International Research Journal of Biological Sciences _____E-ISSN 2278-3202
Vol. **5(10),** 40-44, October **(2016)** *Int. Res. J. Biological Sci.*

Comparative Phytochemical Determination of two spices: *Capsicum frutescens L. and Capsiscum annun L.* (Solanaceae family)

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Available online at: www.isca.in, www.isca.me
Received 16th September 2016, revised 20th September 2016, accepted 6th October 2016

Abstract

The quantification of the phytochemical constituents was undertaken for Capsicum frutescens and Capsiscum annun (solanaceae family) as they are known to be medicinally important. The fruits were collected and milled into powder after drying in an oven at 70°C for 24 h. The dried powder material was used for phytochemical analysis. The phytochemical analysis indicated that most of the screened compounds were present in the samples, including phenols, flavonoids, steroids, alkaloids, glycosides, tannins, saponins and triterpenoids. However, phenols and anthocyanins were not detected in C.annum and C.frutescens respectively. The results also showed a higher presence of phytochemicals in C.annum than in C.frutescens. Quantitative analysis of the fruit revealed high amounts of pectins (14 .60±4.74 %) and alkaloids(5.30±0.01%) in C.annum while high concentrations of saponins were recorded in both species (11.40±2.60 and 3.7±0.30% in C.annum and C.frutescens respectively). Phenols and anthocyanins were detected in lower quantities (1.17±0.37 - 1.9±0.50%) and flavonoids were detected as trace compounds (0.50±0.08-0.90±0.10%). From the results it was possible to conclude that the fruits contained bioactive compounds that help in fighting against degenerative and chronic diseases and determined the fruits' nutritional and medicinal value. This suggests that the fruits could be used for food supplementation in developing countries.

Keywords: Capsicum, Phytochemical, Contents, Analysis, Medicinal.

Introduction

Among medicinal plants, spices are of importance since they are used in nutrition as condiments in sauce and food as well as in traditional medicine to cure various diseases.

Capsicum annum (solanaceae family) is a perennial small shrub growth in suitable climatic conditions and found in tropical and subtropical regions[1,2].

Capsicum frutescens is an annual or short live perennial plant from the solanaceae family, found in tropical and subtropical regions as a wild species and in America. The plant is found as an escape and grows on sandy soils and red loam[3-5].

Capsicum is known as a flavoring and coloring food additive and also as a pharmaceutical ingredient in the United States, Mexico and in manufactured products[6].

It is used in treating intestinal and stomach problems, helps in heart and blood regulation, is used in neuropathy and to treat other diseases such as alcoholism, malaria, fever, muscle spasms, laryngitis, headache and sinusitis[5]. The *capsicum* species are components of many African, Asian, Hungarian and Mexican diets, used as a spice, vegetable and fruit[7]. The fruits are used in fresh salads, baked dishes, to make salsa pizzas, etc. or cooked[8]. Capsaicinoids are chemical compounds found in species and responsible for the purgency of their fruits[9]. Capsaicin exhibits chemoprotective, anti-cancer, anti-tumor proprieties[10] and helps to treat neuropathy, osteoarthritis, neuralgia, and psoriasis[11].

The chemical composition of *Capsicum annum* and *Capsicum frutescence* has been widely studied but no studies on the phytochemical constituents of the species from Congo were found in the literature. The study was undertaken in the objective to determine the phytochemical profile of these plant fruits which are widely consumed, in order to evaluate their medicinal and nutritional value.

Materials and Methods

Plant materials collection and processing: The fresh *Capsicum annum and Capsicum frutescence* fruits were **obtained** from the Total market, Bacongo, in the south-Brazzaville (Congo) on June, 20th to 27th 2015. The fruit identification and authentication were realized by the specialist (Nkouka Saminou) from the herbarium of the Vegetal Research Centre (CERVE, ex/OROSTOM-Congo) where voucher specimens are conserved. The fruits were washed and air-dried at room temperature for 2-3 hours. The air-dried samples were milled into powder with a mechanical blender after drying in an oven at 70°C for 24 h. The powdered sample was stored at room temperature under dry conditions before analysis.

The phytochemical screening was carried out on the dried and defatted powder.

Preparation of the defatted samples: The dried powder (30 g) was soaked in the organic solvent (150 ml of diethyl ether were used) twice for 24 h at the room temperature. The suspension was filtered and the lipid fraction discarded. To evaporate the remaining solvent, the defatted sample was left for 2-3 hours before the extraction.

Extraction procedure: The fat-free powder was extracted with ethanol (90%) using the percolation method. Thus 20g of the defatted sample was percolated with 150ml of the solvent at room temperature for 48h.The suspension was then filtered and the obtained solution was evaporated to one quarter in a water bath and conserved for qualitative phytochemical analysis.

Preliminary phytochemical screening: Qualitative phytochemical analysis of the *capsicum* fruits was realized according the methods used previously[12]. The phytochemicals tested were anthocyanins, triterpenoids, phenols, steroids, tannins, alkaloids, saponins, glycosides and flavonoids.

Quantitative phytochemical analysis: The quantification of bioactive compounds from the fruits was performed by using classic methods[12]. The chemical compounds determined were pectins, alkaloids, flavonoids, saponins, phenols and anthocyanins.

Statistical analysis: Statistical analysis was performed as means±SD of triplicate determinations.

Results and Discussion

Qualitative phytochemical analysis: According to the results (Table-1), tannins, steroids, saponins, triterpenoids, flavonoids, glycosides and alkaloids were detected in both the studied plant samples, but anthocyanins and phenols were not found in *C. frutescens* and *C. annum* respectively. Similar studies reported the absence of tannins, saponins, flavonoids and terpenoids in *C. annum* while phenols, on the contrary, were found in the samples[13]. They were also found in *C.annum,* which contained most of these compounds, as observed in the present investigation[14].

Other reports have shown that flavonoids, saponins, tannins and phenols were not detected in *C.annum*[15]; on the other hand, alkaloids and tannins were not found in *C.frutescens*. Previously alkaloids, saponins, tannins, and triterpenoids were reported to be highly present in *C.annum* whereas in *C. frutescens* the same trend was observed due to the presence of flavonoids, steroids and triterpenoids[16]. The results were unusual in regard to phenols and anthocyanins which were detected either as trace compounds or were completely absent in both *capsicum* fruits. Furthermore, tannins and alkaloids which were highly present in *C.annum* were detected as trace compounds in *C.frutescens*.

Table-1
Qualitative analysis of *Capsicum* species

Phytochemical	Plant specie	
	C.annum	***C.frutescens***
Alcaloids	+++	+
Flavonoids	++	+++
Saponins	+++	++
glycosides	+	+
phenols	—	+
Steroids	++	+++
Tannins	+++	+
Triterpenoids	+++	+++
Anthocyanins	+	—

+++=highly present; = moderately present; += present as trace; — = absent

The results showed the variation in concentration of the tested compounds for both fruits and also the higher presence of screened compounds in *C.annum* than in *C.frutescence*.

Quantitative phytochemical determination: The comparative analysis of the phytochemical contents (Table-2) revealed that *C.annum* contained a high amount of pectin (14.60%), saponins (11.40%) and alkaloids (5.30±0.01%). In *C.frutescens* they were detected at lower percentages: pectins (0.5%), saponins (3.70%) and alkaloids (1.8%).

Table-2
Quantitative analysis of *Capsicum* species

Phytochemical	Amount (%)	
	C.annum	***C.frutescens***
Alcaloids	05.30±0.71	1.80 ±0.28
Flavonoids	0.60±0.20	0.90±0.10
Saponins	11.40±2.60	3.70±0.30
Phenols	01.30±0.50	1.17±0.37
Anthocyanins	01.50±0.10	1.90±0.50
Pectins	14.60±4.74	0.50 ±0.08

Pectin is reported to be a viscous dietary fiber contained in some natural products like fruits and vegetables. The pectin percentages found in *C.frutescens* was in contrast with the finding that fruits contain high amount of pectins. They play role in regulation of blood lipid (especially cholesterol) and glucose levels and are used as food additive due to their gelling properties[17]. Pectins are reported to have various biological properties including insulin content, metal toxic lowering effects, gastric emptying delay, anti-cancer, anti-metastatic and antimicrobial activities[18].

The study showed that saponins were the most abundant compounds. The saponin and alkaloid values recorded in the present work were higher than those of 1.94±0.15%, and 1.55±0.11 and 1.09±1.02% recorded early in *C.annum* and *C.frutescens* respectively[19]. The present study's saponin value recorded for *C annum* was also higher than the 7.40% in *C.frutescens* and the 0.80% recorded in other spices like ginger[20].

The alkaloid percentages recorded in the current study for both *capsicum* species (1.8% and 5.30%) were relatively high but lower than those reported for *C.frutescens* and ginger (13.41 and 11.21% respectively[20]. They were also found to be lower than those recorded for other spices from Congo like ginger and turmeric (11.07 and 7.33%**,** unpublished data). The same trend was observed for the pepper phytochemical content with the high alkaloids (15.67-26.29mg/ml) and saponin values (6.56-15.26.78mg/ml)[21].

The relatively high alkaloid values observed for both species may be linked to the cultivation conditions (pH, temperature and nutrient supply)[22] of which depend the plant production of these compounds.

The high amounts of saponins and alkaloids (except in *C. frutescens*) observed in this work imply that these fruits may help consumers with health care since these phytochemicals are known for their biological properties.

For instance, plant saponins are known to be useful in treating inflammation[23]. Saponins play a role in reduction of cholesterol level and have a cancer protective function[24], precipitation and coagulation of red blood cells, hemolytic activity and bitterness[25,26].

Alkaloids are reported to possess amazing effects and are known as powerful pain killers[27]. They are reported to be anti-inflammatory, antihypertensive and antimicrobial[28]. The presence of alkaloids provides the plant with analgesic, antispasmodic, anti-asthmatic and antibacterial properties[29].

It was noticed from the results that phenols and anthocyanins were recorded in lower concentrations ranging from 1.17±0.37 to 1.90±0.50% for both *Capsicum* species. These phenolic values were within the range of 173.2 to 246.7mg/100g (FW) for *C.annum*[30,31]. Analogically, a lower phenolic content was recorded for spice like ginger (0.444g/g)[32]. However, high values were reported for *Capsicum* species ranging from 2.35 to 3.00%[19].

The Anthocyanin content of C.species was higher than the range of 24.6 to 45.10mg/100g reported for sweet potato[33].

Since phenols and anthocyanins were determined to be present in lower concentrations they may contribute to body health care with valuable properties such as antioxidant, free radical scavenger, antimicrobial, antibacterial, anti-infection[23,34] and physiological functions such as anti-inflammatory effects, UV light protection, and memory impairment reduction[35,36]. Flavonoids were found with pectins in *C. frutescens* (0.50%) as the least abundant compounds in the present study. They were recorded in very lower percentages (0.60±0.20-0.90±0.10%) in both species. The same fact was also observed for pepper with a lower concentration of 0.0019-0.0043 mg/ml[21]. These values were within the average range from 9.70 to 73.70mg/100g for *capsicum* species[37] and were much lower than those reported for both species ranging from 2.43 to 4.91%[19].

The results showed the differences in amounts of phytochemicals screened for both species. The low flavonoid, phenolic and anthocyanin contents recorded in the present work suggest that they are needed in diet supplementation with moderate health contribution and the medicinal and biological properties of *capsicum* species may be attributed mainly to the high amounts of pectins, saponins and alkaloids. Thus the medicinal values of these spices are confirmed; especially *C.annum* which showed higher levels of phytochemicals than *C.frutescens*.

Conclusion

The fruits showed significant differences in phytochemical amounts. *C.annum.* fruits contained higher levels of phytochemicals than *C.frutescens*. Phytochemicals are bioactive molecules of therapeutic importance; their presence suggested that the plant samples may have therapeutic effects on the body.

Studies on the chemical constituents of *C. annum* and *C.frutescens* may be important in folk medicine for therapeutic purposes and will help traditional healers and consumers with new knowledge about processing the plant parts. The phytochemical contents suggest that the fruits of the two species are nutritionally and medicinally important and also have the potential to be recommended as food additives and as drugs of pharmaceutical importance.

Acknowledgement

Authors are thankful to the members of laboratory of biology assistance to carried out experiments, especially to Pr Attibayeba.

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