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Some nutritional aspects of *Lasia spinosa* (kohila)

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Abstract

Lasia spinosa (local name – kohila) is a stout, marshy plant with a creeping spiny rhizome. The tender leaves and rhizomes are used as a vegetable and are recommended for a variety of diseases in Ayurvedic medicine. The present study was carried out to determine the total antioxidant activity of *Lasia spinosa* rhizome and the contribution to antioxidant activity from the polyphenol fraction and ascorbic acid and the dietary fiber content (insoluble & soluble). Rhizomes (n=6) of *Lasia spinosa* were collected from six different markets in the locality near the university.

According to the results obtained from the study, *Lasia* rhizome possessed a wide-ranging antioxidant capacity. A total antioxidant activity of 145.0 – 957.0 μmol/g TEAC on a wet weight basis was observed. The contribution from polyphenols to the antioxidant activity ranged from 14% - 48%. In addition to polyphenols, ascorbic acid also contributes to the total antioxidant activity (34% - 56%). The rhizome is a rich source of dietary fiber with 40% - 75% of total dietary fiber on dry weight basis, (7.2% - 7.5% on fresh weight basis) constituting 35% - 60% and 4% - 18% of insoluble and soluble fiber respectively. The above antioxidants could act independently or synergistically with fiber, since *Lasia spinosa* is a rich source of dietary fiber to reduce the adverse effects of various diseases. Thus kohila rhizome can be considered as a valuable functional food from the viewpoint of its antioxidant and dietary fibre content.

Key words : *Lasia spinosa,* antioxidant activity, polyphenols, ascorbic acid, dietary fiber

Introduction

A member of the family Araceae, the plant *Lasia spinosa* is a stout, marshy plant with a creeping spiny rhizome. The plant with origins in India is now spread to New Guinea, China and Malaya peninsula. The plant is grown / cultivated in marshy areas, muddy streams and swampy grounds (Jayaweera, 1981). The tender leaves and rhizomes are used as a vegetable though not frequently. In the indigenous system of medicine the plant is recommended for a variety of disorders such as cholic, rheumatism, intestinal disorders. In addition, stalk and leaves demonstrate profound anticestodal efficacy. The rhizome is used for treatment of lung inflammation, bleeding cough and the whole plant in uterine cancer (Wealth of India, 1992). The rhizome is most frequently used as a remedy for haemorrhoids in Sri Lanka. The protection offered for some of the above conditions in part may be due to its high fiber content and the compounds with antioxidant activity.

Antioxidants interact with and stabilize free radicals and may prevent some of the damage free radicals otherwise might cause (Bahorum et al., 2004). Examples of antioxidants include polyphenols, beta-carotene, lycopene and vitamins C, E (Harold et al., 2000). Dietary fiber in the diet plays an important role in the physiology of gastrointestinal tract especially in the patients with hypercholesterolaemia and type 2 diabetes mellitus (Wikramanayake, 1996). The present study was carried out to determine (a) the total antioxidant activity of *Lasia spinosa* and the contribution to antioxidant activity from the polyphenol fraction and ascorbic acid and (b) the dietary fiber content (insoluble and soluble dietary fiber) of the rhizome.

Materials and Methods

Materials

Rhizomes (n=6) of *Lasia spinosa* were collected from six different markets in the locality near the university and stored in a freezer (at –20 °C) until analysis. All the enzymes; Trolox and ABTS were purchased from Sigma-Aldrich, USA. Unless otherwise specified all reagents used were of analytical grade. Distilled or deionized water was used in all analysis.

Methods

Dietary fiber content

Dietary fiber content was determined using enzymatic digestion followed by gravimetric method. Edible part of the sample was chopped, homogenized, ultrasonicated and suspended in pH 6-phosphate buffer and digested sequentially with Termamyl at 95°C, pepsin and pancreatin at 40°C respectively. Enzyme digestates were filtered through crucible containing celite for insoluble dietary fiber (IDF). To the filtrate obtained from above step, methanol was added to precipitate soluble dietary fiber (SDF) in the digestates. After 1 hour, precipitates were filtered. Crucibles containing IDF and SDF were rinsed with methanol followed by acetone and dried until a constant weight was obtained in a 105°C oven. Finally IDF and SDF residues were ashed in a Muffle furnace at 550°C for 5 hours (AOAC, 2000).

Antioxidant activity

The antioxidant activity of the samples was determined using 2, 2'-azinobis (3-ethylbenzothiazonline-6 sulfonic acid) diammonium free radical cation salt (ABTS) assay. Fresh $ABTS^{o+}$ solution was prepared each day of analysis. Trolox was used as the standard and the antioxidant activity expressed as µmol/g Trolox Equivalent Antioxidant Capacity (TEAC). Blanched (40°C, 6 min) rhizomes were extracted into methanol-water (1:1) mixture. Extract was divided into 2 portions with one being kept as the control while the other portion was treated with polyphenol oxidase. Accurately measured 1 mL of extract was incubated with 20 µL of polyphenol enzyme solution and 3 mL of phosphate buffer (pH= 6) for 20 minutes at 25 ° C (Lee et al., 1983, Christine et al., 1967). The extracts and standards were then reacted with ABTS cation solution for 15 minutes. The reduction of blue-green $ABTS^{o+}$ radical by hydrogen-donating antioxidant was measured by the suppression of its characteristic long wave absorption spectrum at 730 nm and the antioxidant activities calculated (Awika et al., 2003). The same procedure was carried out with ascorbic acid oxidase instead of polyphenol oxidase to determine the antioxidant contribution from ascorbic acid. Accurately measured extract (500 µL) was incubated with ascorbic acid oxidase enzyme solution (25 µL) and phosphate buffer (pH= 6; 1500µL) for 1 hour at 25 ° C (Xianggun et al., 1984).

Results & Discussion

Table 1 indicates the dietary fiber content of kohila (*Lasia spinosa*) on dry weight basis. The rhizome is a rich source of dietary fiber with a total dietary fibre content of 40-74% on a dry weight basis (7-9 % on fresh weight). The insoluble dietary fiber content varied between 35-59 % whereas the soluble dietary fibre content was 4-17%.

The most consistent benefit of consumption of adequate dietary fiber is regular laxation. Dietary fiber has proved effective in decreasing symptoms of diverticular diseases, Crohn's disease and hemorrhoids (Klurfeld, 1987). The dietary fiber values obtained in this study indicate that the Ayurvedic recommendation of kohila for haemorrhoids and intestinal diseases have some scientific basis. Kohila is rich in IDF (about 49%), so it is less available for bacterial fermentation in the gut and produces a significant change in stool bulk. Health authorities and nutrition societies recommend an intake of 25 g dietary fiber daily in the diet (Marleff et al., 2002). The present study indicated that inclusion of 25-30 g of kohila would cover 6-10% of this requirement. In addition this would add a considerable amount of antioxidant compounds to the diet. However, the antioxidant activity due to ascorbic acid may decrease depending on the processing method.

Table 1. Dietary fiber content of kohila (*Lasia spinosa*) on a dry weight basis.

Sample	IDF%	SDF%	Total dietary fibre%
A	52.3	4.1	56.4
B	35.6	4.9	40.4
C	36.8	9.5	46.8
D	53.8	7.8	61.2
E	43.3	17.4	60.7
F	59.4	14.8	74.2
Range	35.6 - 59.4	4.1-17.4	40.4 -74.2

n = 6; IDF- Insoluble dietary fibre; SDF –Soluble dietary fibre

Variation of values obtained from sample to sample showed the biological variation, which could be due to maturity, and genetic and climatic effects among the samples of a plant, which has no cultivated varieties. According to Deepa et al. (2006) cultivars, maturity and growing conditions seem to play an important role in affecting the metabolism of antioxidant components and thus the antioxidant capacity. Data presented in literature indicates that polyphenol content increases with maturity (James et al., 2002) and ascorbic acid content decreases with storage (Lanaand Tijskens, 2006).

Table 2. Antioxidant activity of *Lasia spinosa* rhizome

Sample	Total antioxidant activity µmol/g TEAC	Contribution of polyphenols µmol/g TEAC	Contribution of ascorbic acid µmol/g TEAC	Total antioxidant activity (polyphenols + ascorbic acid) µmol/g TEAC
A	666	283	259	542
B	204	72	100	172
C	328	142	183	327
D	145	70	49	120
E	461	65	247	316
F	957	434	353	787
Range	145 - 957	65 – 434	49 – 353	120 – 787

n = 6; TEAC- Trolox equivalent antioxidant capacity; * Each result average of 4 readings

The strong association between fruit and vegetable intake and cancer or heart disease prevention is considered to be due to their antioxidant phytonutrients. The results obtained from the study proved that the major contribution to the total antioxidant activity of the rhizome is by polyphenols and ascorbic acid (Table 2). The phenolic compounds present in the rhizome may be phenolic acids, flavonoids, stilbenes or lignans or a mixture of these. In addition, a recent study has shown that carotenoids may also contribute to the total antioxidant activity by a smaller extent (0.4-1.8 $\mu g.g^{-1}$ fresh weight and 0.9-7.2 $\mu g.g^{-1}$ fresh weight for α-carotene and β carotene respectively) (Priyadarshani and Jansz, 2006). However, the results of this study indicate the contribution to antioxidant potential is highest from polyphenols and ascorbic acid.

Conclusion

Amount of antioxidants as measured by ABTS assay shows relative potential of kohila to provide antioxidants for prevention of chronic diseases. These antioxidants could act independently or synergistically with fiber, to reduce the adverse effects of diseases. Thus kohila rhizome can be considered as a valuable functional food from the viewpoint of its antioxidant and dietary fibre content.

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