Journal of Scientific Research & Reports

23(4): 1-13, 2019; Article no.JSRR.48601
ISSN: 2320-0227

Phytochemical Study and Evaluation of the Biological Activity of Anorectic Plants Used in the Seno Province (Burkina Faso)

Dramane Pare[1*], Adama Hilou[1], Jotham Yhi-pênê N'DO[1], Sidonie Yabre[1], Nogma Ernest Sombie[1], Samson Guenne[1], Aristide Traoré[2] and Odile Germaine Nacoulma[1]

[1]Laboratory of Biochemistry and Applied Chemistry (LABIOCA), UFR/SVT, 09 BP 848, Ouagadougou 09, University of Ouagadougou, Ouagadougou, Burkina Faso.
[2]Research Institute for Health Sciences (IRSS), 03 BP 7192 Ouagadougou 03, Ouagadougou, Burkina Faso.

Authors' contributions

This work was carried out in collaboration among all authors. Authors DP, OGN and AH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors JYPN, SY, NES and SG managed the analyses of the study. Author AT managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JSRR/2019/v23i430125
Editor(s):
(1) Dr. Karl Kingsley, University of Nevada, Las Vegas - School of Dental Medicine, USA.
Reviewers:
(1) Alethia Muñiz, Instituto Potosino de Investigación Científica y Tecnológica, Mexico.
(2) Iwona Rybakowska, Medical University of Gdansk, Poland.
Complete Peer review History: http://www.sdiarticle3.com/review-history/48601

Original Research Article

Received 02 February 2019
Accepted 18 April 2019
Published 11 May 2019

ABSTRACT

Background: In Africa plants have always been a good source of medicine for health care. Obesity is a pathology that is growing dramatically in developing countries. Anorectic plants are likely to cause a reduction of exaggerated weight gain. The aim of the study is to determine the phenolic compound content of five anorectic potential plants of Burkina Faso (*Ceratotheca sesamoïdes*, *Gardenia erubescens, Brachystelma bingeri Raphionacme daronii and Vernonia kotschyana*), to determine also their antioxidant potential and their acethylcholinesterase inhibitory capacity.
Place and Duration of Study: Laboratory of Biochemistry and Applied Chemistry (LABIOCA), Research Institute for Health Sciences (IRSS).

**Corresponding author: E-mail: paredra@yahoo.fr;*

Methodology: For the determination of the acute toxicity of the extracts a group of six (6) mice NMRI race were constituted for each plant extract. A dose of 3000 mg / kg of weight was administered to the animals. The methods of screening were used to detect secondary metabolites like tannins, steroids and terpen, flavonoids, coumarins. For the phenol content, the concentration of total phenolics, flavonoids and tannins were determined. The antioxidant property of the extracts was evaluated in vitro using 2,2-diphenyl-1-picrylhydrazyl acid (DPPH), 2,2-azino-bis (3-ethylbenzthiazoline-6-sufonic) (ABTS) and Ferric Reducing Antioxidant Power (FRAP). The acetylcholinesterase activity of the extracts 0.1 mg / ml was determined by a spectrometric assay method.

Results: Acute toxicity evaluated in NMRI mice showed that the methanolic extracts of five extracts show no toxicity. The coumarins and tannins were detected in all five species of plants. The polyphenol contents of *Ceratotheca sesamoides* gave the highest total phenolic compound content with 221.97 ± 1.206 mg EAG / g and also the best flavonoids content with 39.58 ± 0.068 mg EQ / g. Antioxidant tests show that *Vernonia kotschyana* Sch-Bip and *Ceratotheca sesamoïdes* Endl presented the best inhibitions of the DPPH radical with 82.63 ± 3.29% and 83.62 ± 2.12% at 100µg/ml. This activity is also better than that of quercetin which is a reference substance. For the reducing power of radical cation $ABTS^{\cdot+}$ the most active macerates of our extracts were obtained with Vernonia kotschyana (51,388 ± 0,133 mmol ET / g extract) and Ceratotheca sesamoides (50,748 ± 0,395 mmol ET / g extract). *Ceratotheca sesamoides* showed a best activity on reducing power of the ferric ion (7.03 ± 0.44 mmol EAA / g extract), this activity on ferric ion is superior to that of quercetin, which is a reference substance. *Raphionacme daronii* exhibited the greatest inhibition of acetylcholinesterase with a percentage inhibition of 53.542 ± 4.053 at 100 µg / ml.

Conclusion: The study demonstrated that anorexigenic plant extracts have a good antioxidant potential that is necessary for any weight-reducing activity. They also have an ability to inhibit acetylcholinesterase.

Keywords: Anorectic plants; antioxidant; acetylcholinesterase activity.

1. INTRODUCTION

Since the earliest times, plants have been used by humans first to feed themselves, then to heal themselves. The multiple knowledge accumulated during these past centuries have allowed humans to first distinguish between edible plants and toxic plants and medicinal plants called medicinal plants. In Africa, as in most low-income countries, because of the low accessibility of conventional medicine to populations, more than 80% use traditional medicine for their health care [1]. Several plants are used for the management of metabolic diseases such as obesity. Obesity is a chronic condition characterized by excess body fat that results in increased body weight [2].

Today, it is the world's fifth-highest mortality risk factor, with nearly three million people dying each year. This pathology is most often associated with diseases such as hypertension, heart failure, stroke, type II diabetes, insulin resistance, dyslipidemias, certain cancer [3] On the market, drugs Pharmaceuticals are mostly of synthetic origin are used but they have many side effects. Medicinal plants are still an important arsenal for the fight against this disease. Indeed some plants are already known and exploited in this sense. It is recognized that specific chemical constituents such as glycosilated pregnanes [4]. Caffeine [5], mucilages, phenylalanine [6,7,8], hydroxycitric acid [9] found in these plants are responsible for the suppressive effects used to treat the disease.

Burkina Faso, like Sahelian countries, has often been confronted in times of famine [10]. During these periods of food shortage, people usually resort to plants that have appetite suppressant or thirst-quenching effects. These provide them with satiety, usually without significant energy, which can lead to weight loss. So taking a supplement of these appetite suppressants may help you lose weight by reducing appetite and cravings. This anorectic property could be used in the fight against obesity. *Ceratotheca sesamoïdes, Gardenia erubescens, Raphionacme daronii, Brachystelma bingeri and Vernonia kotschyana* are anorectic plants consumed during periods of famine *in Burk*ina Faso [10].

So the purpose of our work is to do a phytochemical screening of the five species and to evaluate their biological activities *in vitro*.

2. MATERIALS AND METHODS

2.1. Materiel

2.1.1 Plant material

The fruits of *Gardenia erubescens*, the leaves of *Ceratotheca sesamoïdes,* the roots of *Vernonia kotschyana*, the tuber of *Raphionacme daronii and Brachystelma bingeri (Photo 1)* were harvested in Dori (locality located 271 km from Ouagadougou in northern Burkina Faso). The species were authenticated by Professor MILLOGO R. Jeanne, botanist at the UFR / SVT of the University of Ouagadougou. Herbarium

Photo 1. ***Vernonia kotschyana (a), Ceratotheca sesamoïdes (b), Raphionacme daronii (c), Brachystelma bingeri (d), Gardenia erubescens*** **(e)**

were deposited at the UFR / SVT under the identification codes of 01ID.16691, 02ID.16693, 03ID16691, 04ID.16692 and 05ID.16693 respectively for *Ceratotheca sesamoides, Brachystelma bingeri, Vernonia kotschyana, Gardenia erubescens and Raphionacme daronii.* The leaves of *Ceratotheca sesamoïdes and Vernonia kotschyana* roots were dried under laboratory conditions and then reduced to powder and stored in freezer bags for extractions. The tubers of *Raphionacme daronii, Brachystelma bingeri*, as well as the fruits of *Gardenia erubescens* were kept in the freezer before extractions.

2.1.2 Animal material

White NMRI mice of both sexes between 7 and 8 weeks of age and body weight between 17 and 39 grams were used for the study. They come from the UFR / SVT animal shop of University of Ouagadougou. They were raised under the following conditions:

- Food granules feed at 29% protein; running water from town;
- Stabulation at a temperature of 25°C; humidity level 30%

2.2 Methods

2.2.1 Study area: Dori

Seno Province, whose capital is Dori (Fig. 1), is located in the north eastern area of Burkina Faso. It has 215 villages and an area of 6979 km2 with a population of 264,815 people [8]. This locality has a Sahelian climate, characterized by a long dry season (May to October) and a short rainy season (average rainfall of 400 mm), with varying temperatures (10–43˝C), low humidity, wind and a large amounts of sunshine, typical of the Sahel. The vegetation is characterized by wooded and shrubby steppe that is heavily damaged. However, there are a few gallery forests which are generally located along the rivers (like the swamp of Dori or the Yakouta River). The dominant types of vegetation are thorn trees [11]. Famine is recurrent in this province. The predominant population is the Fulani group, who are nomadic herders. They have survived drought in this region through their knowledge of appetite suppressing plants. *Ceratotheca sesamoïdes, Gardenia erubescens, Brachystelma bingeri Raphionacme daronii and Vernonia kotschyana* are five plants use as anorectic plant.

2.2.2 Extraction

The samples were extracted by methanolic maceration and 25 g of powder of Ceratotheca sesamoides leaves and roots of Vernonia kotschyana were extracted in 250 ml of methanol. For *Gardenia erubescens, Brachystelma bingeri, Raphionacme daronii*; the fruit and tuber pulps previously stored in the freezer were milled, then 25 g of the ground material of each sample is put into 250 ml of methanol. These different mixtures obtained were stirred magnetically for 24 hours. The extracts obtained are concentrated using a rotary evaporator equipped with a vacuum pump. The dry extract obtained was used for the different tests.

2.2.3 Acute toxicity of extracts

The toxicity was determined according to the method described by OCDE [12].

2.2.3.1 Distribution of mice

The animals were divided into five (5) lots of six (6) mice. Each animal is identified by a different mark. The animals are pre-fasted for 16 hours, then the weight of each mouse is taken, and they receive a dose of plant extract given by batch. After a follow-up for 72 hours, the mortality in each batch was determined.

2.2.3.2 Administration of the extract

Extracts were administered by gavage (oral) using an esophageal tube. For the evaluation of the acute toxicity of the extracts, the 5 lots of 6 mice received a single dose limit of 3000 mg / kg of plant extract once at the beginning of the experiment. The extracts were administered to the animals for a volume not exceeding 0.5 ml.

2.2.3.3 Animal tracking

After the administration of the extract, the animals were observed for 2 hours for the evaluation of signs of intoxication (toxidrome). After having restored a normal diet (water, granules), the animals were then observed at 24, 48 and 72 hours after which the cumulative number of deaths in each batch was noted.

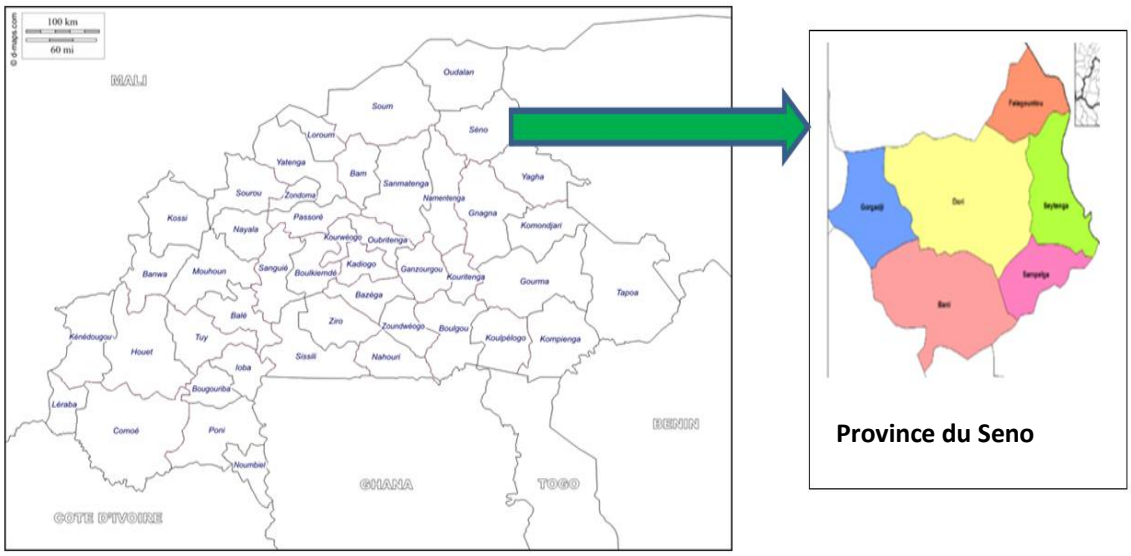

Fig. 1. Study area

2.2.4 Phytochemical studies

2.2.4.1 Screening test for secondary metabolites

The purpose of the tests is to detect the main phytochemicals present in plant extracts. These tests were performed on the extracts of the plant studied. The procedures described by Ciulei [13] have been used for the demonstration of the different chemical groups. So:

- The reaction with iron trichloride ($FeCl_3$) is used for the detection of tannins and polyphenols,
- The Shibata test for flavonoids,
- The Feiggl-Frehden test for coumarins,
- The Liebermann / Buchard test for triterpenes / steroids,
- The foam test for saponosides.

2.2.4.2 Determination of polyphenols

Total phenolics were estimated by the Singleton method [14]. It evaluates all the phenolic compounds that reduce the phosphomoly-bdotungstic reagent (Folin-Ciocalteu reagent). Thus the content of the total phenolics is determined by extrapolation on a standard curve obtained with gallic acid (200 mg / l). In each test tube were added, according to the solutions obtained after dilution, 0.125 ml of the sample to be assayed (gallic acid or sample) and 0.625 ml of Folin Ciocalteu FCR reagent (0.2 N in distilled water). After waiting for 5 minutes, 0.5 ml of sodium carbonate (75 g / l) was added. After stirring, the various solutions were allowed to stand in the dark for 2 hours. The reading was made using a spectrophotometer at 760 nm against a blank consisting of a mixture of 0.5 ml of FCR and 0.5 ml of sodium carbonate. Three readings are made per sample. The total phenolic content is expressed in mg Equivalent of Gallic Acid (EGA) per 100 mg of solids.

2.2.4.3 Determination of flavonoids

The contents of the flavonoids were determined by the method by Arvouet Grand [15]. The method evaluates all compounds reacting with aluminum chloride ($AlCl_3$). A volume of 0.75 ml of 2% $AlCl_3$ (in analytical methanol) is mixed with an equal volume of extract according to the dilution obtained (1/10 or 1/100) in methanol. The optical densities were read after 10 minutes of incubation at 415 nm using a spectrophotometer against a calibration curve previously drawn. The calibration curve is plotted using quercetin as a reference from a dilution. Three readings were performed per sample and the results are expressed in mg Equivalent Quercetin (EQ) per 1 g of extract (mg EQ/ 1g).

2.2.4.4 Tannin dosage

The tannin contents of the samples were determined using the method of the European Commission [16]. A mixture of 1 ml of water, 0.2 ml of extract according to the dilution obtained

with 0.2 ml of ferric ammonium citrate (CAF) with a concentration of 3.5 mg / ml in water and 0.2 ml of NH_4OH 8 mg / ml concentration in water is performed. The concentrations are read after 15 minutes of incubation at 525 nm using a spectrophotometer against a standard curve previously drawn using the tannic acid used as a reference substance. Three readings are carried out for each sample and the results are expressed in mg Tannic acid equivalent (E.A.T) per 1 g of dry extract (mg EAT / 1 g).

2.2.5 Biological activities

2.2.5.1 Antioxidant activity

a. DPPH (2,2diphenyl-1-picrylhydrazyl) method

The anti-radical activity of the extract (1 mg/ml) was evaluated by the DPPH (2,2diphenyl-1-picrylhydrazyl) method [17].. This method is based on the reduction in absorbance at 517 nm of the stable free radical DPPH, in the presence of a hydrogen radical donor (Koleva et al., 2002) three (03) tests were carried out by mixing 100 µl of the sample and 200 µl of DPPH (20 mg / l in methanol). After 15 minutes of incubation, the absorbance is read at 517 nm against a blank (100 µL of methanol and 200 µL of DPPH) using a spectrophotometer. Quercetin was used as reference substances. The antiradical activity was expressed in percent inhibition.

b. ABTS [2,2'-azinobis- (3-ethylbenzothiazoline-6-sulfonic acid)] method

It is based on the discoloration of the stable radical cation ABTS.+ [2,2'-azinobis- (3-ethylbenzothiazoline-6-sulfonic acid)], in ABTS, in the presence of antiradical compounds. The monitoring is done by measuring the absorbance at 734 nm because the chromophoric radical cation ABTS.+ blue-green color produced by reaction of ABTS with potassium persulfate at λmax at 734 nm. The method of Re et al [18] was used.

Preparation of the ABTS solution: A mass of 10 mg of ABTS was dissolved in 2.6 ml of distilled water. 1.7212 mg of potassium persulfate is added and the mixture is kept in the dark at room temperature for 12 hours. The mixture is then diluted in ethanol so as to obtain an absorbance of 0.70 ± 0.02 at 734 nm.

Test on the samples: In 3 eppendorf tubes containing 10 µl of sample solution (1 mg / ml) were added to 990 µl of ABTS solution. + freshly prepared. The same operation was carried out for the Trolox used as reference. The whole is protected from light for 15 minutes and the absorbances are read at 734 nm spectrophotometer against a standard Trolox curve. The concentration of compounds having a reducing effect on the radical cation $ABTS^{\cdot+}$ (antiradical compounds) is expressed in mmol Trolox equivalent (mmET) / g of dry extract

c. Reducing power FRAP (Ferric reducing antioxidant power)

The ferric ion (Fe^{3+}) to ferrous ion (Fe^{2+}) by reducing compounds follows an electron mono electron transfer [19]. In test tube containing 0.5 ml of extract (1 mg / ml), 1.25 ml of phosphate buffer (0.2 M, pH 6.6) and 1.25 ml of potassium hexacyanoferrate (1% aqueous) were added. The mixture was heated at 50°C in a bain-marie for 30 minutes. After cooling, trichloroacetic acid (1.25 mL, 10%) was added, and the mixture was then centrifuged (2000 rpm for 10 minutes). Three aliquots (125 µl) of the supernatant were transferred to 96-well microplate to which 125 µl of distilled water and then 25 µl of FeCl3 (0.1% aqueous) were added. The reductive power was evaluated at 700 nm against a standard curve of ascorbic acid using a spectrophotometer (Epoch 251465, Biotek Instruments, USA). The experiment is carried out in triplicate (independent tests), and the reduced activity of the extract is expressed in mmol Equivalent Ascorbic acid per gram of extract (mmol EAA / g extract). Quercetin was used as reference substances.

2.2.5.2 Inhibition of acetylcholine esterase

The inhibitory activity of the extracts was evaluated using the procedure described by Lopez [20]. 100 µl of sample (0.1 mg / ml in 50 mM Tris-HCl buffer, pH 8, 10% methanol) were mixed with 100 µl of AChE (0.22 U / ml in 50 mM Tris-HCl buffer). HCl, pH 8, 0.1% BSA) and 200 µl of buffer (50 mM Tris-HCl, pH 8, 0.1% BSA). The mixture was incubated for 5 minutes at 30°C in a 1 ml vat. 500 µl of DTNB (3 mM in TrisHCl buffer, pH 8, 0.1 M NaCl, 0.02 M MgCl 2) and 100 µl of ATCI (15 mM in water) were added thereafter. A blank was also prepared under the same conditions by replacing AChE with 100 µl of buffer (50 mM Tris-HCl, pH 8, 0.1% BSA). The reaction was monitored for 5 minutes at 405 nm using a spectrophotometer Buffer (0.1% in 50 mM Tris-HCl, pH 8, 10% methanol) been used as a negative control. Anti-acetylcholinesterase

activity (I%) is expressed as percentage inhibition

2.2.6 Statistical analyzes

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

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1 Acute toxicity of extracts

The results showed that up to 3000 mg / kg of body weight extracts of *Gardenia erubescens*, *Ceratotheca sesamoïdes, Vernonia kotschyana, Raphionacme daronii and Brachystelma bingeri* showed no mortality (Table 1). The LD50 values are therefore greater than 3000 mg / kg of body weight.

3.1.2 Results of screening test

We can note that two main groups of compounds were found in all these plant extracts namely the group of sterols and triterpenes and coumarins. flavonoids were detected only in *Gardenia erubescens* and *Ceratotheca sesamoïdes* extract (Table 2).

3.1.3 Phenolic content

The overall results of total phenolics, flavonoids, flavonols and tannins are recorded in Table 3. We find that the extract of *Ceratotheca sesamoïdes* which has a content of 221.97 ± 1.206 (mg EAG / 1 g), is the richest in phenolic compounds than the other four extracts. The lowest content of phenolic compounds was obtained with *Brachystelma bingeri* extract (01.70 ± 0.090 mg EAG / 1 g), a content is not statistically different from that of *Gardenia erubescens* and *Raphionacme daronii*. With regard to the total flavonoid assay, the extract of *Ceratotheca sesamoïdes* is the only one with a content of 39.58 ± 0.068 (mg EQ / 1 g of extract) and for the other plants no content was detected.

Table 1. Acute toxicity of extracts

Extraits	Doses (mg/kg)	Number of mice	Average weight (g)	Number of dead	% of mortality	toxidromes
Vernonia kotschyana	3000	6	29,5±5,8	00	00	reduced displacement
Gardenia erubescens	3000	6	26,9±5,5	00	00	Agitation
Ceratotheca sesamoïdes	3000	6	22 ± 3,65	00	00	Agitation
Brachystelma bingeri	3000	6	23,33 ±1,36	00	00	Agitation
Raphionacme. daronii	3000	6	25,33 ±1,36	00	00	Agitation

Table 2. Screening test

Species test	*Ceratotheca sesamoïdes*	*Gardenia erubescens*	*Raphionacme daronii*	*Brachystelma bingeri*	*Vernonia kotschyana*
Saponosids	+	–	+	+	+
Tannin and polyphénols	+	–	–	–	–
Flavonoïds	+	+	–	–	–
Steroids and triterpènes	+	+	+	+	+
Coumarins	+	+	+	+	+

+= Presence - = Absence

Table 3. Phenolic contents

Contents species	Total phenolic (mg EAG/1 g)	Total flavonoids (mg EQ/1 g)	Total tannins (mg EAT/1 g)
Brachystelma bingeri. A	01,70 ± 0,090[c]	Traces	Traces
Ceratotheca sesamoïdes. Endl	221,97 ± 1,206[a]	39,58 ± 0,068	Traces
Gardenia erubescens.	14;55 ± 0,106[c]	Traces	Traces
Raphionacme daronii.	05,26 ± 0,256[c]	Traces	Traces
Vernonia kotschyana	43,84 ± 0,178[b]	Traces	Traces

Results indicated by different letters are statistically distinct (p <0.05; Mean ± S.E.M = Mean values ± Standard error of means of three experiments)

3.1.4 Biological activities

3.1.4.1 Antioxidant activity

a) Inhibition of the radical DPPH

V. kotschyana and *C. sesamoïdes* presented the best inhibitions of the DPPH radical with 82.63 ± 3.29% and 83.62 ± 2.12% at 100 µg/ml. The activity of these species is also better than that of quercetin which is a reference substance. *Gardenia erubescens, Brachystelma bingeri* and *Raphionacme daronii* had the lowest anti-radical activity (Table 4).

b) Activity on the ABTS

The reducing power of the radical cation ABTS+ obtained is 51.388 ± 0.133 mmol ET / g of extract; 50.748 ± 0.395 mmol ET / g; 33.544 ± 0.213 mmol ET / g extract; 32.954 ± 0.707 mmol ET / g extract and 31.881 ± 0.585 mmol ET / g extract respectively for extracts of Vernonia kotschyana, Ceratotheca sesamoïdes, Gardenia erubescens, Brachystelma bingeri and Raphionacme daronii. Thus we note that by this method, the most active macerates of our extracts were obtained with Vernonia kotschyana (51,388 ± 0,133 mmol ET / g extract) and Ceratotheca sesamoides (50,748 ± 0,395 mmol ET / g extract but these activities are less than quercetin used as a reference who gave 69.00 ± 1.41 mmol ET / g extract (Fig. 2).

C) Reducing activity (FRAP)

The FRAP method evaluates all compounds capable of reducing ferric ion by the transfer of an electron. The values expressed in (mmol EAA / g) are as follows: C. sesamoïdes (7.03 ± 0.44); V. kotschyana (1.44 ± 0.08); R. daronii (0.015 ± 0.001); B. bingeri (0.013 ± 0.004); G. erubescens (0.012 ± 0.003). We note through these values that the highest reducing power was obtained with the extract of Ceratotheca sesamoïdes (7.03 ± 0.44 mmol EAA / g extract), this activity is superior to that of quercetin, which is a reference substance (Table 5).

3.1.4.2 Inhibition of acetylcholinesterase

The extract of R. daronii and B. bingeri showed the highest acetylcholinesterase inhibitions with percentages of 53.542 ± 4.053% and 48.188 ± 6.106 at the concentration of 100 µg / ml and the lowest inhibition was obtained with the extract of G. erubescens (14.88 ± 2.616% at a concentration of 100 µg / ml) (Fig. 3).

3.2 Discussion

The extracts of Gardenia erubescens, Ceratotheca sesamoïdes, Vernonia kotschyana, R. daronii and Brachystelma bingeri showed no mortality at 3000 mg / kg body weight. Considering the toxicity scale of Hodge and Sterner [21]., macerates of our species are not toxic orally in NMRI mice. This low toxicity could justify the fact that these species are consumed by the populations.

The five species showed high levels of total polyphenols and showed the presence of flavonoids. Indeed these compounds endowed with anorectic activity. Black tea polyphenols are able to reduce weight gain through their appetite suppressant effects [22,23]. The presence of these compounds in plant extracts may explain the traditional use of these plant species as anorectic plants. Also the presence of inulin in the tuberous roots of *V. kotschana* [24], of saponosides, steroids, triterpenes in Brachystelma bingeri, Gardenia erubescens and Cerathoteca sesamoides [25,26]. Could justify their uses because these molecules have an anorectic potential [27].

Table 4. Results of DPPH activity

Espèce	*V. kotschyana*	*C. sesamoïdes*	*G. erubescens*	*B. bingeri*	*R. daronii*	Quercetin
Inhibition (%)	82,63±3,29[a]	83,62±2,12[a]	32.95 ±1.45[b]	06.39 ±0.03[c]	8.57± 0.029[c]	82.17 ±0.30[a]

Different letters in the same column indicate significance difference (p<0.05); Mean ± S.E.M = Mean values ± Standard error of means of three experiments

Table 5. Results of reducing activity (FRAP)

Species	*V. kotschyana*	*C. sesamoïdes*	*G. erubescens*	*B. bingeri*	*R. daronii*	*Quercetin*
Antioxidant capacity (mmol EAA/g d'extrait)	1,44±0,08[c]	7,03±0,44[a]	0,012±0,003[d]	0,013±0,004[d]	0,015±0,001[c]	4.69 ± 0.05[b]

Different letters (a, b, c, d) in the column indicate significance difference (p<0.05); Mean ± S.E.M = Mean values ± Standard error of means of three experiments

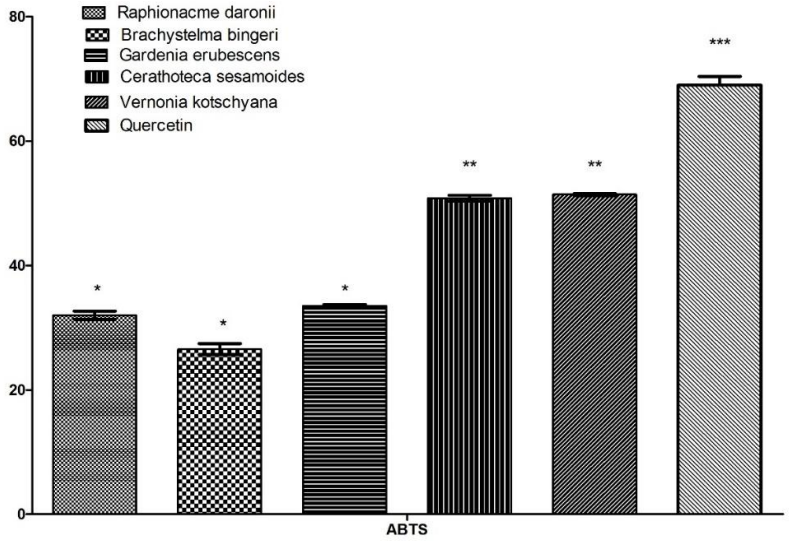

Fig. 2. Effect of extract on ABTS
****P-value is significant at p < 0.05*

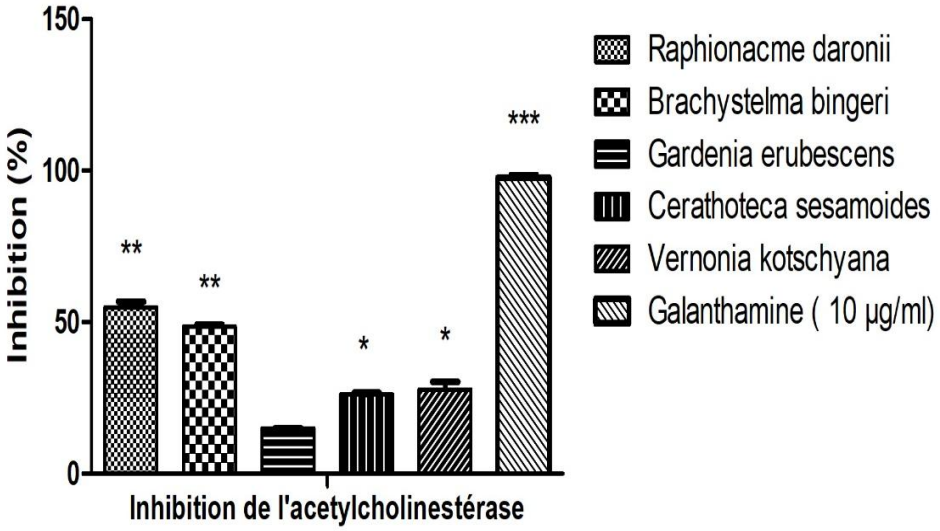

Fig. 3. Acetylcholinesterase inhibition
Mean ± S.E.M = Mean values ± Standard error of means of three experiments

The extracts also gave a good antioxidant potential. They showed an ability to reduce the DPPH radical, neutralize the ABTS radical cation and reduce the ferric ion. *V. kotschyana and C. sesamoïdes* presented the best inhibitions of the DPPH radical with 82.63 ± 3.29% and 83.62 ± 2.12% at 100 µg/ml. These extracts are therefore a good way to fight against oxidative stress. Indeed, obesity is associated with an increase in reactive oxygen species (responsible for oxidative stress) due to the presence of excess adipose tissue. Adipocytes and preadipocytes have been identified as a source of pro-inflammatory cytokines, including TNF-α, IL-1 and IL-6. These cytokines are potent stimulators for reactive oxygen species (ORS) production by macrophages and monocytes; therefore, an increase in cytokine concentration may be responsible for an increase in reactive oxygen species (ORS). Oxidative stress can be a cause

and consequence of obesity. Polyphenols have good antioxidant capabilities, they have a wide range of biological actions, such as free radical scavenging, metal chelation, and enzyme modulation capabilities [28]. The presence of polyphenols in the extracts could explain the good antioxidant activity observed. Flavonoids are also endowed with antioxidant activity. They are mainly recommended for their antioxidant action. Some flavonoids have the ability to chelate metal ions such as Fe^{2+} and Cu^{2+} which play a vital role in oxygen metabolism and free radicals. They are also able to chelate free radicals immediately by giving a hydrogen atom or a single electron transfer. Thus the complete mode of action of flavonoids includes: the extinction of the element free radical, chelating the metal, suppressing the enzymes associated with the generation of free radicals. Quercetin, kaempferol, naringenin and hesperidin are examples of antioxidant activities [29,30]. The presence of polyphenol and flavonoids could explain the good antioxidant activity. The antioxidant activity of these anorectic species could be used in the fight against oxidative stress diseases most often associated with obesity.

All our extracts showed an interesting acetylcholinesterase inhibitory activity but low compared to galanthamine which is a reference inhibitor compound of acetylcholinesterase with an inhibition of 98.28 ± 1.52% at 10 µg / ml [31]. However, *R. daronii* and *B. bingeri* with inhibition percentages of 53.542 ± 4.053% and 48.188 ± 6.106 are potential sources of inhibitor of acetylcholinesterase activity and could be used for the search for treatments for related diseases. oxidative stress [32]. Inhibition of acetylcholinesterase is also a strategy for the treatment of Alzheimer's disease, senile dementia, ataxia, myasthenia, and Parkinson's disease [33]. These plant extracts in addition to their potential anorectic could be used in the fight against Parkinson's disease.

4. CONCLUSION

The results of this study show that *Ceratotheca sesamoïdes, Gardenia erubescens, Brachystelma bingeri Raphionacme daronii* and *Vernonia kotschyana,* anorectic species consumed in Burkina Faso, are not acutely toxic. The methanolic extract of these plants also has a good antioxidant potential. Antioxidant capacity is necessary in the anti-obesity activity of an extract. So these species traditionally used as anorectic plants may have a good ability to reduce body weight.

ETHICAL APPROVAL

All experimental animal protocols had complied with the instructions of the Institutional Animal Ethics Committee (directive 2010/63/EU on protection of animals used for scientific purposes). Ethical approval code: 2010/63/EU, Date of approval: 20 October 2010. The institutional animal ethical guidelines were strictly observed. All authors hereby declare that "Principles of laboratory animal care were followed, as well as specific national laws where applicable

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Jäger AK, Hutchings A, van Staden J. Screening of Zulu medicinal plants for protaglandin-synthesis inhibitors. J of Ethnopharm. 1996;52:95-100.
2. seidell JC, Flegal KM. Assessing obesity: Classification and epidemi-ology. BMB. 1997;53:238–252.
3. Priyanka M, Pragyanshu K, Sneha J, Mahendra B, Kanthi KK, Kamlesh KB. Screening of six ayurvedic medicinal plants for anti-obesity potential: An investigation on bioactive constituents from *Oroxylum indicum* (L.) Kurz bark. Journal of Ethnopharmacology. 2017;197:138-146.
4. Van Heerden FR. Hoodia gordonii: A natural appetite suppressant. Journal of Ethnopharmacology. 2008;119:434-437.
5. Parveen K. Herbal fight for obesity. International Journal of Parmaceutical Research of Development. 2011;3(4):193-201.
6. Dimitri T. L'obésité: Découvertes récentes relatives aux mécanismes moléculaires à l'origine de nouvelles stratégies théra-peutiques. Université Henri Poincare - Nancy 1, Mémoire de thèse. 2010;1-79.
7. Halford J. Serotonin (5-HT) drugs: Effects on appetite expression and use for the treatment of obesity. Curr Drug Targets. 2005;6(2):201-13.
8. Antonucci F, Cangiano C, Cascino A, Ceci F, Del-Ben M, Laviano A, et al. Eating behavior and adherence to dietary

prescriptions in obese adult subjects treated with 5-hydroxytryptophan. American Journal of Clinical Nutrition. 1992;56(5):863-7.
9. Igho O, Shao KH, Rachel P, Barbara W, Edzard E. The use of garcinia extract (Hydroxycitric Acid) as a weight loss supplement: A systematic review and meta-analysis of randomised clinical trials. Journal of Obesity. 2011;16-9.
10. Millogo R. L'homme, le climat, et les ressources alimentaires végétales en période de crise de subsistance au cours du 20ème siècle au Burkina Faso. Mémoire de thèse, Université de Ouagadougou. 2011;1-211. In French
11. MATD. Plan communal de developpement de. Dori 2009–2013, Rapport de la commune de Dori; MATD: Dori, Burkina Faso ; 2013. (In French)
12. Ligne directrice 423 de l'OCDE pour les essais de produits chimiques, Toxicité orale aiguë - Méthode par classe de toxicité aiguë; 2001;1-14. In French
13. Ciulei I. Pratical manuals on the industrial utilization of medicinal and aromatic plants: Methodology for analysis of vegetable drugs. Ministry of Chemical Industy, Bucharest. 1982;1-67.
14. Singleton LV, Orthofer R, Lamuela-Raventos RR. Analysis of total phenol and other oxydation substractes and antioxidants by mean of Folin- Ciocalteu reagent. Methode in Enzymology. 1999; 299;152-178.
15. Arvouet-Grand A, Vennat B, Pourrat A, Legret P. Standardisation d'un extrait de Propolis et identification des principaux constituants. Journal de Pharmacie de Belgique. 1994;49:462-468. In French
16. Commission européenne. Procédures de prises en charge des céréales par les organismes d'intervention ainsi que les méthodes d'analyse pour la détermination de la qualité. Journal Officiel des Communautés Européennes. 2000;824:1-20. In French
17. Velazquez E, Tournier HA, Mordiyavich-Buschiazza P, Saavedra G, Schinnella GR. Antioxydant activity of Paraguayan plants extracts. Fitoterapia. 2003;74:91-97.
18. Re R, Pelligrini N, Proteggente A, Yang M, Rice-Evans C. Antioxydant activity applying on improved ABTS radical cation decolourisation assay. Free Radical Biology, and Medicine. 1999;26:1231-1237.
19. Hinneburg I, Damien-Dordan HJ, Hiltunen R. Antioxidant activities of extracts from selected culinary herbs and spices. Food Chemistry. 2006;97(1):122-129.
20. Lopez S, Batisda J, Viladomat F, Codina C. Acetylcholine inhibitory activity of some Amaryllidaceae alkaloids and Narcissus extracts. Life Sciences. 2002;71:251-2529.
21. Hodge HC, Sterner JH. Determination of substances acute toxicity by DL50. American Industriel Hygien Association. 1943;10:1-93.
22. Ramadan G, Nadia M, El-Ghffar EAA. Modulatory effects of black v. Green tea aqueous extract on hyperglycaemia, hyperlipidaemia and liver dysfunction in diabetic and obese rat models. Br. J. Nutr. 2009;102:1611–1619.
23. Chen N, Bezzina R, Hinch E, Lewandowski PA, Cameron-Smith D, Mathai ML, et al. Green tea, black tea, and epigallocatechin modify body composition, improve glucose tolerance, and differentially alter metabolic gene expression in rats fed a high-fat diet. Nutr. Res. 2009;29:784–793.
24. Inngjerdingen KT, Meskini S, Austarheim I, Ballo N, Inngjerdingen M, Michaelsen TE, et al. Chemical and biological characterization of polysaccharides from wild and cultivated roots of *Vernonia kotschyana*. Journal of Ethnopharmacology. 2012; 139(2):350-8.
25. Nacoulma O. Plantes médicinales et pratiques médicales traditionnelles au Burkina Faso: Cas du plateau central. TOME II. Thèse d'Etat, Univ. Ouaga. 1996;1-260. In French
26. Kini F, Saba A, Ouedraogo S, Tingueri B, Sanou G, Guissou IP. Potentiel nutritionnel et thérapeutique de quelques espèces fruitières « sauvages » du Burkina Faso. Pharmacopée et Médecine Traditionnelle Africaines. 2008;15:32-35. In French
27. Kim JH, Kang SA, Han SM, Shim I. Comparison of the antiobesity effects of the protopanaxadiol- and protopanaxatriol-type saponins of red ginseng. Phytother Res. 2009;23(1):78-85.
28. Rodrigo R, Miranda A, Vergara L. Modulation of endogenous antioxidant system by wine polyphenols in human disease. Clin Chim Acta. 2011;412(5-6): 410-424.

29. Hasanein P, Fazeli F. Role of naringenin in protection against diabetic hyperalgesia and tactile allodynia in male wistar rats. J. Physiol. Biochem. 2014;70:997–1006.
30. Zang Y, Zhang L, Igarashi K, Yu C. The anti-obesity and anti-diabetic effects of kaempferol glycosides from unripe soybean leaves in high-fat-diet mice. Food Funct. 2001;6:834–841.
31. Sombié PAED. Évaluation du potentiel thérapeutique des galles de Guiera senegalensis J.F GMEL (Combretaceae) pour le traitement du diabète de type 2 et/ou de ses complications au Burkina Faso. Thèse doctorat, Université du Ouagadougou. 2013;1-200. In French
32. Bataille S, Ternaux J. Etude du rôle de l'acétylcholine et de l'acétylcholinestérase dans le développement des motoneurones spinaux et la protection contre un stress oxydatif. Thèse de doctorat, Université d'Aix-Marseille. 1999;1-155. In French
33. Mukherjee PKV, Kumar M, Mal PJH. Acetylcholinesterase inhibitors from plants. Phytomedicine. 2007;14:289–300.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle3.com/review-history/48601