins and the reduction of calcium entry into the cell by the inhibition of adenyl cyclase (Etou et al., 2017; Thomas et al., 2018) and on the arteries, vasodilation following the release of nitrogen monoxide (NO) (*Schmid* et al., 2018; Cavalcanti et al., 2022). Both

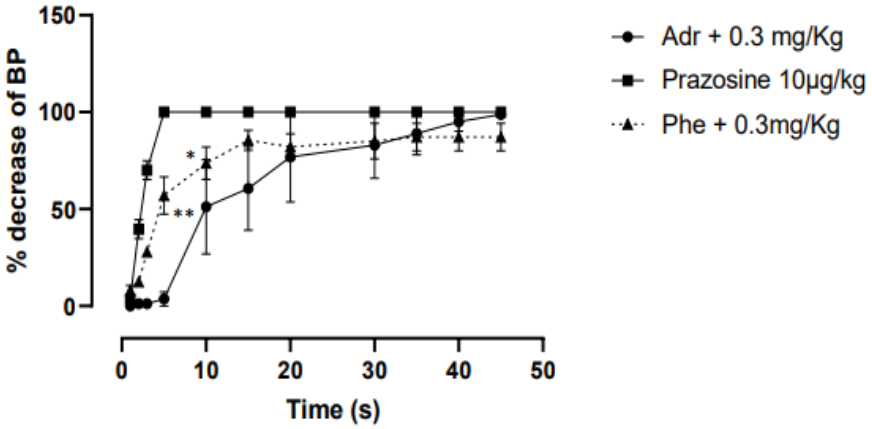

Figure 4. Effect of aqueous extract of *G.tessmannii* to 0.3mg/kg in presence of adrenalin or phénylephrin, and the prazosin in presence of phenylephrin. Values are expressed as a percentage of regression. Each value is represented by the MES mean (n=6). * p<0.05; ** p<0.01.
Source: (Koumba et al., 2019).

Table 1. Phytochemical analysis of the main groups in stem barks of *G. tessmannii.*

Active compounds	Aqueous macerate
Alkaloids	+
Flavonoids	+
Polyphenols	+
Saponins	+
Sterols and terpenes	-

+/− = presence/absence of the groups.
Source: (Koumba et al., 2019)

of these effects are capable of inducing low blood pressure. The persistence of the negative chronotropic effect in the presence of atropine (at 20 mg/kg) also suggests the presence of non-cholinergic cardio-inhibiting substances.

In the same study, results showed that the aqueous extract of *Guibourtia tessmannii* induced inotropic and chronotropic-positive effects similar to those of adrenaline at dose 0.3 mg/kg (Lubawy et al., 2019). Similar effects were observed with the aqueous extract of *Passiflora foetida* on isolated rat heart (Bleu et al., 2020).

Adrenaline causes elevated blood pressure by stimulating the β1-adrenergic receptors of the myocardium and activating the α1-adrenergic receptors of the epithelial arteries (Walther et al., 2022).These results suggest the probable existence of a competition between the parasympathetic principles contained in the aqueous extract of the bark of *G. tessmannii* and atropine on the muscarinic action sites. Similar results were observed on the isolated aorta of rat with the aqueous extract of *G. tessmannii* (Koumba et al., 2019) and *Trema orientalis* (Etou et al., 2016).

Phenylephrin is known as a stimulating α1 vasoconstrictor and prazosin is ranked among the most selective and powerful α1 antagonists (Simon and Rousseau, 2017). Prazosin immediately and significantly ($p < 0.05$; about 5 s) inhibited the hypertensive effect of phenylephrine in normotensive rats. *G. tessmannii* extract decreased the increase in blood pressure caused by phenylephrine as a function of time. The 0.3 mg/kg dose resulted in a rapid decrease (between 1 and 5 s, $p < 0.05$) in blood pressure, but did not reach the initial values ($p < 0.01$ to t=10 s).The results of the effect of the extract of *G. tessmannii* compared to that of prazosin suggest that the extract would have an action on the same sites of action as the latter, the stimulating α1 receptors. Indeed, blocking α1 receptors induces a hypotensive effect. Thus we can suggest that the aqueous extracts of *G. tessmannii* would induce a blocking α effect on the vessels hence vasodilation with the consequence of lowering the blood pressure.

Phytochemical screening

Phytochemical screening using qualitative analysis on aqueous extracts from *G. tessmannii* is shown in Table 1. Sterols and terpenes were not detected. Alkaloids, polyphenols, flavonoids and saponins were present. Some of family of molecules is known in the literature as potential antioxidant (Bopenga Bopenga et al., 2020; Ekhlil et al., 2016).

Total polyphenols content

Figure 5 showed the total polyphenols content in aqueous extract stem barks of *Guibourtia tessmannii*.

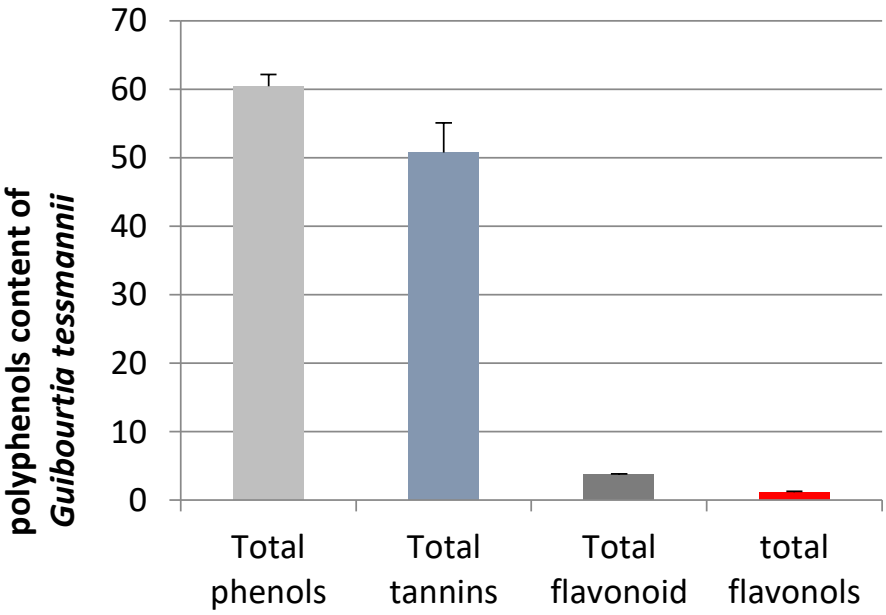

Figure 5. The total polyphenols content in the bark of *Guibourtia tessmannii.*
Source: (koumba, 2020).

Table 2. Antioxidant activities from water extracts of stem bark of *G. tessmannii.*

DPPH		AA		FRAP	
IC_{50}[a]	AAI[a]	IC_{50}[a]	AAI[a]	IC_{50}[a]	AAI
6.53 ± 0.23	1.53	3.04 ± 0.60	3.04	3.65 ± 0.02	-

AA: ascorbic acid. DPPH: 2.2-diphenyl-1-picrylhydrazyl. FRAP: ferric reducing antioxidant power. IC_{50}: Concentration in mmol EAA/g (Ascorbic acid mmol equivalent per 1 g extract) compulsory to remove 50% of radicals. IAA: antioxidant activity index. [a]Values signify means of three replicates ± standard deviation.
Source: (Nsi Akué et al., 2019).

The results showed a high total phenol content (60.45±1.7 mg gallic acid equivalent), with a tannin content of 50.75 ± 4.29 tannic acid equivalent. The content of flavonoids and flavonols was the lowest, 3.75 ±0.09 and 1.12 ±0.15, respectively, of quercetin equivalent.

The quantitative study of the polyphenol content in the aqueous extract of *Guibourtia tessmannii* revealed a high content of total phenolic compounds and tannins, but a low content of total flavonoids. These results corroborate those of Nyangono et al. (2013) which revealed low total flavonoids compared to that of tannins in the aqueous extract of *G. tessmannii*. Tjeck et al. (2020) also found higher flavonoids content than tannins in the aqueous extract. This variation may be related to the harvest area. In addition, the concentration of flavonoids in plant extracts depends on the polarity of the solvents used in the extract preparation (Nawaz et al., 2020). Nyangono et al. (2013) found higher levels of flavonoids in the hydroethanolic extract than in the aqueous extract of *G. tessmannii.*

Antioxidant activities

The results of the antioxidant activity evaluated in using the DPPH and FRAP methods of stem bark of water extracts of *G. tessmannii* are presented in the Table 2. The lowest IC_{50} value is, the higher the antioxidant activity is. Water extracts present high trapping capacity of free radicals as evidenced by the low values of IC_{50} recorded, 6.53 mmol AAE/g of extract with DPPH and 3.65 mmol AAE/g of extract with FRAP. The antioxidant activity index (AAI) of water extract determinate by DPPH method confirm that *G. tessmannii* present a strong antioxidant activity (AAI= 1.53). These results matched perfectly phytochemical screening indicating the presence in water extracts. This AAI is similar to that other *Guibourtia* species also found in Gabon (Obame-Engonga

et al., 2017). These authors have showed that *Guibourtia ehie* present an AAI of are 2.31, attesting potential antioxidant of species of to the genus *Guibourtia*. The FRAP test showed a high reductive activity of iron from the extract. Which confirms the effectiveness potential antioxidant of *G. tessmannii*? This antiradical activity is probably due to the composition of different phenolic compounds of the plant.

Flavonoids are particularly active antioxidants in the maintenance of blood circulation and would contribute to increased production of nitric oxide (Ayalew et al., 2022). These results confirm the use of this plant species in traditional medicine in Central Africa and are consistent with those of Nyangono et al. (2013) on the bark of *G. tessmannii* in Cameroon. The relationship between antioxidant compounds in plants and the treatment of these diseases is well established (Bezerra-Filho et al., 2019; Di Lorenzo et al., 2021). *G. tessmannii* is used in the treatment of hypertension and diabetes in Gabon (koumba et al., 2016; Tjeck et al., 2017). Qualitative studies have shown that the bark of *G. tessmannii* contained flavonoids, triterpenes, sterols, alkaloids, tannins and polyphenols (Koumba et al., 2019; Deeh Defo et al., 2018). The environment, organ harvesting periods, organ storage conditions and extraction solvents can influence the synthesis and expression of plant phytochemical components (Bimal et al., 2021). Antioxidants present in *G. tessmannii* are part of the therapeutic arsenal of arteriosclerosis and cancers that are the facilitators of high blood pressure (Sorriento et al., 2018).

G. tessmannii is a plant used in traditional medicine and known to have effects on high blood pressure, but its action on the body is not well known. This led us to try to verify some site of action of its aqueous extract as used in traditional medicine.

The presence of some of these compounds may justify the hypotensive effect of *G. tessmannii* bark extract. Isolated in polyphenolic and flavonoid compounds of *Desmodium velutinum* have been shown to have hypotensive properties (Mboungou-Bouesse et al., 2022). The presence of polyphenols and flavonoids may also justify this hypotensive effect.

Indeed, flavonoids are known to have beneficial effects on the cardiovascular system of mammals (Fusi et al**.**, 2020). The presence of alkaloids in the plant is capable of causing hypotension in whole animals by release of histamine from the mast cells of the muscarinic receptors stimulated causing vasodilation by the endothelium relaxing derivative factor and caused a hypotension (Lau et al., 2015). Similar effects were found by Koumba et al. (2019) in the study of the aqueous extract of *G. tessmannii* on the isolated rat aorta. Medicinal plants are extremely promising for preventive effect in the pathogenesis and treatment of many diseases, particularly diseases mediated by reactive oxygen species (ROS) such as cancer, diabetes, hypertension, and alzheimer's disease and oxidative stress (Gullón et al., 2017; Shohag et al., 2022).

Conclusion

Study of the antioxidant activity of *G. tessmannii* trunk bark according to FRAP and DPPH methods showed that the aqueous extract has appreciable antioxidant activity. The extract would have an inhibitory effect on the elevation of adrenaline and phenylephrine-induced blood pressure due to a likely mechanism of interference with the adrenergic system. *G. tessmannii* extract would then have an antagonistic effect on one and/or the muscarinic or α/β1-adrenergic receptors.

These results show that *G. tessmannii* could be used to prevent oxidative stress and justify the using of this plant in therapeutic treatments, such as high blood pressure and diabetes.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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