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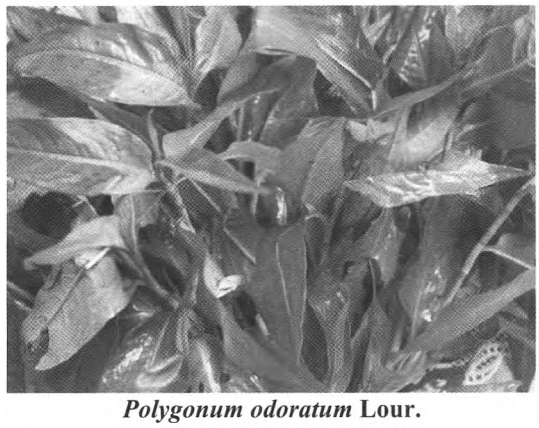
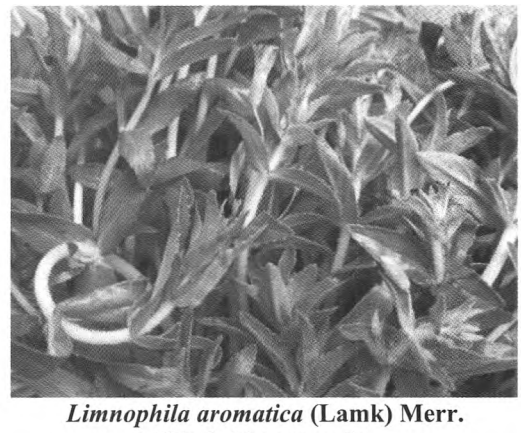
INTRODUCTION

When considering the health benefits of vegetable consumption, dietary fiber and phytochemicals especially antioxidants are taken into account. Some Thai local vegetables have recently gained increasing attention because of their various biological activities. Among them, *Polygonum odoratum* Lour. (Polygonaceae), *Limnophila aromatica* (Lamk) Merr. (Scrophulariaceae), *Basella alba* L. (Basellaceae), and *Toddalia asiatica* (L.) Lamk. (Rutaceae) are somewhat familiar and have been used traditionally for culinary and medicinal purposes. Previous studies revealed the antioxidant activity of leaf extracts derived from *P. odoratum*, *L. aromatica*, *B. alba* and *T. asiatica* analyzed by DPPH assay. However, the data related to antioxidant activity of the stem bark of *T. asiatica* was rare. [1, 2]

The current study was undertaken to compare antioxidant potency and total dietary fiber content of these vegetables in order to select the suitable raw materials for dietary supplement development.

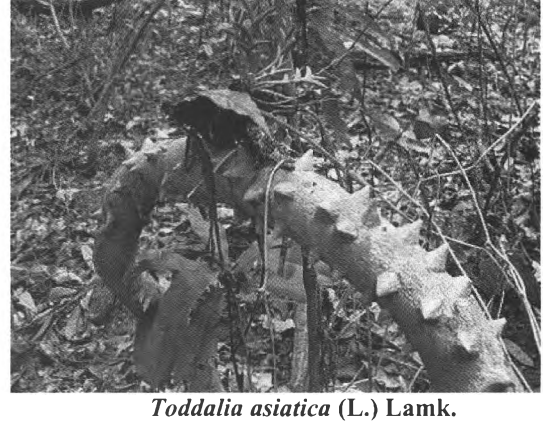


***Polygonum odoratum* Lour.**
"Phak-paew"



***Limnophila aromatica* (Lamk) Merr.**
"Phak-kha-yaeng"

***Basella alba* L.**
"Phak plung"



***Toddalia asiatica* (L.) Lamk.**
"Phak paem pa" or "Khruea ngu hao"

Figure 1. Four Thai local vegetables used in the study

MATERIALS AND METHODS

Plant materials and extract preparation

Aerial parts of three Thai local vegetables were purchased from Talad-Thai market, Pathum Thani in August 2011 and *Toddalia asiatica* stem bark was collected from Nakhon Ratchasima during the same time period. The air-dried and ground plant samples (100 g) were extracted with 95% aqueous ethanol (300 ml x 12) at room temperature. After filtering and removing the solvent via rotary evaporator at 45°C, the greenish brown semisolids were obtained and kept at 4°C until analysis.

Total dietary fiber assay

This assay quantifies the total dietary fiber (TDF) content by means of enzymatic-gravimetric method based on the procedure of AOAC (1997) [3]. For each vegetable, quadruplicate milled samples (0.3-0.5 mm mesh) were gelatinized with heat stable α-amylase and then digested with protease and amyloglucosidase to remove the protein and starch present in the samples. Ethanol was added to precipitate soluble dietary fiber. After filtration the residue was washed with ethanol and acetone, followed by drying and weighing. Half of the samples were analyzed for protein by Kjeldahl nitrogen analysis and the other halves were ashed (525 °C, 5 h). TDF value was the weight of the residue less the weight of the protein and ash.

Antioxidant capacity determination by photochemiluminescence (PCL)

In order to gain better precision, the antioxidant capacities of the vegetables were evaluated by means of PCL using PHOTOCHEM® (Analytik Jena, Germany).

PCL assay was performed according to Popov and Lewin [4] and can be carried out by two different protocols, ACW and ACL, which permit the measurement of the antioxidant capacity of the water- and lipid-soluble components, respectively. In this study, calibration and measurements were conducted as described in the ACL kit protocol (Analytik Jena) in which Trolox was used as the reference standard. The crude extracts were dissolved in methanol (10 mg/ml) prior to being subjected to the assay and the measurement of each sample was repeated three times. The results were expressed as Trolox equivalent unit (nmol) per 1 µg of tested sample.

RESULTS AND DISCUSSION

The yields of the ethanolic extraction of *P. odoratum*, *L. aromatica*, *B. alba* and *T. asiatica* were 16.4, 21.5, 21.4, and 19.3 % by dry weight, respectively. The TDF contents of dried powder derived from these plants varied from 17.83% - 57.53% (w/w). *T. asiatica* showed the greatest TDF content (57.53%). Significant TDF values were also demonstrated in *P. odoratum* and *L. aromatica* (43.19% and 32.16%, respectively), while *B. alba* contained the least amount of TDF (17.83%).

Evaluations of antioxidant potency were carried out via PCL assay and expressed as capacity of the obtained extracts to counteract the superoxide anion $O_2^{\bullet -}$, which is one of the most dangerous reactive oxygen species to occur in human body. In addition, this method was chosen for our analysis because it is rapid, highly sensitive, simple and reproducible. However, the ACW procedure was not compatible to measure antioxidant capacities of the ethanolic extracts of the tested vegetables.

As summarized in Figure 3, *L. aromatica* extract was found to be the most potent (1.46 nmol Trolox equivalent /µg), followed by the extracts of *T. asiatica* and *P. odoratum* (1.09 and 1.06 nmol Trolox equivalent/µg, respectively). However, the *B. alba* extract showed the weakest activity (0.56 nmol Trolox equivalent /µg). The strong antioxidant activities of *P. odoratum* and *L. aromatica* extracts were consistent with the result of Nanasombat and Teckchuen (2009)[2]. This activity was probably due to the presence of lipid-soluble components such as carotenoids, phenolic compounds, etc. Most reports indicated that the protective effect against oxidative radicals of any botanical extracts was attributable to phenolic compounds. [5]

Table 1. Total dietary fiber (TDF) content found in four Thai local vegetables

Plant sample	% TDF (w/dw)	% Protein (w/dw)	% Ash (w/dw)
P. odoratum	43.19	21.36	8.52
L. aromatica	32.16	19.70	5.99
B. alba	17.83	29.07	4.31
T. asiatica	57.53	7.16	6.26

Note: *dw = dry weight*

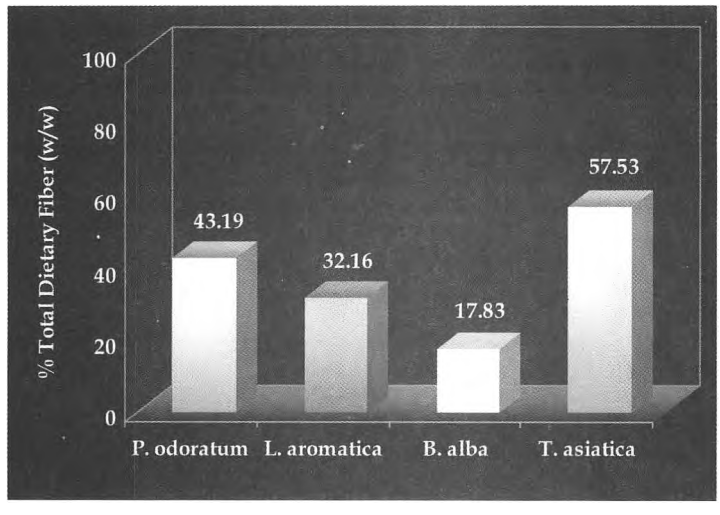


Figure 2. Total dietary fiber contents (% w/dry weight) of four Thai indigenous vegetables

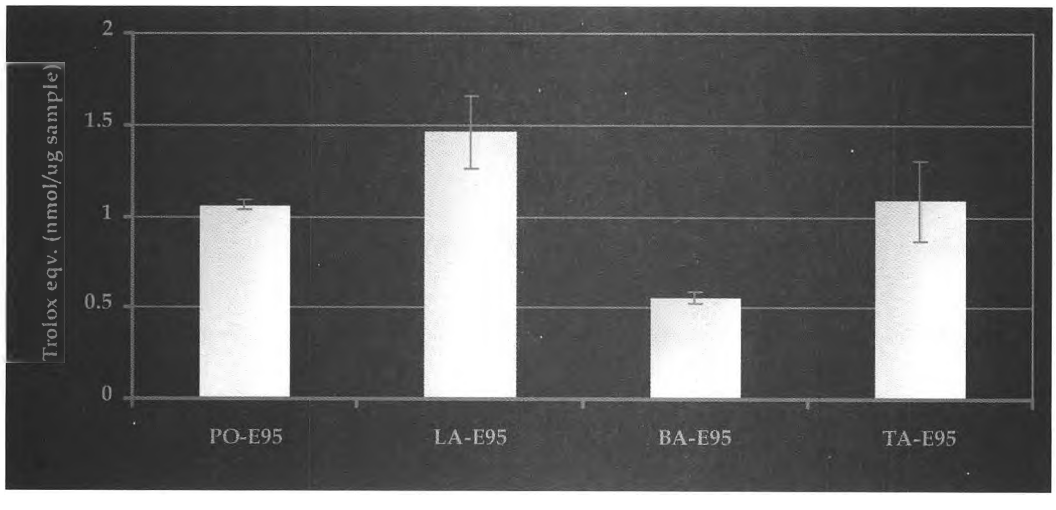


Figure 3. Antioxidant capacity (Trolox equivalent: nmol/μg sample) of the ethanolic extracts of *P. odoratum* (PO-E95), *L. aromatica* (LA-E95), *B. alba* (BA-E95) and *T. asiatica* (TA-E95)

CONCLUSION

Based on the results, *L. aromatica* and *P. odoratum* were interesting due to their strong antioxidant activity and high dietary fiber content. Although *T. asiatica* possessed the highest fiber composition and significant antioxidant property, it is not easily available. This suggests that supplementing a balanced diet with *L. aromatica* and *P. odoratum* may be beneficial to human health. Increased consumption of these plants would seem to be useful to most consumers since both plants are rather cheap and abundant. Nevertheless, utilization of these plants as fiber and antioxidant sources for developing as food supplement or functional food requires further studies.

ACKNOWLEDGMENTS

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