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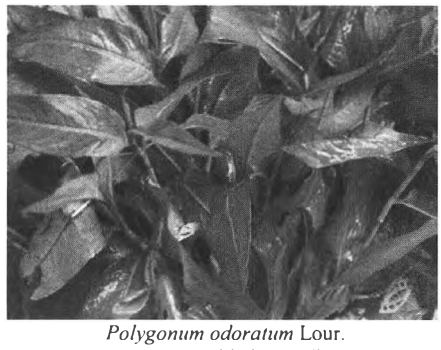
INTRODUCTION

Nowadays, changes in life style, especially consumption behaviors, lead to an increase in patients with non-infected chronic diseases (such as obesity, diabetes, cardiovascular diseases and cancer). Accordingly, there has been a growing interest in health food products which help support well-being. Recently, several Thai indigenous vegetables have gained increasing attention due to their various bioactive substances and dietary fiber.

Among them, *Polygonum odoratum* Lour. (Polygonaceae), *Limnophila aromatica* (Lamk) Merr. (Scrophulariaceae), and *Gymnema inodorum* Decne. (Asclepiadaceae) are rather well known and have been used in traditional cuisine and medicine. Previous studies revealed the antioxidant activities of leaf extracts derived from *P. odoratum* and *L. aromatica*, analyzed by DPPH assay. [1, 2]

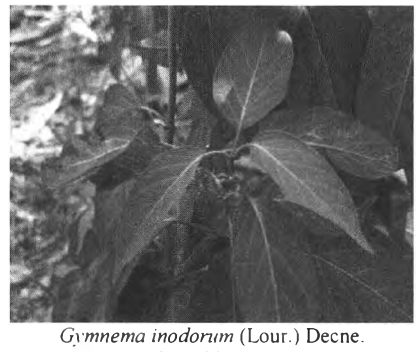
G. inodorum has been well known to have therapeutic effects in curing certain diseases such as diabetes, rheumatic arthritis and gout. It exerts hypoglycemic effect caused by triterpenoid saponins or gymnemic acids which inhibit glucose absorption from the intestinal tract and suppress the increase in blood glucose level in oral glucose tolerance tests in rat.[3] Moreover, its antioxidant property was also reported. [1, 3]

Hence, this study was carried out to determine dietary fiber content and antioxidant capacity of these local vegetables to use them for health food product development emphasized on low calorie and high in dietary fiber.



Polygonum odoratum Lour.
"Phak paew"

Limnophila aromatica (Lamk) Merr.
"Phak ka yaeng"



Gymnema inodorum (Lour.) Decne.
"Phak chiang da"

Figure 1 Thai indigenous vegetables used in the study

MATERIALS AND METHODS

Plant materials and extract preparation Fresh aerial parts of *P. odoratum* and *L. aromatica* and leaves of *G. inodorum* were purchased from Nakorn Pathom province in June 2012. For *P. odoratum* and *L. aromatica,* 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. *G. inodorum* fresh leaves were chopped and blended with distilled water (1 kg : 3 L of water). Then it was filtered and lyophilized to powder. All crude extracts were kept at 4°C until analysis for antioxidant capacity.

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) [4]. For each vegetable, quadruplicate dried-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 (SDF). 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. The insoluble dietary fiber (IDF) contents were evaluated by the similar method for the TDF, but the ethanolic precipitation of SDF was not undertaken. After that, SDF value was calculated by TDF value minus IDF value.

Antioxidant capacity determination by photochemiluminescence (PCL) The antioxidant capacities of the obtained extracts were assessed by means of PCL using PHOTOCHEM® (Analytik Jena, Germany) that provides high sensitivity and precision of the data. PCL assay was operated according to Popov and Lewin [5] 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 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. The results were expressed as Trolox equivalent unit (nmol) per 1 µg of tested sample. In case of *G. inodorum* extract, it was subjected to ACW kit protocol in which ascorbic acid (vitamin C) was used as the reference standard. The measurement of each sample was triplicated.

RESULTS AND DISCUSSION

The yields of *P. odoratum* and *L. aromatica* extracts were 16.4 and 21.5 % by dry weight, respectively. The extraction of *G. inodorum* leaf yielded 4.30 % by fresh weight. As shown in **Table 1** and **Figure 2,** TDF contents of dried powder derived from three plants varied from 34.41% - 47.51% (w/dw) which the IDF proportions were more than 95% of the TDF values. *P. odoratum* showed the highest TDF content followed by *L. aromatica* and *G. inodorum* (47.51%, 44.27% and 34.41%, respectively).

Assessments of antioxidant potency were performed 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. From the compatible procedures used, it suggested that antioxidant capacities of the *P. odoratum* and *L. aromatica* extracts were mainly owing to the presence of lipid-soluble components (such as carotenoids, phenolic compounds, etc.) while the active antioxidants of *G. inodorum* were water-soluble compounds.

As summarized from PCL assay, *L. aromatica* extract was found to be more potent (1.46 nmol Trolox equivalent /µg) than the *P. odoratum* extract (1.06 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]. Significant antioxidant property of *G. inodorum* extract was also demonstrated (6.50 nmol ascorbic acid equivalent /µg). Most studies indicated that the protective effect against oxidative radicals of any botanical extracts was due to phenolic compounds.

Table 1 Dietary contents found in three Thai local vegetables

Plant sample	% SDF (w/dw)	% IDF (w/dw)	% TDF (w/dw)
P. odoratum	0.95	46.56	47.51
L. aromatica	1.89	42.38	44.27
G. inodorum	0.18	34.23	34.41

Note: SDF = Soluble dietary fiber; IDF = Insoluble dietary fiber; TDF = Total dietary fiber; dw = dry weight

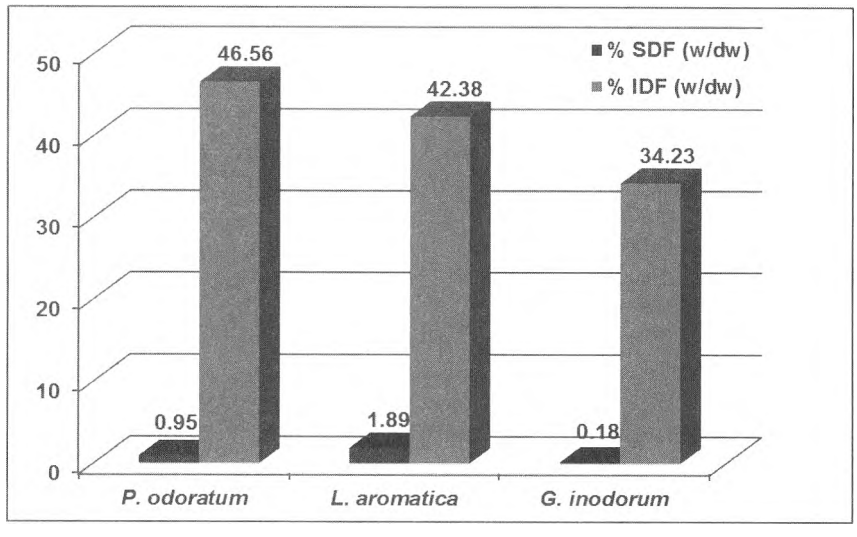


Figure 2 Soluble and insoluble dietary fiber contents (% w/dry weight) of three Thai indigenous vegetables (SDF = Soluble dietary fiber; IDF = Insoluble dietary fiber)

Three indigenous vegetables tested were composed of noticeable dietary fiber contents and antioxidant capacities. Therefore they were chosen to utilize as raw materials for development of health food products, for example, in tablet form as shown in **Figure 3.**

[A] [B] [C]

Figure 3 Samples of dietary fiber tablets (no coloring agent) from *Limnophila aromatica* [A], *Polygonum odoratum* [B], and *Gymnema inodorum* [C]

CONCLUSION

P. odoratum, L. aromatica, and *G. inodorum* were interesting to be the alternative sources for dietary fiber and antioxidant. Although *G. inodorum* comprises of lower dietary fiber content than *P. odoratum* and *L. aromatica*, it exerts a prominent property i.e. glucose absorption inhibiting action that is profitable to the consumer. Thus supplementing a balanced diet with *L. aromatica*, *P. odoratum* and *G. inodorum* would be beneficial to persons who have health problems (e.g. constipation, obesity, diabetes) as well as healthy human who are deficient in fiber intake (25-30 g/day recommended) [6]. Nevertheless, utilization of these vegetables for developing as health food product or food supplement requires further studies such as stability of the active components and safety assessment for long term consumption.

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