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ORIGINAL RESEARCH ARTICLES

Ethnobotany and preliminary bioactivity investigation on hepatoprotective medicinal plants from the Mouhoun Region of Burkina Faso

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Abstract

An ethno botanical survey of medicinal plants used to treat hepatitis in the Mouhoun region of Burkina Faso was undertaken. The extracts of the most quoted species were then evaluated for their phytochemistry and their antioxidant activity:

The anti-radical activity (by the method of the discoloration of the ABTS cation radical) and that of the antioxidant (by the method of the reduction of the iron ion, FRAP) were evaluated. Then the phenolic content of the aqueous extracts was determined and a correlation was studied between these two parameters.

The antioxidant tests showed that the plants counted have a good antioxidant power. The three most active extracts are those of the trunk and root bark of *Pseudocedrela kostchyi*, and the trunk bark of *Sterculia setigera*. The extract of the bark of the trunk of *Sterculia setigera* showed the highest total tannin and phenolic content, while that of the leaves of Piliostigma reticulatum showed the highest content of flavonoids. The analyses showed that there is a relationship between the total phenolic contents and the antioxidant capacities of all the extracts (R2 = 0.82).

The extracts of the trunk and root barks of *Pseudocedrela kostchyi*, and that of the trunk bark of Sterculia setigera showed the best antioxidant properties. They could be good candidates for the search for liver protective molecules.

Keywords: hepatoprotection; Medicinal plants; antioxidant activity; Mouhoun region; Burkina Faso

Introduction

Hepatitis is an inflammation of the liver. Two billion people worldwide have already been in contact with the hepatitis B virus with 800,000 deaths a year, [1]. In many developing countries there is no real program for the prevention and management of viral hepatitis [2]. According to WHO in 2004, more than 3,300 deaths were recorded in Burkina Faso. The standard treatment of hepatitis is based on use of alpha interferon associated with nucleotide analogues and it is very expensive and not always effective in Burkina Faso villages [3]. The chronicity of liver infections causes an increase in toxic free radicals [4]. These free radicals play an important role in altering the hepatocyte membrane. That causes lysis of the liver cell membrane, producing inflammation. The antioxidant compounds of plant extracts having the ability to neutralize free radicals can serve to protect the integrity of hepatocytes.In this sense, an ethnob-

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otanical survey in the Mouhoun region of Burkina Faso has identified medicinal plants used against liver diseases and retained the six most widely used plants: Cassia mimosoides L. (Caesalpiniaceae), Piliostigma reticulatum (DC.) Hochst. (Caesalpiniaceae), Pseudocedrela kostchyi Harms (Meliaceae), Sterculia setigera Del. (Sterculiaceae), Prosopis chilensis (Molina) Stuntz emend. Burkart var (Mimosaceae) and Trametes versicolor (L.) Lloyd (Polyporaceae). The extracts of these species were evaluated for their antioxidant capacity,awell as the content of phenolic compounds.

Material and Methods

Ethnobotany survey

Ethnobotanical investigation area

The survey was conducted in Mouhoun region (with an area of 34497 km^2 which represents 12% of the national territory, [5]. Located in north-west of Burkina Faso, the chief town in the region is Dedougou, occupies about. Region of Mouhoun haspedoclimatic conditions propitious to the diversity of the vegetation [6]. 90% of the population has agriculture as a mainsource of income [7]. The diversity of the vegetation is an indisputable asset for traditional practitioners and herbalists who are constantly consulted by the population for their health problem [8].

The survey

Asemi-structured interview process has been used [9]. with tradi- tional practitioners and herbalists. It allows to record local tradi- tional medicine knowledge dealing with hepatitis treatments. The dialogue for data collection using the questionnaire has been in French and/or local languages (Dafin, Dioula, Moore). The an- swers to the questionnaire provided information on the name of the plant used, the part used, the method of preparation, the route of administration, the other pathologies treated, the type and du- ration of the treatment. After every questionnaire fulfillment a field trip with the respondent allows collection (for the herbar- ium), picturing and the GPS data each plant cited,Herbariums were authenticated by Professor Jeanne MILLOGO, botanist at University de Ouagadougou.

The ethnobotany data were processed by using Sphinx V5 software to obtain the citation frequency of each plant.

The choice of the six more used plants was made on the basis of this survey data and bibliographic research in databank.

Antioxidant activities and determination of phenolic compounds Plant material

The whole plants of Cassia *mimosoides* L., trunk barks of *Piliostigma reticulatum* (DC.) Hochst., Trunk and root barks of *Pseudocedrela kostchyi* Harms and *Sterculia setigera* Del., Fruits of *Prosopis chilensis* (Molina) Stuntz emend. Burkart var. was harvested in the Mouhoun region. Seagrass beds were deposited in the UFR / SVT herbarium under the respective identification codes 05ID 16677, 07ID 16679, 04ID 16676, 08ID 16680, 01ID 16673. *Trametes versicolor* (L.) Lloyd was harvested in the same Locality and identified at the Laboratory of phytopathology of the University Ouaga I Pr Joseph KI-ZERBO.

Extraction

The fine powder obtained by grinding the dried plant parts was extracted with distilled water according to the maceration process for the root and trunk bark of Sterculia setigera. For other plant organs (Cassia *mimosoides, Piliostigma reticulatum, Pseu- docedrela kostchyi, Prosopis chilensis, Trametes versicolor*), an aqueous decoction was carried out. Extractions were carried out to conform to the traditional forms in which these plants are used by the respondents. The aqueous maceration was done at 1/10 keeping the powder in contact with the distilled water for 24 hours. For the decoction, it consisted of maintaining 20 g of plant powder of each drug in a flask containing 300 ml of distilled water to boil for 30 minutes. The decoction was done under reflux. The extracts obtained were filtered with a nylon fabric and then centrifuged at 2000 rpm for 10 minutes. The su- pernatant was collected in plastic jars and placed in the freezer for freeze-drying thereafter.

Solvents and reagents

Ethanol 95% (prolabo); Distilled water; Tris-HCl buffer (50 mM pH 7.4); Methanol 95%. ABTS or 2,2'-azinobis- (3-ethylbenzothiazoline-6-sulfonic acid) (FLUKA Biochimika, Germany); Acetic acid; Ascor- bic Acid, Hydrochloric Acid (SIGMA-ALDRICH, Germany); Sulfuric acid (SDS, France); Trichloroacetic acid (FLUKA Chimika, Switzerland); Pure acetic anhydride (Labosi, France); Sodium carbonate (Labosi, France); Magnesium chloride (SIGMA-ALDRICH, Germany); Sodium hydroxide (Merck, Germany); Potassium persulfate (SIGMA-ALDRICH, Ger- many); 0.2M phosphate buffer pH 6.6; Phosphate buffer 1.15M pH 7.5; Aluminum trichloride (Labosi, France); Gallic acid (Sigma); Ellagic Acid (Sigma); Tanic Acid (Sigma); FeCl3 (Labosi); NaOH (Merck); Quercetin (Sigma).

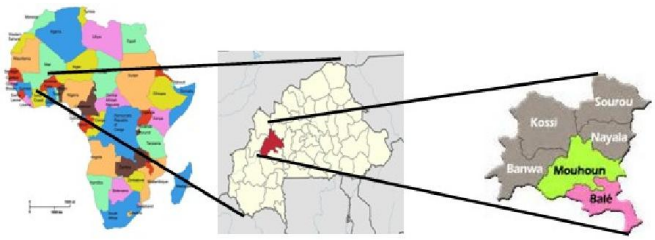

Figure 1 Location of the inventory sites

Antioxidant activities

Reduction of the radical cation ABTS +.

The TEAC (Trolox Equivalent Antioxidant Capacity) test was determined using the ABTS •+ radical [10]. ABTS was dissolved in water at the concentration of 7 mM (stock solution). The ABTS (ABTS +) cation radical was produced by reacting the stock solution of ABTS with 2.45 mM potassium persulfate (final concentration) and the mixture placed in the dark at room temperature for 12-16h before use. The reaction mixture consists of 1 ml of diluted ABTS + solution and 10 μL of extract (1-25 μg/ml) or Trolox as standard (0-15 μM) in ethanol or the appropriate solvent. The mixture is incubated for 30 min at room temperature and the absorbance is read at 734 nm. The percent inhibition of absorbance at 734 nm was calculated according to formula:

$$\%\,\mathrm{Inhibition} = \frac{A_0 - A_1}{A_0} \times 100 \qquad ARP = \frac{1}{IC_{50}} \times 100$$

$$TEAC = \frac{ARP_{produit}}{ARP_{Troxlox}}$$

Where A_0 is the absorbance of the control and A_1 is the absorbance of the sample or standard. The curve of inhibition of the absorbance as a function of the concentration of the extract or trolox was established for the determination of the 50% inhibitory concentration (IC 50). The Anti-Radical Power (ARP), trolox Equivalent Antioxidant Capacity (TEAC) has been determined through the formulas [11] .

Reducing power of iron

The reducing power of the samples was evaluated according to the spectrophotometric method described by [12] . 1 ml of the extract (0.02 g / ml was mixed with 2.5 ml of phosphate buffer (0.2M, pH 6.6) and 2.5 ml of 1% potassium ferricyanide (v/v). The mixture was incubated at 50° C for 20 min. 2.5 ml of 10% (v/v) trichloroacetic acid (TCA) were then added and the mixture centrifuged for 10 min. 2.5 ml of the obtained supernatant were then removed and mixed with 2.5 ml of distilled water and ml of 0.1% (v/v) ferric chloride ($FeCl_3$). The absorbance was read at 700 nm. The AAE (Ascorbate Acid Equivalent) value is inversely proportional to the reducing power.

Determination of total phenolics

The total phenolics were assayed according to the Singleton method [13]. The phenolic compounds react with the folin-ciocalteu reagent (FCR) in an alkaline medium. Molybdate reduced forms a blue complex whose maximum absorption is at 760 nm. The mixture consisted of 1 ml of extract, 1 ml of 2N FCR and 3 ml of 20% sodium carbonate. The absorbance was measured after forty minutes at room temperature with an agilent spectrophotometer (Agilent 8453) equipped with UV-visible and ChemStation software. The standard curve was plotted with tannic acid (0.1 to 1 mg / ml).

Determination of tannins

The assay is performed according to the method described by Tibiri [14]. 100mg of polyvinyl polypyrrolidone (pvpp) were used to precipitate 2mg of total phenolics. Such a mixture is vortexed, kept at 4° C for 15 minutes and then centrifuged for ten minutes. After forty minutes, the assay tube is centrifuged and the absorbance of the supernatant is measured at 760 nm. The tannin content is determined by differentiating the total phenolics (including tannins) and the second missing value of the tannins. The standard curve was plotted with tannic acid (0.1 to 1 mg / ml) with $R^2 = 0.99$.

Dosage of flavonoids

The flavonoid assay was carried out according to the method described by Abdel-Hameed [15]. 100 μL of extract of concentration 10 mg/mL in methanol are mixed with 100 μL of 2% aluminum trichlorid and a drop of acid Acetic acid then the volume is brought to 5 ml. The absorbance is measured at 415 nm after 40 minutes. The control tube consists of 100 μL of extract and one drop of acetic acid. The amount of flavonoids in the extract was determined by reading Agilent (Agilent 8453) spectrophotometer equipped with UV-visible and ChemStation software against a standard quercetin curve (R2 =0.999).

Statistical analysis

For statistical analyzes, Microsoft Excel has been used to obtain averages and standard deviations. One-way ANOVA followed by the Turkey test were used to measure the degree of statistical significance of the results using the XL stat module. A significant difference is considered for $p < 0.05$.

Results and Discussion

Results

The majority of respondents (65%) were male (71%). The plants counted with 41 species belong to 22 families (Table 1). The most represented families were fabaceae, mimosaceae, combretaceae, rubiaceae and anarcadiaceae with a citation frequency greater than 7% (Figure 1). Trunk barks and leaves were the most frequently used parts with frequencies above 30% (Figure 2). The most common method of preparation used by the respondents was the decoction with 52.9% (Figure 3).

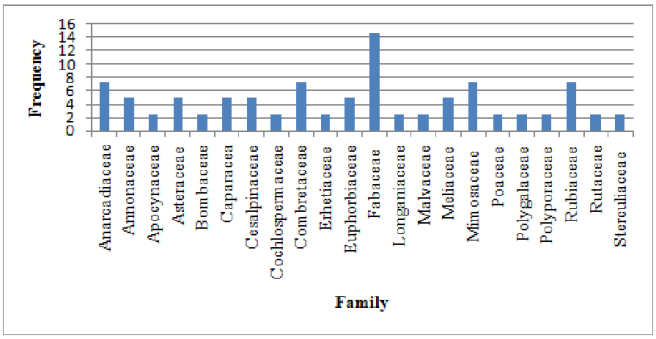

Figure 2 Apportionment ofplants according to family

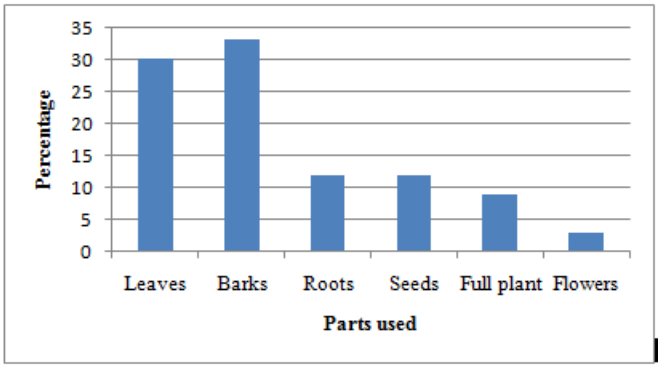

Figure 3 Apportionment of plants according to family

Evaluation of the antioxidant capabilities through the ABTS method showed that the bark extract of the root of *Pseudocedrela kostchyi* had the highest antioxidant capacity (0.53 ± 0.03 as the TEAC value, while the most Low capacity was observed with the whole plant extract of Cassia mimoso¨ides (Table 2) The FRAP method showed that the iron ion reduction capacities ranged from 13.63 to 134.52 ESA / ml. Extracts from the trunk bark of *Pseudocedrela kostchyi* showed the greatest reduction in iron ion compared to other extracts (Table 2).

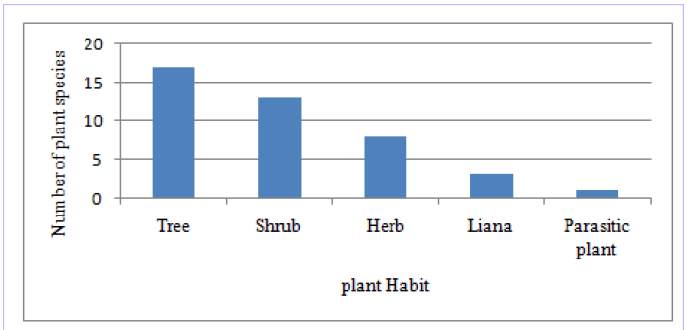

Figure 4 Apportionment according to plant habit

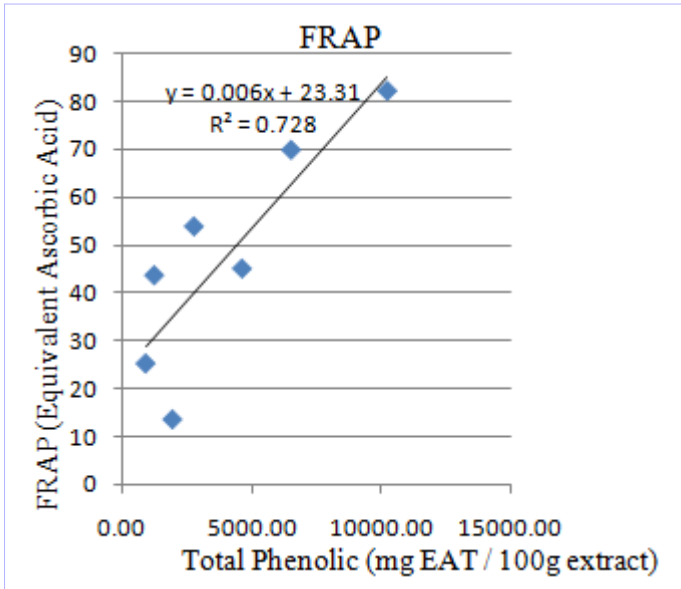

Figure 5 Plot of the correlation betweentotal Phenolic and FRAP

The total phenolics content of the extracts was between 2.76 and 17.33 g EAT / 100 g of extract. The high content was obtained with the extract of the trunk bark of *Sterculia setigera* (Table 2). The tannin content of the extracts varied from 0.71 to 15.03 g EAT / 100 g. Extracts from the trunk bark of *Sterculia setigera* and *Pseudocedrela kostchyi* showed the highest levels of tannins. The flavonoid content was higher in the leaves of *Piliostigma reticulatum* with 739.67 ± 0.01mg EQ/100g compared with the rest of the extracts. The flavonol content was greater than 300mg EQ/100g in the extract of the trunk bark of *Sterculia setigera* and *Pseudocedrela kostchyi* (Table 2).

Discussion

The listed species belonged to families of which the mostrepresented is the fabaceae. Hailement [16]. found that fabaceae were the most widely used in Ethiopia against malaria. It should be

Table 1 Diseases treat andform of plant used

Scientific name and family	parts used	mode of préparation	Mode Of administration	Associated plants	Number of quotation	Diseases
Adansonia digitata L. **(Bombacaceae)**	Fragment leafy and stem bark	Calcination and decoction	Oral and purging	*Cassia nigricens and Entada africana*	3	Malaria, Hepatitis, diarrhea
Boscia angustifolia A. Rich **(Capparaceae)**	Roots	Decoction	Drink and bath	*Cassia nigricans*	2	Asthma, haemorrhoids, Hepatitis
Carica papaya L. **(Annonaceae)**	leaves	Maceration	Drink, purgation and bath	*Manhhot utilissima, Citrus limon and Cordia africana*	4	fever, stomach ache, Hepatitis
Cassia mimosoïdes L. **(Caesalpiniaceae)**	Full plant	Decoction	Drink	*Cassia tora*	2	Jaundice
Parkia biglobosa (Jacq.) R.Br. exG.Don **(Mimosaceae)**	leaves	Calcination	Digest	*Acacia nilotica*	1	Hepatitis
Chrysantellum americanum L. **(Asteraceae)**	Full plant	Decoction	Drink	*Gardenia erubescens*	6	Malaria, Hepatitis
Citrus limon (L.) Burm. F. **(Rutaceae)**	leaves	Maceration	Drink	*Manhhot utilissima, Carica papaya, Acacia nilotica*	2	Hepatitis, Jaundice
Combretum micranthum G. Don **(Combretaceae)**	leaves	Decoction	Drink and bath	*Manhhot utilissima, Citrus limon* and *Carica papaya*	2	Fever, Malaria, Jaundice
Detarium microcarpum Guill. & Perr. **(Caesalpiniaceae)**	Stem bark	Decoction	Drink	*Guiera senegalensis*	2	Hepatitis
Guiera senegalensis J.F. Gmel. **(Combretaceae)**	Fragment leafy	Decoction	bath	*Saba senegalensis*	2	hemorrhoids, abdominal pain, malaria
Hibiscus sabdariffa Mendonça & Torret **(Malvaceae)**	Fragment leafy	Infusion	Boisson		1	Hepatitis
Manhhot utilissima F. lancifolia Roberty **(Euphorbiaceae)**	leaves	Infusion and maceration	Drink and bath		2	Jaundice, hepatitis
Phyllanthus maderaspatensis L. **(Euphorbiaceae)**	Full plant	Decoction	Bath and drink	*Chrysantellum americanum*	4	Malaria, hepatitis
Piliostigma reticulatum (DC.) Hochst.**(Fabaceae)**	Leaves	Decoction	Bath		3	Cold, cough, bronchitis, headache, hepatitis
Prosopis chilensis (Molina) Stuntz emend. Burkart var **(Milosaceae)**	Seeds ripening	Infusion	Bath		1	Hepatitis
Pseudocedrela kostchyi Harms **(Meliaceae)**	Bark of stem and root	Maceration	Drink and bath		4	Hepatitis
Saba senegalensis (A. DC.) Pichon **(Apocynaceae)**	Fragment leafy	Infusion	Inhalation ant bath		2	Hepatitis
Securidaca longepedunculata **(Polygalaceae)**	Fragment leafy	Decoction	Inhalation et bain		2	Stomach ache, Hepatitis
Senna obtusifolia (L.) **(Caesalpiniaceae)**	Leaves	Infusion	Drink and bath	*Cassia mimosoïdes*	2	Jaundice
Sterculia setigera Del. **(Sterculiaceae)**	Bark of stem and root	Decoction and Maceration	inhalation	*Coclospermum planchonii*	5	heart palpitations, low blood pressure and hepatitis
Tamarindus indica L. **(Caesalpiniaceae)**	Leaves, stem bark	Decoction	Bath and drink	*Adansonia digitata, Daniellia oliveri, Crossopterix febrifuga*	2	Hepatitis and stomach ach
Terminalia laxiflora Eng. & Diels **(Combretaceae)**	Stem bark	Calcination	Suck	*Coclospermum planchonii, Sterculia setigera*	3	Malaria and hepatitis
Trichilia emetica subsp. suberosa J.J. de Wilde **(Meliaceae)**	Root bark	Maceration	Bath and drink		2	Hepatitis
Ximenia americana L. **(Olacaceae)**	Stem bark	Decoction	Inhalation et bath	*Saba senegalensis*	4	Malaria, Jaundice
Cochlospermum planchonii Hook.f.**(Cochlospermaceae)**	Root bark	Decoction	Buccal way	*Tamarindus indica*	3	Malaria, liver ailments
Acacia nilotica (L.)Delile***(Fabaceae)***	Seeds	Infusion	Buccal way and purge	*Citrus limon, Parkia biglobosa*	2	Painful, menstruation, jaundice, shingles
Acacia seyal Delile **(Fabaceae)**	Stem bark	Decoction	purge		1	Constipation, hernia, hepatitis
*Cassia nigricans*Vahl **(Fabaceae)**	Full plant	Decoction and Infusion	Buccal way and purge	*Boscia angustifolia*	3	Hepatitis and heart ailments
*Cordia africana*Lam. **(Erhetiaceae)**	Leaves and stem bark	Decoction and Infusion	Buccal way, bath and purge	*Carica papaya*	3	Lack of appetite, infant fever, hepatitis and thoraxiales pain
Daniellia oliveri Benn. **(Fabaceae)**	Stem bark	Decoction	Buccal way and purge	*Tamarindus indica*	2	Ulcers, hemorrhoids, Hepatitis
Entada africana(L.) Merr **(Fabaceae)**	Bark of stem and root	Decoction and infusion	Buccal way	*Adansonia digitata*	1	Jaundice, upset stomach cough
*Gardenia erubescens*Stapf&Hutch**(Rubiaceae)**	Seeds and stem bark	Decoction and infusion	Buccal way	*Chrysantellum americanum*	2	Hepatitis, lunbar rpain and aches
Lannea velutina (L.) **(Anarcadiaceae)**	Stem bark	Maceration	Purge and buccal way		1	Fever, abdominal pain, jaundice.
*Maerua angolensis*DC. **(Capparaceae)**	Leaves	Decoction and infusion	Purge and buccal way		2	Hypertension, malaria, jaundice
Sarcocephalus latifolius(Sm.) E.A.Bruce **(Rubiaceae)**	Leaves and stem bark	Decoction or Infusion	Buccal way, bath and purge		3	Stomach aches, skin diseases, hepatitis
Cymbopogone giganteus Chiov.***(Poaceae)***	Trunk and seed	Maceration	Buccal way		3	hepatitis in children, Indigestion, colic
Crossopterix febrifuga (Afzel. ex G. Don) Benth. **(Rubiaceae)**	Leaves	Infusion	Buccal way	*Tamarindus indica*	2	Jaundice
Spondias mombin L. **(Anacardiaceae)**	Leaves and stem bark	Decoction	Purge and buccal way		2	Jaundice, Malaria
Annona senegalensis Pers. **(Annonaceae)**	Young shoots, leaves and stem bark	Decoction	buccal way	*Chrysantellum americanum*	2	Enhances the activity of liver and heart
Scleeocarya birrea (A. Rich) Hochst **(Anarcadiaceae)**	Seed rupening	Maceration	buccal way		1	Liver, gargle and buccal diseases
Trametes versicolor var and Burkart (L.) Lloyd **(Polyporaceae)**	Hate	Infusion	buccal way		5	hepatitis, high blood pressure

Table 2 Means of determinationof phenolic compounds and antioxidant activities

		Dosage of phenolic compounds		Antioxidant activities	
Plant species	Phenolic content (g EAT/100g of extract)	Tanin content (g EAT/100g of extract)	Flavonoid content (mg EQ/100g of extract)	ABTS	FRAP
C. mimoso¨ıdes (Full plant)	2,76±0,01^{e}	2,50±0,36^{e}	562,03±0,19^{c}	(TEAC)	(ASE/ml)
S. setigera (Root bark)	1,24±0,02^{g}	1,12±0,01^{fg}	327,31±0,18^{e}	0,05±0,01^{d}	53,83±5,6^{bc}
S. setigera (Stem bark)	17,33±0,05^{a}	15,03±0,33^{a}	590,84±0,11^{b}	0,17±0,07^{c}	43,64±3,3^{c}
P. reticulatum (Stem bark)	4,61±0,02^{d}	4,13±0,14^{d}	739,67±0,01^{a}	0,16±0,02^{c}	63,38±0,9^{b}
P. kostchyi (Stem bark)	6,49±0,01^{c}	5,63±0,30^{c}	484,50±0,09^{g}	0,1±0,01^{cd}	45,05±1,7^{bc}
P. kostchyi (Root bark)	10,17±0,08^{b}	10,02±0,30^{b}	629,31±0,19^{f}	0,53±0,03^{ab}	69,77±0,8^{b}
P. chilensis (Seeds)	1,93±0,01^{f}	1,40±0,21^{f}	425,19±0,22^{d}	0,4±0,007^{b}	82,06±1,3^{b}
T. versicolor (Full plant)	0,91±0,01^{h}	0,71±0,21^{fg}	108,44±0,13^{h}	0,06±0,002^{d}	13,63±0,8^{f}
Trolox				0,08±0,001^{d}	25,28±3,2^{d}
Quercetin				1±0,08^{a}	134,52±2,5^{a}

noted that the pathophysiology of malaria presents a hepatic phase, which could bring about a rapprochement with hepatitis. Among the plants cited appears a fungus Trametes versicolor which is a saprophyte. The virtues of saprophytes used in traditional medicine depend on the host [17] . In the case of our fungus work is the one being harvested on the species *Parkia biglobosa*.

Trunk barks and leaves were the most frequently cited by respondents [18]. while flowers, fruits and roots held low frequencies [19]. The low use of roots and fruits could contribute to the preservation of biodiversity [20]. in the Mouhoun region. The most cited method of preparation is the aqueous decoction, which is corroborated by some authors in the literature [21].

The group of phenolic compounds includes a wide range of secondary metabolites including flavonoids, tannins and phenol acids [22]. In scientific journals, phenolic acids, tannins and flavonoids are compounds with several biological activities such as antioxidant activity [23]. In this work, these phenolic compounds have been assayed for their contribution to the antioxidant capacities of the extracts. The extract of the bark of the trunk of Sterculia setigera showed a high total phenolic content (17.33 ± 0.05). In the work of Osemeahon [24]. significant total phenol content was found in the vegetative aerial parts of Sterculia setigera. The extracts with the highest tannin content are those of the trunk of *Pseudocedrela kostchyi* and *Sterculia setigera*. The tannins have the ability to adopt conformations that allow them to oppose mechanical and biological attacks that may threaten the integrity of hepatocytes [2]. The dosage of the flavonoid extracts showed higher levels in the leaf extract of Piliostigma reticulatum. Flavonoids would have a great ability to protect primary metabolites such as lipids from oxidation, which is a route of attack from liver aggressors.

The antioxidant tests were carried out by two methods, including the evaluation of the capacities of the extracts to stabilize the ABTS + radical and to reduce the iron ion. The extracts showed on the whole an ability to stabilize the ABTS radical. This study demonstrates the ability of the extracts to neutralize the free radicals produced by the different systems that are the source of oxidative stress [25, 26]. This neutralizing capacity suggests their potential for use as therapeutic agents of pathologies such as viral hepatitis that produce radicals in the body [27].

As regards the reduction of the iron ion, this test consisted in determining the capacity of the extracts to transform the fer- ric ion into ferrous ion by the supply of an electron [28] . The extracts all showed an interesting activity, ranging from 13.63 ± 0.8 to 82.06 ± 1.3 ESA / ml. The antioxidant effects of the extracts demonstrate their ability to give electrons to block the chain of production of free radicals caused by the hepatic affections. The bark of the trunk of *Pseudocedrela kostchyi* and *Sterculia setigera* showed the greatest abilities to reduce the iron ion. Ugulu [29]. In evaluating the antioxidant properties of plants found that the leaves and trunk bark exhibited better antioxidant activities.

A correlation curve between total phenolic content and antioxidant activity gave a positive correlation coefficient with R^2 = 0.7281 (Figure 4). The antioxidant activity of the extracts

could be explained by their richness in polyphenolic substances such as tannins, flavonoids [30]. The antioxidant capacity of the extracts observed is a solid argument that could justify their use in traditional medicine especially for these hepatoprotective properties [14]. The literature has often pointed to the close link between these properties and the antioxidant potential of plants [31]. Several authors explain the hepatoprotective effect of plants by their ability to relieve the liver cells of oxidative stress [32,33] .

Conclusions

This study is an asset for the preservation of ethnobotanical knowledge that is transmitted orally. The antioxidant properties of the extracts could justify the use of these plants in traditional medicine against stress diseases such as hepatitis. Extracts from the trunk and root bark of *Pseudocedrela kostchyi* and from the trunk bark of *Sterculia setigera* which exhibited the best antiox- idant properties deserve further investigation into their hepato- protection mechanism.

Authors' contributions

All authors had similar contributions regarding the manuscript writing, literature research, review design, literature analysis and final text approval.

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References

[1] O WH. Hepatitis: Improved health of people with viral hepatitis. 2014;12:1-6.

[2] Pietra V, Kiema J, Sorghum D, Kabore SPC, Mande S, Castelli F, Puoli MR, and Simporé J. Prevalence of markers of hepatitis B and antibodies against Hepatitis C virus among health personnel in Nanoro, Burkina Faso. Science and Technology. Health Science. 2008; 31:59.

[3] Konate K. Phytochemistry and Research Potential hepatoprotective and extracts of immunostimulant Cienfuegosia digitata Cav., And Sida alba L. (Malvaceae) traditionally used against hepatic diseases for the treatment of viral hepatitis B. University of Ouagadougou. 2012; 1:170-180.

[4] Ouattara MB, Kiendrébbéogo MR, Konate K, Compaoré M, Meda RN, Bationo JH, Millogo-Rasolodimby J, Thiombiano A and NACOULMA OG. Potential Antibacterial and Antioxidant Activity of Polyphenols of Sesbania pachycarpa Antibacterial Potential And Antioxidant Activity of Polyphenols of Sesbania. African Journal of Scientific Research. 2011; 5:1-17.

[5] The figures in the region of Mouhoun. National Institute of Statistics and Demography (INSD) and Ministry of Economy and Finance of Burkina Faso. on insd.bf (2011 edition). 2011 .

[6] Region BN. National Institute of Statistics and Demography (INSD) and Ministry of Economy and Finance of Burkina Faso. Insd.bf. 2013; 20:7-9.

[7] Dabat MH. Agricultural Market of the Regions Boucle du Mouhoun, Center, Hauts Bassins, Sahel. 2010.

[8] Didier P. Traditional Medicine and Integrative Medicine. 2016.

[9] Yelemou B, Bationo BA, Yameogo G, Rasolodimby JM. Gestion traditionnelle et usages de Piliostigma reticulatum sur le Plateau central du Burkina Faso. BOIS & FORETS DES TROPIQUES. 2007;291(291):55-66.

[10] Pellegrini RR, Prottegent NA, Pannala A, Yang M, Rice-Evans C. Radical Biology and Medicine, flight. 1999; 5:1231-1237.

[11] Kroyer GT. Red clover extract as antioxidant active and functional food ingredient. Innovative Food Science & Emerging Technologies. 2004;5(1):101-5.

[12] Apati P, Szentmihályi K, Kristo ST, Papp I, Vinkler P, Szoke E, Kery A. Herbal remedies of Solidago—correlation of phytochemical characteristics and antioxidative properties. Journal of Pharmaceutical and Biomedical Analysis. 2003;32(4-5):1045-53.

[13] Singleton VL, Orthofer R, Lamuela R, Rosa M. Analysis of total phenols and other oxidation substrates and antioxidants by means of folin-ciocalteu reagent. In Enzymology Academic Press. 1999; 299: 152-178.

[14] Tibiri A, Rakotonandrasana O, Nacoulma GO, Banzouzi JT. Radical scavenging activity, phenolic content and cytotoxicity of bark and leaves extracts of Entada Africana Guill. And Perr.(Mimosaceae). Journal of Biological Sciences. 2007;7(6):959-63.

[15] Abdel-Hameed ES. Total phenolic contents and free radical scavenging activity of certain Egyptian Ficus species leaf samples. Food chemistry. 2009 ;114(4):1271-7.

[16] Bekalo TH, Woodmatas SD, Woldemariam ZA. An ethnobotanical study of medicinal plants used by local people in the lowlands of Konta Special Woreda, southern nations, nationalities and peoples regional state, Ethiopia. Journal of Ethnobiology and Ethnomedicine. 2009;5(1):26.

[17] Deeni YY, Sadiq NM. No TitleAntimicrobial properties and phytochemical con-stituents of the leaves of African mistletoe (Tapinanthus dodoneifolius (DC) Dancing) (Loranthaceae) year ethnomedicinal plant of Hausaland, Northern Nigeria. Journal of Ethnopharmacology. 2002; 83: 235-240.

[18] Wondimu T, Asfaw Z, Kelbessa E. Ethnobotanical study of medicinal plants around 'Dheeraa'town, Arsi Zone, Ethiopia. Journal of Ethnopharmacology. 2007;112(1):152-61.

[19] Yineger H, Yewhalaw D. Traditional medicinal plant knowledge and use by local healers in Sekoru District, Jimma Zone, Southwestern Ethiopia. Journal of Ethnobiology and Ethnomedicine. 2007;3(1):24.

[20] Ashagre M, Asfaw Z, Kelbessa E. Ethnobotanical study of wild edible plants in Burji District, Segan area zone of southern nations, nationalities and peoples region (SNNPR), Ethiopia. Journal of ethnobiology and ethnomedicine. 2016;12(1):32.

[21] Tadesse M, Hunde D, Getachew Y. Survey of medicinal plants used to treat human diseases in Seka Cherkosa, Jimma Zone, Ethiopia. Ethiop J Health. 2005;15:89–106.

[22] Manach C, Scalbert A, Morand C, Rémény C, Jiménez L. Polyphenils, food source and biovailabality. Am. J. Clin. Nutr. 2004. 79:727-747.

[23] Balasundram N, Sundram K, Samman S. Phenolic compounds in plants and agri-industrial by-products: Antioxidant activity, occurrence, and potential uses. Food chemistry. 2006;99(1):191-203.

[24] Osemeahon SA, Barminas J, Aliyu BA, Nkafamiya II. Development of sodium alginate and konkoli gum grafted-polyacrylamide blend membrane: optimization of grafting conditions. African Journal of Biotechnology. 2008; 7:1309-1313.

[25] Ionescu E. eugen ionescu scholarship program 2014-2015 hospital universities and their research themes, 2015; 1:24.

[26] Catalfamo M, Le SC, Lane HC. The role of cytokines in the pathogenesis and treatment of HIV infection. Cytokine Growth Factor Rev. 2012;23:207–14.

[27] Khaliq I, Hof C, Prinzinger R, Böhning-Gaese K, Pfenninger M. Global variation in thermal tolerances and vulnerability of endotherms to climate change. Proc. R. Soc. B. 2014;281(1789):20141097.

[28] Oyedemi SO, Yakubu MT, Afolayan AJ. Antidiabetic activities of aqueous leaves extract of Leonotis leonurus in streptozotocin induced diabetic rats. Journal of Medicinal Plants Research. 2011;5(1):119-25.

[29] Ugulu I, Baslar S, Yorek N, Dogan Y. The investigation and quantitative ethnobotanical evaluation of medicinal plants used around Izmir province, Turkey. Journal of Medicinal plants research. 2009;3(5):345-67.

[30] Meda NTR, Bangou J, Bakasso S, Nacoulma OG. Antioxidant activity of phenolic and flavonoid fractions of Cleome gynandra and Maerua angolensis of Burkina Faso. Journal of Applied Pharmaceutical Science. 2013; 3:36-42.

[31] Sarkar MK, Sil PC. Hepatocytes are protected by herb Phyllanthus niruri protein isolate against thioacetamide toxicity. Pathophysiology. 2007;14(2):113-20.

[32] Evans JF, Ferguson AD, Mosley RT, Hutchinson JH. What's all the FLAP about?: 5-lipoxygenase-activating protein inhibitors for inflammatory diseases. Trends in pharmacological sciences. 2008;29(2):72-8.