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Bromatological and Phythochemical Study of the Medicinal and Edible Plant *Solanum Nigrum L.* (*Solanaceae*) in Huambo Municipality - Angola

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Abstract

In order to determine the phytochemical and bromatologic components of *S. nigrum L.*, plant widely used as medicine and food for the population in the Huambo province, in Angola, young leaves were harvested in the morning period. They were subsequently put to dry in shade for 15 days, mashed in a traditional mortar and passed through a sieve to reduce them in finer powder. 500g of leaves powder were sent to National Center for Animal and Plant Health in Cuba (CENSA) for the determination of secondary metabolites and bromatologic analisis. Qualitative phytochemical analysis were performed using the Rondina and Coussio methodology (1969), the bromatologic trials by the Kjeldahl methods and thermogravimetric balance was used for dry matter and moisture calculation. Tannins, alkaloids, flavonoids, primary and secondary amines, leucoanthocyanidins, free phenols and triterpenes and or steroids were identified. In this study quinones rings lactónicos were not detected. 29.04% protein was found in dry matter, 16.35% of dry matter and 84.65% of humidity. This plant is considered a functional food for its phytochemical and bromatological composition.

Keywords: *S. nigrum*; Secondary metabolites; Primary metabolites; Medicinal; Eating plant

Introduction

The use of plants in the treatment of several diseases is a practice that was widely used by our ancestors, especially in times of lack of more advanced pharmaceuticals. The use of natural products with therapeutic properties is as old as human civilization and for a longtime animal, plant and mineral products were the main sources of medicines [1]. On the other hand, the rescue of traditional medicine as a way of replacing high cost and potentially toxic synthetic medicines with natural medicines, once again, is a trend that includes veterinary medicin [2,3]. There are medicinal and edible plants that constitute a nutritional and therapeutic source. Thus, it is essential to identify and study them in order to determine their phytochemical and bromatological composition, as well as the study of general and specific toxicity, to better ensure therapy and food safety in their consumption, either by rural and urban populations. The food is an essential factor in disease prevention and health improvement, it prevents and control various types of chronic untransmissible diseases, such as diabetes, hypertension, cancer, heart disease, among others. Several studies have been conducted to prove the beneficial properties of certain foods in the face of decreased resistance, imbalance of microbial flora, inflammatory bowel disease, atopic eczema, among other disorders. This way such foods are called functional [4].

Angola is located in the southern part of Africa and is one of the regions with the greatest diversity of flora in the world. It has more than 5000 species, however, there are few studies of this extensive vegetation, still little known as to its beneficial potential for the population [5]. Angolan medicinal plants have several therapeutic actions, many of them however are not described in traditional use [6]. Huambo province has a flora rich in medicinal plants and extensive knowledge of the use of traditional medicine, as well as a large culture of consuming wild vegetables with therapeutic properties, including Solanum nigrum. This plant species belongs to the Solanaceae family and is popularly known

in Brazil as Erva-Mora and in Angola as losuwa. It is an annual herbaceous plant and belongs to the same genus as eggplant (Solanum melongena), potato (Solanum tuberosum) and tomato (Solanum lycopersicum). Thus, due to the lack of knowledge about its phytochemical and bromatological composition in the province of Huambo Angola, this study aims to conduct such a survey.

Material and Methods

Harvest and preparation of plant material

S. nigrum was harvested in Huambo municipality, located in the central plateau, belonging to the agricultural zone 24. The average temperature vary between 19ºC and 21ºC, the average annual precipitation vary from 1100 mm to 1400 mm and two seasons established according to the rainy season. and dry; the soils are of ferralitic characteristics [7]. The plant was identified at the Luanda National Botanic Center (CNB) where was deposited a copy under the code Hb74. Young leaves were harvested between March and April 2013, in the morning, following the techniques proposed by [8]. The leaves were dried in the shade for 15 days, crushed in a traditional mortar (pestle) and sieved to shrink the particles to fine powder.

Phythochemical and bromatological study

For the qualitative characterization of secondary metabolites, the [9] phytochemical filtration was used (Table 1) held at the biopharmaceutical department of the National Center for Animal and Plant Health in Cuba (CENSA). In the qualitative analysis the cross system was used and the presence or absence of secondary metabolites in the samples was specified according to [10]. To determine the plant dry matter and humidity, a thermogravimetric balance was used. The protein percentage was determined by the Kjeldahl method. This method is based on the digestion of sulfuric acid in the presence of a catalyst to convert the nitrogen of the organic compounds into ammonia nitrogen. Ammonia is released by the addition of distilled sodium hydroxide and recovered in a boric acid solution.

Table 1: Selective specific reactions for functional chemical groups.

Metabolites	Assay	Solution
Free phenols	FeCl3 1- 10 %	Fenol 1%
Tanins	Gelatine 1%	Tanic Acid 1%
Primary and secondary amines	Ninidrine 0.2%	L-Aspartic Ácid
Triterpenes and / or steroids	Lieberman	Colestherol 2%
Flavonoids	Shinoda	Quercetin 2%
Leucoanthocyanidins	Rosehein	D (+) Cathequin 1 %
Cardiotonic Glycosides	Kedde	Digitalis 2% (mass/volume)
Alchaloids	Dragendorff	Gramin 2% Efedrin 2%

Quiz

A survey was conducted to survey the population's knowledge regarding the use of the plant as a medicine and food. This was based on obtaining the knowledge of the population most directly involved with the sale of this plant. For this, semi structured forms were used as proposed by [11], plus free questions and informal conversations investigating the use of S. nigrum for the consumption and treatment of some diseases, considering the one proposed by [12]. The quiz consisted of two fundamental parts: 1) knowledge of the plant, its use as a food and / or medicine, including its therapeutic benefits, 2) parts of the plant used and form of preparation. One hundred and four people of both genders answered the questionnaire, most of them women who were selling the plant in formal and informal markets. The Microsoft Excel program was used for the percentage quantification of the results of the applied quiz.

Table 2: Results of qualitative phytochemical analysis of *S. nigrum* (Losuwa), indicating Presence Positive (+), moderate (++) without presence and Significant presence

Metabolites	Presence
Primary and secondary amines	+++
Free Phenols	+++
Tanins	+
Triterpens/Steroids	++
Quinons	-
Flavonoids	++
Alkaloids	+++
Leucoantocianidins	++
Lactonics Acid	-

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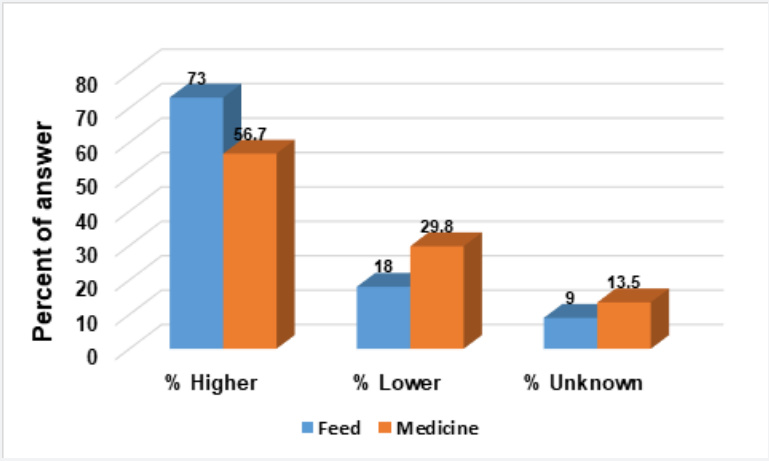

Figure 1: Percentage of population surveyed respondents about S. nigrum (Losuwa) knowledge about its use as food and medicine.

Results

There is a high knowledge of the plant as food by the population, which justifies its consumption in rural communities mainly, 73% consume the plant as food, 18% have little knowledge about consumption and 9% did not know it as an edible plant. In turn, they affirm the existence of various forms of preparation of the plant for its consumption; it can be simply boiled and then boiled, added salt and consumed accompanied by funje (cornmeal dough or sweet potato) and also with rice. Another form of consumption after cooking would be to season it with vegetable oil, tomatoes, onions and other spices. About the knowledge of the plant as a medicine, it can also be observed in figure 1, that it is widely used in communities for the treatment of various health disorders. 56.7% use the plant as a medicine, 29.8% have little knowledge about its use as a medicine and 13.5% do not use it as a medicine. The S. nigrum questionnaire was associated with the treatment of various health disorders such as pain, inflammation, liver, gastric and skin diseases. The functional groups found are shown in (Table 2) that are involves in therapeutic effects of S. nigrum plant. Bromatological analysis of S. nigrum indicated 16.35% dry matter, 84.65% humidity and 29.04% protein in dry matter.

Discussion

In this study the results confirm that the people use this plans as feed the same [13], in their studies of edible wild plants in India, found similar ways of preparing S. nigrum cooked with rice and meat. In subcontinental India, 9500 wild plants are used as food, medicine, fuel, essence, fiber and other purposes by more than 53 million tribes belonging to 550 different communities [14]. The S. nigrum is part of a group of medicinal plants studied with action on the cardiovascular system and that, besides this activity, would also have action on diabetes control and high blood lipid content [15]. Studies by [16] and [17] refer to the use of S. nigrum as a drug, presenting antibacterial, antifungal, anti-inflammatory, anticancer, antioxidant, antipyretic and cytotoxic activity. Therefore, in Huambo, this plant is known as both food and medicine, that is, it is used for nutritional and therapeutic purposes, effectively proving to be a functional food. As can be seen, secondary metabolites with relevant therapeutic properties were detected in this study. They may be related to the pharmacological effects to which the investigated population referred, such as the use of this plant as an analgesic, in inflammatory processes and in cases of typhoid fever. Thus, primary and secondary amines, free phenols and alkaloids are abundantly present.

Qualitative phytochemical filtering studies performed by [18] in S. nigrum, revealed the presence of tannins, alkaloids, flavonoids, saponins and proteins, which shows the components that give the plant nutritional and therapeutic properties. Alkaloids are given pharmacological activities on the central nervous system as a depressant or as a stimulant, act at the level of the autonomic nervous system as sympathomimetic, sympatholytic, anticholinergic and parasympathomimetic. Antiparasitic, analgesic, antimalarial, anxiolytic and antihypertensive activity are also described [19]. Although tannins are not as abundant, this constituent is extremely important from a therapeutic point of view, as it has antioxidant, anthelmintic, astringent, healing, antidiarrheal action, among others. [20] state that there are several studies that detected anthelmintic action in legumes being the same attributed mainly to the presence of condensed tannins. Tannins are also attributed to antiseptic and antimicrobial action (antibacterial and antifungal), as well as reports of regenerative and healing action in wounds or burns [21].

Leucoanthocyanidin, flavonoids and triterpenes were notably found in this study. These secondary metabolites have various therapeutic properties, including analgesic, anti-inflammatory, antibacterial, anticancer, antioxidant action and Flavonoids present as biological properties, decreased blood capillary permeability and increased resistance. They are also anti-inflammatory, antiallergic, hepatoprotective, antispasmodic, antioxidant and are free radical scavengers [19,21]. Flavonoids have become important dietary compounds with promising therapeutic potential. Epidemiological reports and evidence

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suggest that flavonoid-rich diets, such as quercetin, have effects on the prevention and treatment of cardiovascular disease, cancer, and kidney and liver failure [22]. Triterpenes are compounds with antiviral, antibacterial, anticancer and antifungal activity [23]. This plant has a bitter taste, which may be related to the occurrence of hydrophobic alkaloids and amino acids, such as valine, leucine, isoleucine, phenylalanine, tyrosine and tryptophan [24].

According this study bromatologically is rich. Dry matter is the water-free part of food, which means that it is where all or most of the nutrients are concentrated. This high amount of protein demonstrates its high nutritional value for the population, associated with its high availability, ease of culture, low cost, annual growth, and the presence of metabolites with functional properties. According to [25], vegetable proteins are a source of nutrients of great interest due to their variety, availability and cost. The functional properties and nutritional benefits of each protein group can be explored [26] describe for proteins functions such as tissue formation (connective tissue, muscle, blood, keratin, among others), constitution of enzymes and support to the immune system. The amount of protein detected in the plant under study is of great interest in the food field and its participation in the human diet should be better explored and encouraged [27]. This edible and therapeutic plant reveals a range of phytochemicals and an enviable amount of protein that gives it great importance in feed as well as in the treatment of various diseases in both humans and animals. Its routine use is facilitated by its availability, low cost and ease of cultivation [28].

Conclusion

S. nigrun is well known and used as medicine and food by the population of Huambo Angola. Studies have also indicated that this plant is a functional feed as it has in its composition secondary metabolites of therapeutic relevance and a large amount of protein in the dry matter.

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